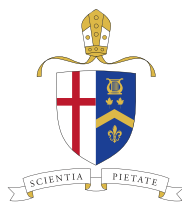


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Editorial

Research is a dynamic process involving systematically investigating phenomena to establish new knowledge. It transcends age and profession, welcoming diverse young minds from various backgrounds. Research expands our understanding of the world by exploring, investigating, and analyzing different aspects of our surroundings.

Young people's curiosity and desire to learn will help unlock new frontiers of knowledge. *The Young Researcher* allows determined researchers to showcase their work and contribute to the scholarly community. These researchers began their research journey at a young age, developed critical thinking skills, learned how to analyze findings and cultivated a passion for lifelong learning. They are also the torchbearers of progress, laying the foundation for future breakthroughs in academia and beyond.

The Young Researcher is not merely a publication; we are a beacon of learning that embodies the diverse perspectives seen throughout the globe. We promote curiosity and develop students' interests, encouraging them to pursue their passions and contribute to the academic conversation. The fresh insights these young minds bring help to evoke discoveries and push the boundaries of existing expertise. We take comfort in knowing that the future of research is in the hands of these brilliant young scholars who will fuel progress and innovation.

In conclusion, we have an unwavering commitment to nurturing young talent and advancing knowledge. The talented young minds we bolstered this year will help cultivate discoveries, ultimately developing the scope of academia. Join us on an academic journey as we grow our understanding through these works.

The Editors

Caelen Carroll
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How's the #GabFam: A 2022 Characterization of the Alternative Social Media Platform Gab

Jose Montalvo

This study aimed to develop a characterization of the alternative social media platform Gab in 2022 based on the themes and narratives found in the top posts of that year. Using a qualitative content analysis, this study identified six key themes from the dataset: Suppression, Persecution/Oppression, Conspiracy, Societal Degradation, Establishment Complacency, and We're the Saviors. Based on these themes, this study argues that Gab can be characterized as a platform centered around the idea that its users are under attack, implying that ideas about marginalization may be central to group identity within alternative online environments.

Keywords: Gab, alt-tech, social media, alt-right, alternative platform

Disclaimer: This study features direct quotes from social media users. Some of these quotes include slurs against members of various marginalized groups and other offensive language. These quotes do not reflect the opinions or beliefs of the researcher.

1. Introduction

In recent years, a variety of alternative social media platforms have arisen centered around the promotion of free speech and lax content moderation. A well-known example of this phenomenon was the platform Parler which was removed from various app stores and web hosting services because of its treatment of posts that incited the violence of January 6th, 2021 (Kao, 2022). Afterward, many users from both

Parler and Twitter migrated to Gab, another free-speech platform, causing it to gain 2.3 million new users (Goodwin, 2021). Because of this recent spike in popularity within the alternative social media sphere, Gab merits special attention as a means of gaining a greater understanding of the growing trend of alternative online communities. Thus, this study aimed to analyze Gab in order to provide political scientists, policymakers, and advocacy groups with a clearer understanding of the platform's community in 2022 and the alternative media movement more generally.

2. Literature Review

Alternative social media platforms have been broadly characterized as more conservative, more associated with conspiracy theories, and more focused on unmoderated free speech than mainstream platforms (Stocking et al., 2022). Within this context, various studies have aimed to characterize Gab to understand how it fits into the greater alternative online environment.

2.1: Early Research & Gab as Alt-Right

Early literature on Gab focused on characterizing the platform based on its ideology and user base. Various studies characterized the platform as generally aligned with the American alt-right¹ and extreme conservatism (Lima et al., 2018; McIlroy-Young & Anderson, 2019; Than et al., 2020; Zannettou et al., 2018; Zhou et al., 2018). More specifically, Zannettou et al.'s early research led them to the conclusion that Gab featured a high prevalence of hate speech and was generally used by alt-right users to share news (Zannettou et al., 2018). Lima et al.'s research further supports this assertion by determining that the news being shared on Gab was overwhelmingly aligned with the political right and often came from alternative sources (Lima et al., 2018). While these studies focused on the news shared on the platform, Than et al.'s research reached a similar conclusion by analyzing the most commonly discussed topics on Gab. Based on the prevalence of topics such as Holocaust denial and antifeminism, the researchers concluded that Gab could be broadly characterized as an alt-right platform (Than et al., 2020). Finally, McIlroy-Young & Anderson's research provides a chronological perspective on the nature of Gab, concluding that once users had become accustomed to Gab and had welcomed new users to the #GabFam, discussion quickly shifted to alt-right topics (McIlroy-Young & Anderson, 2019). Thus, based on the news being shared on the platform and the discussions in which its users engage, there is ample support in the literature to treat Gab as an alt-right platform.

2.2: The Post-2020 Era & Digital Marginalization

However, more recent research on the platform has challenged this notion. In their study on Gab in the Covid era, Dehghan & Nagappa found that instead of being homogeneous, communities on Gab were highly factionalized and experienced a high degree of infighting (Dehghan & Nagappa, 2022). Zeng & Schäfer's research on Covid conspiracies on Gab provided greater insights into this phenomenon since the researchers were unable to develop uniform definitions for the conspiracy theories they studied because of variations caused by factionalization (Zeng & Schäfer, 2021). This widespread factionalization led Dehghan & Nagappa to argue that treating Gab as a uniformly alt-right platform prevented researchers from understanding the nuances that Gab's various communities exhibit. Instead, they argued that the platform's users are united by a common sense of mistrust of and separation from the mainstream (Dehghan & Nagappa, 2022). Jasser et al.'s research expands on this idea and argues that although users on Gab are generally far-right, their uniting characteristic is a sense of marginalization and persecution by mainstream social media platforms (Jasser et al., 2021). Ali et al.'s research backs this characterization as they found that when users were banned from platforms like Twitter and Reddit, they moved to Gab and often complained about their persecution by these platforms (Ali et al., 2021). Thus, there exists ample debate in the literature regarding Gab's nature as a platform, with researchers debating whether Gab is united by a shared ideology or by a shared sense of marginalization.

This leaves a clear gap in the literature which this study aims to address by characterizing Gab based on the narratives expressed in the platform's top posts for 2022.

2.3: Research Question

Additionally, another gap exists based on time-frame. Since Gab is a social network, it is inherently

¹ "a set of far-right ideologies, groups and individuals whose core belief is that "white identity" is under attack by multicultural forces using "political correctness" and "social justice" to undermine white people and 'their' civilization." ("Alt-Right")

defined by its users and what they discuss; things that can often change over time. As seen above, interpretations of the social network's nature vary greatly based on the year a study was conducted, indicating that Gab may be a platform highly sensitive to current events. This sensitivity requires that research be conducted frequently so that researchers and policymakers can have accurate information on the platform's ever-evolving nature. By analyzing 2022's top posts, this study aims to address this gap through an up-to-date characterization of Gab.

Thus, this study aims to answer the question "How can Gab be characterized based on the narratives that emerge from a qualitative analysis of 2022's top posts?"

3. Method

Much like on Twitter or Facebook, users on Gab interact with others by making posts that other users can react to or comment on (Goodwin, 2021). In order to provide a greater understanding of the Gab community, this study employed a qualitative content analysis of these posts in order to determine the common themes and narratives that may define the platform's community.

3.1: Sample

The sample consisted of the 88 Gab posts labeled as the top posts of 2022 by the platform. Top posts are determined based on factors such as their number of likes, reposts, and comments ("Gab Social"). These posts were selected as a sample for two key reasons.

First, the use of the top posts would reconcile two leading theories within the literature on alternative online communities. The first theory is the theory of affective economies which was used in Deem's analysis of the alt-right community on Twitter. Under this framework, these groups may be treated as affective economies, a social structure where group emotions are developed through the repeated sharing of emotions among group members (Deem, 2019). In contrast to this decentralized approach, another approach more commonly used with Gab is the thought-leader model. Instead of believing that Gab operates as a decentralized network of group emotions, researchers

like Zhou et al., argue that the platform is generally organized around a few users who "lead the discussion in Gab, with most users consuming or reacting to this content" (Zhou et al., 2018). Thus, in order to bring together the inputs of both these thought leaders and the greater Gab community, this study analyzed the top posts of 2022 since they reflected the ideas of thought leaders that resonated most with Gab's overall community.

Second, using the whole year of 2022 as a sample allows this study to see how 2022's events have impacted Gab. This enables the study to provide a more up-to-date account of Gab and may help it address some of the rifts that have emerged in the literature over time.

3.2: Analysis

In accordance with much of the literature which has analyzed social media, this study uses qualitative content analysis to analyze the posts within the sample (Snelson, 2016). More specifically, this study follows a nondirected qualitative content analysis heavily based on the method used in Goossens et al.'s study of social media narratives regarding the insanity defense in Canada. In this method, the researcher develops codes used to organize posts by topic. These codes are developed inductively from the posts themselves instead of being predetermined by the researcher (Goossens et al., 2021). This is done to ensure that the characterization of Gab developed by this study is not hindered by previous characterizations of the platform. In order to develop the codes, the first 33 posts in the dataset were coded while a preliminary codebook was developed. Then, these posts were coded again in order to refine the codebook and ensure that codes are consistent and are not drifting. Following this, the entire dataset was coded to expand the original codebook. Finally, all 88 posts were coded again with the final codebook, and themes were derived from the codes. In order to characterize Gab based on the narratives that can be found in its posts, these themes were generally developed based on these narratives.

In addition to being consistent with the literature on social media, this qualitative approach was chosen in order to allow for the development of a more nuanced understanding of Gab's narratives. As explained in Colley & Moore's study on 4chan, another alter-

native social media platform, many of the ‘Big Data’ quantitative content analysis methods that have been used to study alternative communities can miss the nuances within and across different posts (Colley & Moore, 2022). Thus, this study uses a qualitative content analysis method in order to avoid this and provide a clear, nuanced account of the narratives that define Gab.

3.3: Ethical Considerations

A few ethical considerations were accounted for in the method to ensure that this study was conducted ethically and safely. First, in accordance with ethical guidelines from the Association of Internet Researchers, posters on Gab had their identity protected through pseudonymization (Franzke et al., 2020). Users had their names and identifying information removed from posts and were instead called “user 1, 2, 3, etc.” In this way, the people being observed in the study were protected without limiting the potential of analysis that incorporates the fact that a single poster may have made multiple posts. Another ethical concern is the privacy of the participants. The social media research ethics guide from the University of

Aberdeen emphasizes the importance of the difference between public and private online spaces, noting that studying private spaces without the knowledge of the participants may be unethical (Townsend & Wallace, 2016). To avoid violating the privacy of participants, this study only looked at posts that were made publicly on Gab, instead of within private networks. By doing this, this study ensured that only information and opinions that have been made public by users were analyzed.

4. Results

4.1: Codes

Over 40 codes were developed through the inductive coding process. The full codebook can be found in Appendix A (pages 27-29). A sample of notable codes, their definitions, and the number of posts they appeared in can be found here.

Code	Definition	# of Posts
Covid	Posts that reference the Covid-19 pandemic or response methods such as masking, vaccinations, or lockdowns	9
Children	Posts that mention children or their abuse through things like pedophilia or child sex abuse imagery	9
Freedom/Rights	Posts that mention or allude to freedoms and rights and/or their violation	8
Misinformation/Misdirection	Posts that mention or imply misinformation, disinformation, misrepresentation, or deliberate misdirection by major public figures or the media	6
Resistance	Posts that mention or advocate for civilian resistance against government action	10
Trucker Protests	Posts that mention the trucker convoy protests of 2022	14
2020 Election	Posts that mention or make reference to the 2020 Election in the United States, its results, or the events of January 6th, 2021	7

4.2: Themes

Theme 1: Suppression

One of the major themes that emerged from the dataset was suppression. Many users expressed concerns about perceived efforts to suppress their expression because of their political beliefs. For example, user 64 wrote:

“Want to defend traditional European morals and ideals? The system will shut down your social media, bank account, and try to prosecute you for hate crimes.”

Other posts corroborated the idea that people with traditional or conservative values were under attack by sharing personal experiences of perceived suppression, in line with the interpretation that Gab operates as an affective economy. User 80 shared a particularly concerning and emotionally charged instance of this suppression, writing:

“My home was just SWATTED. My children were home and had to witness everything ... From what I understand, this is happening to many conservative show hosts in order to have their homes raided, their privacy violated, and to put their lives at risk.”

While these posts focus on real-world experiences with perceived suppression, other posts focused on users’ experiences of suppression within the digital world. User 20 expressed the idea of digital suppression in general terms, posting:

“The other platforms feel like hanging out in the break room at work. Everyone has to watch what they say and put their best foot forward so they don’t get fired, and certain topics are off limits and you have to be careful what jokes you even tell.”

User 23 corroborated this narrative by sharing a screenshot of the following Twitter post and writing:

“This tweet made me banned on Twitter. Am sad because I make many friends at Twitter. I learn West values very fast. No matter. I strong. I start again. I make friends on Gab now.”

Twitter Post:



Notably, both of these users place the blame for their suppression on other social media platforms, highlighting the importance of digital experiences in Gab users’ collective identity, in line with Jasser et al.’s conceptualization of the platform (Jasser et al., 2021). Taken together, these posts indicate that users on Gab share the belief that dissenting, conservative, and “Western” opinions are being suppressed by the mainstream, both online and offline.

Theme 2: Persecution/Oppression

Another major theme was the idea that Gab users were being persecuted in the real world by a variety of forces. Some users treated the mainstream media as the force that was persecuting them, supporting the idea that Gab users see themselves as separated from and antagonized by mainstream environments. For example, user 9 complained about the way the media was treating members of the Canadian trucker convoy, asking:

“Why isn’t the media reporting on all the food we gave the homeless? We spent over \$100,000 feeding hungry Canadians.”

Other users placed the blame for their oppression on governments, like user 11 who implied government violence on citizens when they wrote:

“I didn’t see the left screaming “Freedom for Canada” when the citizens were getting beaten in the street by their own government just a week or two ago”

Notably, this post also attacks the political left, indicating an antagonistic relationship that other posters on Gab corroborated. Finally, some users portrayed members of the political left as the people persecuting them and portrayed their persecution as a violation of their rights. For example, user 2 posted:

“I have nearly \$90,000 in mask fines from Speaker Nancy Pelosi because I refuse to wear a mask on the house floor. Masks have not stopped the spread of Covid and it is a violation of my rights to force me to wear a mask.”

Taken together, these posts indicate that users on Gab believe that both they and their rights are under attack by forces like the mainstream media, their government, and the left-wing leaders who may be leading those governments.

Theme 3: Conspiracy

Many users on Gab expressed ideas implying that covert conspiracies were at play in the world around them. These conspiracies tended to be about 2 topics: Covid 19 and the 2020 Election. Some users simply questioned the effectiveness of Covid 19 response measures, like user 36 who wrote:

“If masks, distancing, lockdowns, and these vaccines could stop a pandemic, they would have by now.”

However, other users more explicitly attacked these measures by implying they were being used to harm people. For example, user 13 wrote:

“Congrats to all those who didn’t have their DNA tampered with in 2021”

(Note: this post was included in the dataset since the top posts for the year were collected on December 31st, 2022 so posts from December 31st, 2021 were included. Given the popularity of this post and its potential to expand the understanding of medical conspiracies on Gab, it was kept in the sample.)

Other users also questioned the validity of the pandemic itself, like user 82 who referred to it as the “plandemic.” User 5 also promoted the idea that the Covid 19 pandemic was deliberately created while

connecting it to the platform’s other main topic of conspiracy, writing:

“Gab is the only place where you can say things like this: Covid-19 was created and leaked by the Globalist American Empire to steal the 2020 election, facilitate the largest transfer of wealth and power in human history, and usher in totalitarian global communism.”

When it came to the 2020 election, various users shared the idea that the election was fraudulent. For example, user 58 posted:

“Only in America will we stop a football game, drag out measuring chains and look at a play 15 times from 6 different angles to make sure we make the right call, but will not verify the integrity of an election of the highest office in our nation!”

Finally, some users believed the events of January 6th, 2021 were also part of a conspiracy relating to the 2020 election. For example, user 67 shared a photo of a Twitter post calling the events of January 6th “a legal protest that was turned into a riot by the FBI punks antifa and Black Lives Matter devils posing as Trump supporters” and commented:

“took the words right out of my mouth! F-ck China joe binden, the DEM who were behind the violence, and the coward RINOs who turned a blind eye”

Thus, users on Gab seem to share the belief that there are hidden conspiracies at play that aim to harm them, although they vary when it comes to the specifics of those conspiracies. This suggests that conspiracy and the idea that all is not as it seems are key components of the Gab worldview and affective economy. Notably, these varying theories and degrees of conspiracy regarding the pandemic and 2020 are in line with the interpretation of Gab’s conspiratorial environment as highly factionalized (Zeng & Schäfer, 2021).

Theme 4: Societal Degradation

Many users in the dataset seemed to believe that society was in a state of decline. Some users, like user 49, who remarked we live in a “disgustingly low-trust world”, did not explicitly identify any factor or group

that was responsible for this decline. However, other users placed the responsibility for this decline on specific groups, although they often differed on which groups these were. Some users blamed the political left and LGBTQ community for this decline, like user 38 who posted:

“America has zero moral authority to criticize the choices of another nation’s leader. There aren’t hundreds of photos of Putin sniffing little children while his son smokes crack and gets blown by every sex slave in Ukraine while mentally-ill trannies in his administration openly work to normalize pedophilia and sex with dogs. The Biden Administration has literally made America a global embarrassment.”

Other users blamed immigrants for the decline of society, like user 74 who shared a tweet remarking “Controlling who enters your country matters” and then wrote:

“There is nothing wrong in wanting to maintain the civilization & culture of the Nation that your ancestors built for ‘you’ ... Invasion & societal degradation was never part of their future vision.”

Notably, this post also frames immigrants as invaders, reflecting the idea that emotions and particularly fear play an important role in discourse on Gab. Finally, some users blamed teachers and teachers’ unions, like user 83 who shared a tweet reading “If it takes a law to stop you from holding a classroom discussion with 5-year-olds about sex, you shouldn’t be a teacher. Actually, you shouldn’t be allowed within several miles of a school”, and then wrote:

“Crush the Satanist Teachers Unions #savethechildren”

Thus, users on Gab seem to agree that society is in a state of decline, but they differ when it comes to who they blame for this decline.

Theme 5: Establishment Complacency

Many posts that discussed conspiracy theories and perceived evils in the world also complained about the role of established political and social institutions in upholding these processes. Often, the institution ac-

cused of complacency was the Republican party. For example, user 4 accused members of the GOP of being complacent with a stolen election when they posted:

“Donald Trump won the 2020 election. It was stolen. Republicans who refuse to say this won’t really fight to secure elections going forward.”

In contrast, other users went beyond accusing members of the GOP of complacency and instead accused them of directly facilitating the theft of the 2020 election. User 74, for example, shared the following image and wrote:

“Wake up, people! The #GOP was complicit, and the #UNIPARTY is REAL. #FIX2020”



Finally, other users accused the broader conservative establishment of helping steal the election. User 25 expressed this sentiment while reflecting Gab’s greater mistrust of traditional media sources when they wrote:

“18 months ago, the entire GOP establishment AND the conservative think tanks AND Fox News were telling you that election fraud never happened. That’s because they all helped get Biden elected. Never Forget.”

Another traditional institution Gab users believed was upholding conspiracy theories was the Supreme Court of the United States. More specifically, users accused the Supreme Court of spreading false, harmful information about the Covid-19 pandemic. For example, user 10 wrote:

“Supreme Court Justices just falsely claimed:

1. The jab prevents transmission
2. Omicron is as deadly as Delta
3. 100K children are hospitalized with COVID, many on ventilators
4. Vax mandates would prevent 100% of cases
5. Hospitals are overrun

Every point is provably false. Even a ‘casual’ look at the medical literature would have enlightened the Justices.

Their ignorance and dangerous spreading of misinformation is a serious problem. #SCOTUS”

In response to this perceived abandonment by traditional institutions, some users began encouraging people to take matters into their own hands. User 82 expressed this sentiment, writing:

“I don’t need the Supreme Court telling me what I can or can’t do regarding this plandemic. People are hoping for them to make the right decision so they don’t have to defend themselves. I understand, but at some point, we have to rely on ourselves.”

Thus, many users on Gab seem to believe that a variety of traditional institutions (spanning from the mainstream media to conservative parties) are part of the forces upholding the degradation and destruction of society, causing some users to encourage the abandonment of these institutions and greater self-reliance.

Theme 6: We’re the Saviors

Users on Gab expressed the belief that the Gab community and the people it supports were filling the gaps left by traditional institutions when it came to defending things like freedom. For example, user 9 expressed support for the trucker convoy protests writing:

“Truckers have done more to fight for freedom in Canada in the last week than the entire GOP has for us in the last 40 years.”

Other users believed that Gab itself served as a bastion of free speech on the internet. Hence, user 5 began their post proposing a global conspiracy theory by saying

“Gab is the only place where you can say things like this:”

Moreover, some users framed this in stark contrast to other social media platforms, reflecting Gab users’ perceptions of themselves in relation to other online communities. Thus, user 20 praised Gab, writing:

“Being on Gab feels like hanging out with friends at a bar. People say whatever they want and don’t give a crap about being politically correct or offending anyone. Everyone can be themselves.

The other platforms feel like hanging out in a break room at work. Everyone has to watch what they say and put their best foot forward so they don’t get fired, and certain subjects are off limits and you have to be careful what jokes you even tell.

What Andrew Torba has built here is truly American, and the dedication he has to preserve free speech online is amazing.”

Thus, users on Gab believed that as the world was falling apart and they were under attack, Gab provided a space for free expression and opposition to the forces they saw as corruptors of the world.

4.3: The Gab Narrative

All these themes can be used to develop a shared narrative for Gab. This “Gab narrative” appears to be built on the following ideas. Themes 3 and 4 (Conspiracy and Societal Degradation, respectively) imply that users on Gab believe that society itself is under attack, although they seem to disagree on who or what specifically is attacking society. Theme 5 (Establishment Complacency) demonstrates users’ feeling that the institutions meant to protect them from these forces have abandoned them and may even be supporting their oppression. Themes 1 and 2 (Suppression and Persecution/Oppression, respectively) show users’ belief that when they take matters into their own hands to defend themselves and their society, they are silenced or attacked. Finally, theme 6 (We’re the Saviors) shows how users see Gab as a place where they are able to come together to fight back without feeling like their opinions will be silenced. Thus, the follow-

ing may be seen as the “Gab narrative”.

Society is under attack by various forces, some of them covert. As traditional institutions have failed to protect us, we have taken matters into our own hands and have faced persecution in both virtual and real environments. However, Gab allows us to come together and fight back.

5. Discussion & Conclusions

5.1: Gab in 2022

The above themes and narratives imply 2 major things about Gab in 2022: that its users hold diverse opinions within a set of widely accepted ideas and that it is centered around ideas of marginalization and the systems that uphold it. Within themes, users frequently differed on the specifics of their arguments. For example, in theme 4, some users blamed immigrants for societal decline while others blamed members of the LGBTQ community and the political left. In themes 3 and 5, users varied greatly when it came to the degree to which they believed in the various conspiracy theories they shared. These variations lend support to previous researchers’ conclusions that Gab does not neatly fit under one political ideology (Dehghan & Nagappa, 2022; Zeng & Schäfer, 2021). What did seem to unite Gab was a sense of marginalization. Themes 1 through 4 show that users within the dataset tended to see themselves or their society as under attack, implying that marginalization plays a major role in Gab users’ self-perception. Additionally, in line with previous research, users in this study expressed that they were being marginalized by mainstream forces and social media platforms (Dehghan & Nagappa, 2022; Jasser et al., 2021; Ali et al., 2021). Thus, based on the top posts of 2022, Gab can be characterized as a platform most heavily defined by its users’ sense of marginalization by both mainstream and covert forces.

This study also makes a novel contribution to the field’s understanding of marginalization on Gab with the theme of establishment complacency. The presence of this theme advances the field by demonstrating that a significant component of these users’ sense of marginalization may be the idea that they have been abandoned by traditional institutions they ex-

pect to protect them and represent their views such as political parties and news outlets. This may open the way for future researchers to continue exploring the role of these themes of abandonment or betrayal on Gab or within other alternative online communities.

5.2: Connections to Other Alternative Communities

None of this is to say that Gab does not bear significant similarities to other alternative online communities. Gab’s defining theme of marginalization also seems to appear within the alt-right. In a study of this group on Twitter, the researcher characterized the online alt-right based on its use of narratives relating to ideas of white victimization and the need for white members of society to “take back” their societies (Ganesh, 2020). This theme of marginalization as a uniting theme for alternative online communities is further corroborated in the literature that has studied the ‘manosphere,’ a term used to refer to various extremely misogynistic communities online. Marwick and Lewis’s research found that many of the members of this group are united by the narrative that modern feminism is victimizing men and poses a serious threat to their well-being (Marwick & Lewis, 2017). Gab’s similarity to these communities because of its focus on marginalization provides insights into the way it fits into the greater alternative online environment and opens the way for potential future research into the similarities and differences between specific ideas about marginalization within these communities.

6. Limitations & Suggestions for Future Research

This paper has a few limitations, both in its method and its conclusion. At the method level, the paper’s results may be limited by the fact that codes were developed inductively and then applied by a single person. This means there is a high potential for bias to come through in the codes and analysis of themes in this paper. Although a codebook with clear definitions was used in an effort to limit this from occurring, future research replicating this study’s method could be sig-

nificantly improved by the use of multiple coders. This paper's conclusion is limited by the fact that the study was conducted on a somewhat small sample of posts within just one year. Because the posts evaluated came only from the top posts of 2022, this characterization of Gab may only provide a surface-level understanding of what Gab looked like only in 2022. This may account for the fact that topics like Holocaust denial did not appear in the sample despite their prevalence in other studies. To better understand Gab, future researchers could conduct a similar study in future years with a few key differences. In addition to having multiple coders, the study could look at the top posts in addition to posts within specific communities on Gab to understand the diversity of views on Gab and avoid the bias involved with coding popular posts. Posts with highly radical ideas may not have appeared in the dataset because their fringe beliefs within Gab prevented them from going viral. Future researchers should continue to use qualitative methods to analyze Gab as it can provide a useful complement to the quantitative data that has dominated research on Gab as expressed earlier.

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Appendix A: Full Codebook

Code	Definition	# of Posts
Abortion	Posts that mention abortion or the court cases <i>Roe v. Wade</i> or <i>Dobbs v. Jackson</i>	1
America	Posts that mention the United States of America	15
Canada	Posts that mention Canada	13
Communism	Posts that mention Communism	2
Community	Posts that mention community or aim to build a stronger community on Gab	7
Corruption	Posts that mention or imply political corruption	5
Covid	Posts that reference the Covid-19 pandemic or response methods such as masking, vaccinations, or lockdowns	9
Children	Posts that mention children or their abuse through things like pedophilia or child sex abuse imagery	9
China	Posts that mention China	1
Discrimination	Posts that mention or imply discrimination	1
DNA	Posts that mention DNA or its alteration	1
Drug Abuse	Posts that mention drug abuse or people who abuse drugs	2
Education	Posts that mention education, educational environments like schools or universities, or their students	6
Elections	Posts that mention elections or election fraud	3

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Elites	Posts that mention or make reference to “Elites”	2
Firearm	Posts that mention firearms or their use	4
Freedom/Rights	Posts that mention or allude to freedoms and rights and/or their violation	8
Gab	Posts that mention Gab	6
Gender	Posts that mention gender	1
Global Finance	Posts that mention global financial systems and institutions	3
GOP	Posts that mention the Republican Party/GOP or its members	12
Government Violence	Posts that mention or imply government violence	2
Healthcare	Posts that mention healthcare	3
Hong Kong	Posts that mention Hong Kong	1
Immigration	Posts that mention immigration, immigrants, or deportation	3
K. Rittenhouse	Posts that mention or reference Kyle Rittenhouse, his actions, his trial, or its results	2
Law Enforcement	Posts that mention law enforcement	5
LGBTQ	Posts that mention or reference the LGBTQ community	3
Media	Posts that mention mainstream media/news sources	2
Misinformation/Misdirection	Posts that mention or imply misinformation, disinformation, misrepresentation, or deliberate misdirection by major public figures or the media	6

A 2022 CHARACTERIZATION OF THE ALTERNATIVE SOCIAL MEDIA PLATFORM GAB

Patriotism	Posts that mention patriots or allude to patriotism as a value	2
Pornography	Posts that mention pornography	3
Race	Posts that mention race	3
Religion	Posts that mention religion	8
Resistance	Posts that mention or advocate for civilian resistance against government action	10
Russia	Posts that mention Russia	6
SCOTUS	Posts that mention the Supreme Court of the United States, its rulings, or its justices	6
The Left	Posts that make reference to the political left, liberals, the Democratic Party, the Canadian Liberal Party, or their voters/members	11
The West	Posts that mention or allude to the political West and or “Western values”	3
Trucker Protests	Posts that mention the trucker convoy protests of 2022	14
Tyranny	Posts that mention or imply some form of tyranny or tyrannical government	2
Ukraine	Posts that mention Ukraine or the ongoing conflict in the country	3
2020 Election	Posts that mention or make reference to the 2020 Election in the United States, its results, or the events of January 6th, 2021	7

Health Promotion on TikTok: The Inclination of Doctors and Medical Students in New York

Thaddeus Gagaring

Abstract: As the use of social media starts becomes more popular in the 21st century, health professionals on Facebook, Instagram, YouTube, and Twitter utilize these platforms to discuss unknown health topics. Content analysis was used to gain data on how successful health professionals were at promoting health on TikTok. A survey was then utilized to discover how the success of health professionals on TikTok would impact the likelihood that medical students and doctors in New York City would be inclined to promote health on the platform. The results confirmed that doctors and medical students were reluctant to use social media in the medical field or even download applications to do so. This research can lead to new conversations regarding the impact of the promotion of health professionals on doctors and medical students, as these findings rejected past research.

Keywords: Medical students, doctors, TikTok, social media, health promotion

Introduction

Today unlike in the early 2000s, platforms like Instagram, YouTube, Facebook, and Twitter are very popular. These platforms allow users to communicate about their everyday life while sharing information with others online. However, the same can be said for promoting health awareness through social media. For example, famous health professionals like Doctor Mike use social media to discuss health-related issues while reacting to medical shows like House MD or Grey's Anatomy. Promoting this use would allow users on social media to know more about diseases that are not widely known or reduce misconceptions about health. TikTok, a rising social media platform, is a new way to efficiently promote health as users can share videos about various topics. Although social media is widely used to promote health, whether the success of promoting health on the platform would incline medical students and doctors to do the same is yet to be known.

Review of Literature

Throughout the 21st century, social media use is becoming more prevalent as new generations frequently use platforms like Instagram, Twitter, and TikTok. With the rise of social media, it is known that platforms can positively impact people's health awareness, incentivizing health professionals to promote health. These incentives lead researchers to study variables that health professionals can incorporate into promoting health and evaluating the effectiveness of the platforms. Most have concluded that health promotion on social media can benefit people's health awareness on specific topics. However, in most studies, it has not yet known whether doctors and medical students would be inclined to use social media to promote health on the platform after knowing the success of other videos. Therefore, this study will research the inclination of New York-based medical students and doctors regarding health promotion on TikTok after viewing the success of other videos on the platform.

Factors Needed to Promote Health Efficiently

A study done by the Society for Public Health Education portrays how social media can promote health due to the ability of the platforms to attract public audiences effectively. They present the idea of a theory-based intervention related to social and behavioral change to effectively encourage healthy habits in its viewers (Korda & Itani, 2013). In addition, Korda and Itani (2013) present numerous factors that need to be considered to raise the health awareness of users: preferred content, demographic profiles, information preferences, and custom messages. While Korda and Itani (2013) address how media platforms can be beneficial in advocating health through behavior and social change-based theories, another study by the Society for Public Health Education introduces a new perspective to endorse health on social media. For example, Neiger et al. (2013) argue that health promotion practitioners must find strategies to engage users in a social media conversation, which Korda and Itani have yet to discuss as they have only discussed factors to promote health awareness. In the *Journal of Interactive Advertising*, Park et al. (2011) agrees with Neiger regarding the necessity for health organizations to identify strategies for promoting public health.

The Popularity of Certain Media Platforms: Users' Perspective

Social media websites have become incredibly popular as "two out of three Americans use social media" (Park et al., 2011). However, today, different platforms vary in popularity with different groups. For example, Plaisime et al. (2020) indicates that 53.8% of teens mainly use Instagram. This statistic can be contrasted with Gabarron et al. (2018) who point out that most adult users mainly use Facebook. These findings portray the generation gap: younger generations use Instagram more while older generations use Facebook more. Although Plaisime states that Instagram is the most used among teens, Alshammari and Alshammari (2017) contradicts that statement, saying "92.3% of those under 25 years old used social media with some type of video like YouTube." In addition, a study by the Egyptian Journal of Hospital Medicine found that the frequency of use between both generations of

users is similar, which has yet to be discovered by Park and Plaisime. The Egyptian study found that 85.7% of participants above 25 years and 80.4% of those under 25 old use social media more than once a day (Alshammari & Alshammari, 2017).

A new perspective on how influencers impact the users' knowledge is portrayed as influencers have a role on social media to alter the opinions or ideas of users. For example, Grace Gault (2022) explains how TikTok influencers' advertisements about branded content are disguised through their "authentic" appeal. Additionally, users on social media cannot trust what they see online as influencers are highly biased due to the fake relationships they have with followers due to the monetization of their social media presence (Gault, 2022). Thus, there is an element of misinformation or bias toward users in social media. Promoting health can further be an issue as influencers could promote misinformation about a particular product to gain a steady income.

The Use of Social Media by Health Professionals

Medical professionals have been trained to provide patient information on social media networks like Twitter and YouTube. For example, Bruno (2020) argues that doctors use TikTok to promote health efficiently through credentials, medical background, target audience, and username. According to Alshammari and Alshammari (2017), 59.9% think using social media in health education for the public is a good idea, which incentivizes health professionals to use TikTok. Ettel et al. (2012) establishes a sense of urgency by explaining that adolescents do not know where to seek health information. This information supports the ideas of Alshammari and Alshammari, who explain how social media can positively impact public health education. As there is a positive effect on users, there is a need for health professionals to use TikTok in the medical field. A new idea introduced by Park et al. (2013) adds that health professionals on Twitter advocated for specific health issues tailored to one's demographic, which Bruno did not find as he strictly focused on TikTok health professionals. Hudnut-Beumler et al. (2016) claims that health practitioners in communities like Saludable Omaha use Facebook and YouTube to promote healthy eating,

which supports the overall idea that social media is actively used in the medical field. Ramanadhan et al. (2013) explains that there are three types of content: organization promotion, health education, and cross-promotion; other studies have yet to research this. Edney et al. (2018) suggests that, other than social media platforms, watches like Garmin and Fitbit use advertising skills to promote wellness which can be used by health professionals, which adds a new health promotion method other than social media. Kotsenas et al. (2018) describes how Dr. Ruben Mesa created a YouTube video about specific health topics to reestablish communication between him and his patients who were out of state. In addition, studies by Kotsenas and Hudnut-Beumler similarly address the use of YouTube to promote health. However, Jackson et al. (2014), Stelfox et al. (2020), and Surani et al. (2017) agree that social media can cause cyberbullying, misinformation, and compromise patient confidentiality, which suggests a risk for multiple doctor and patient relationships.

Call to Research

Though there is a considerable amount of research on using social media to advocate for health, there is more to be found about the topic. Previous studies have found that the general population uses social media platforms like Facebook, Twitter, Instagram, and YouTube. However, only one research study found that TikTok could be prevalently used to promote health, which is unexpected as the platform has been widely used pre- and post-pandemic. Many have concluded that numerous variables, such as preferred content or custom messaging, are needed to advise for a better lifestyle. Others found that health professionals already use these techniques to promote health which can positively affect users. However, studies have yet to discover whether health professionals would be inclined to use social media to promote health after knowing the success of other videos on the platform. In addition, most researchers have stated that health organizations advocate for health but did not specify a region, which adds to the knowledge gap in this research topic. Research journals agree that doctors and health organizations are involved in advising social media users to lead a better lifestyle but have yet to discuss medical students

in the conversation as they are the future generations of doctors. Lastly, as most of these scientific journals need constant updates, studies need to examine the frequency of health professionals on social media before or even after the COVID-19 pandemic. This uncertainty caused by a gap in knowledge in the field led to the focus of this research which will determine if doctors and medical students in the New York City area are inclined to promote health after viewing the success of health promotion videos on TikTok. I hypothesize that doctors will likely be reluctant to advocate for others to take on a better lifestyle and advocate health topics to users on social media because they are in an older generation. My second hypothesis is that medical students will inquire about how other health professionals use social media to their advantage, and they will promote health on TikTok through the influence of others, especially those of a younger generation. These knowledge gaps prompted me to the research question, "Are doctors and medical students in the New York area more inclined to promote health on TikTok after viewing the success of health professionals on the platform?"

Method Alignment

Chosen Methods

A mixed methods approach was chosen for this research as content analysis allows analysis of the success of health promotion on TikTok by inputting specific examples in the survey, which is the second method used. A mixed methods approach (survey and qualitative analysis) seems important as Plaisime et al. (2020) used a mixed methods approach to explain what factors are needed to effectively promote health towards a particular group relating to this topic. They used this approach to quickly distribute the survey to participants and qualitatively analyze the responses, as more than one method was needed. The content analysis method was essential because Bruno (2020) evaluated how successful health professionals are at promoting health on TikTok in terms of likes and comments, which is included in the present survey. Moreover, he used content analysis to analyze video-based content, especially healthcare communications. Thus, the justification for choosing both con-

tent analysis and a survey is the same as that of Bruno and Plaismie, that is, to gain responses easily and analyze the video-based health promotions by health professionals which can be shown in the survey. Additionally, past research supports the decision to use a survey. For example, Alshammari and Alshammari (2017), Gabarron et al. (2018), Ettel (2012), and Surani (2017) used surveys to investigate the impact of health professionals using social media to advocate health topics to users and why it can be important for health professionals to use these platforms. Therefore, previous studies closely align with my research as I am testing whether doctors and medical students can see the same importance as other health professionals already do. In addition, I chose a survey over any other procedure because of the need to present something new, since most researchers have already made new discoveries something with other methods, such as meta-analysis.

Rationale

I chose medical students and doctors in New York City for my target demographic group. First, I chose medical students as they will be future generations of doctors. Additionally, they were not considered in past research. Second, I chose doctors as there is a generation gap among medical students, resulting in differing opinions. For example, Surani (2017) argued that younger people were likelier to use TikTok. So, I chose doctors and medical students to show the difference in age and generation gap through social media. Lastly, I investigated medical students and doctors in New York City because most research studies did not explicitly state a region.

Survey Properties and Goals

Throughout my survey, participants were asked for consent due to Institutional Review Board's (IRB) guidelines; if participants did not consent, then the survey would close out for them. Furthermore, I added demographic questions to separate both groups (doctors and medical students) into two different sections for branching in the survey. In addition, by asking these questions, I can measure different aspects of the success of health professionals on TikTok as it impacts the two groups. The section "Health Promo-

tion and Social Media Use" included multiple choice, Likert scale, and rating questions that were used to answer how the success of health professionals on TikTok impacted the likelihood of doctors and medical students doing the same. The multiple-choice questions measured doctors' and medical professionals' awareness of other health professionals on social media (as portrayed by researchers like Ettel) and their social media use. The Likert scale questions measured how the success of health professionals through comments, likes, and followers (as shown by researchers like Bruno) had affected the opinions of the participants in my survey. These opinions were then analyzed by comparing the initial likelihood that doctors and medical students would promote health on TikTok after viewing the success of health professionals and the likelihood before viewing the success of health professionals on the platform. Lastly, the rating questions, as shown in the appendix, were used to measure the likelihood of the participants promoting health on the platform after viewing the success of other health specialists on TikTok. In order to test the clarity and comprehension of these questions, I sent the survey to my AP Research class to be peer-reviewed to look for whether these factors were visible in my survey.

Methods

Procedures

First, a survey was created on Microsoft Forms to examine the impact of knowing the success of health promotion videos on medical students and doctors in the New York City area. Before sending out my survey to the public, I sent out the draft survey to my AP Research class to be peer-reviewed to find out which questions were needed to answer my research question directly. I emailed those in the needed demographic group to distribute the survey while reminding doctors and medical students to take my survey. Before participating in the survey, participants were asked for their consent to preserve anonymity and privacy. I created two sections for the survey: demographic and preliminary info and health promotion and social media use. The first section, demographic and preliminary info, asked participants about their ethnicity and gender. Then, to advance my research project, I added

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a question asking whether they were medical students or doctors in the New York City area, which helped me allocate the groups to their tailored questions. For example, I asked medical students about their schools and doctors' specialty. Then I questioned whether they would use TikTok to promote health, considering the impact before knowing how successful health promotion videos were on TikTok. Next, I asked rating questions on a scale of 1 (lowest) to 5 (highest) and Likert questions that allowed participants to choose "strongly disagree," "disagree," "neutral," "agree," and "strongly agree." These questions helped assess the impact of knowing the success of health promotion videos on medical students and doctors. To display the success of health promotion videos on TikTok, I used content analysis with the search bar on TikTok to look for keywords like "doctors," "health," "disease," and "health awareness" to find videos that were successful based on comments, likes, and examples. For instance, one of the questions included in my survey is "@lifeofadoctor, an emergency physician on TikTok, has about 3.6 million followers and an average of 123.4 million likes, where he discusses reacting to medically related videos and explains what these medical conditions can be. After finishing the following section, participants could submit the survey, while the responses were saved in the Microsoft Forms application and later transferred into Microsoft Excel.

Paired Samples T-Test

Paired Samples T-Test					
Measure 1	Measure 2	t	df	p	
Medical students should use TikTok to promote health.	Use TikTok or any other form of social media to promote health awareness.	-1.000	8	0.347	
Note: Student's t-test.					

Descriptives

Descriptives	N	Mean	SD	SE
Medical students should use TikTok to promote health.	9	2.556	0.882	0.294
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152

Figure 1. A paired-samples t-test was conducted to compare whether medical students should use TikTok to promote health and whether they would use the platform to promote health awareness. There was no significant difference in the scores for whether medical students should use TikTok to promote health ($M=2.556$, $SD=0.882$) and to use TikTok or any other form of social media to promote health awareness ($M=2.725$, $SD=0.960$) conditions; $t(8) = -1.000$, $p=0.347$.

Analytics

The statistics software "Jasp" was used to analyze the survey responses from Microsoft Excel. Before putting the data into Microsoft Excel, I changed the Likert scale values to numbers from 1 (strongly disagree) to 5 (strongly agree) to make the data easy to analyze in the statistical software. I analyzed my results mainly using a paired-samples T-test and a correlation test. Paired-samples T-tests are used to analyze categories with categorical and numerical values, while correlation tests strictly analyze two different numerical values. I did not use an ANOVA as these tests did not fit my data or help me establish the research project's goal. Any p-values that were less than 0.05 showed the significance of the results and that my results were not by chance.

Results, Findings, and Analysis

Throughout my research, I collected 51 responses from my survey. Of those, four were discarded because they were not medical students or doctors, one was removed because they did not consent, and four were eliminated because they were medical students stationed outside of New York City. Therefore, 42 results were analyzed. Statistical analysis tests, mostly paired samples t-tests and r-Pearson's correlation

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tests, were run on JASP. These data sets were used to determine the significant relationships among the different variables.

As seen in Figure 1, a paired-samples t-test showed no significant relationship between the two factors ($p=0.347$, above 0.05, thus denoting no statistical significance). With the mean values between 2 and 3, medical students already despised using any form of social media to talk about health-related issues. Therefore, we can see that before viewing the success of health promotion videos on TikTok, medical students believed that they should not use TikTok

to promote health awareness as one factor does not influence the other. Despite lack of a relationship between these two factors, a Pearson product-moment correlation coefficient test revealed some meaning in the data. Figure 2 shows a p-value of 0.005 (less than 0.05, indicating statistical significance). This data set reveals some significant relationships between the two variables. However, because there were no markers of significance on the paired samples t-test, there is no cause-and-effect relationship between medical students using TikTok to promote health and using the platform to increase the health awareness of others.

Correlation

Pearson's Correlations

Variable	Medical students should use TikTok to promote health.
1. Medical students should use TikTok to promote health.	n
	Pearson's r
	p-value
2. Use TikTok or any other form of social media to promote health awareness.	n
	Pearson's r
	p-value

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2. A Pearson product-moment correlation coefficient was computed to assess the relationship between medical students who should use TikTok and use TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r = 0.839$, $n = 9$, $p = 0.005$]. Increases in thinking that medical students should use TikTok was correlated with increases in using TikTok to promote health awareness.

Paired Samples T-Test

Paired Samples T-Test

Measure 1	Measure 2	t	df	p
Doctors should use TikTok to promote health.	- Use TikTok or any other form of social media to promote health awareness.	0.926	30	0.362

Note. Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Doctors should use TikTok to promote health.	31	2.871	0.922	0.166
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152

Figure 3. A paired-samples t-test was conducted to compare whether doctors should use TikTok to promote health and use TikTok or any other form of social media to promote health awareness. There was no significant difference in the scores for whether doctors should use TikTok to promote health ($M = 2.871$, $SD = 0.922$) and to use TikTok or any other form of social media to promote health awareness ($M = 2.725$, $SD = 0.960$) conditions; $t(30) = 0.926$, $p = 0.362$.

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Correlation ▼

Pearson's Correlations

Variable	Doctors should use TikTok to promote health.
1. Doctors should use TikTok to promote health.	n
	Pearson's r
	p-value
2. Use TikTok or any other form of social media to promote health awareness.	31
	Pearson's r
	p-value

* p < .05, ** p < .01, *** p < .001

Figure 4. A Pearson product-moment correlation coefficient was computed to assess the relationship between doctors who should use TikTok to promote health and use of TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r = 0.435$, $n = 31$, $p = 0.015$]. Increases in thinking that doctors should use TikTok was correlated with increases in using TikTok to promote health awareness.

Thus, the idea of medical students using TikTok to promote health has yet to determine their choice to promote health awareness through any form of social media.

The same tests used in Figures 1 and 2 were used in the same way but for doctors instead of medical students as the target population. For example, a paired-samples t-test presents the idea that there is no significant connection between the variables ($p = 0.362$, above the threshold for statistical significance) (Figure 3). Analysis of the mean values for this figure indicates that doctors agreed with medical students since they also initially disagreed with the idea of health professionals using TikTok to promote health. This idea is supported by the mean values being 2.871 for doctors using social media and 2.725 for using the platform

to increase the health literacy of others. Moreover, a Pearson product-moment correlation coefficient represents a p-value of 0.015, a significant positive correlation (Figure 4). However, due to the results from the paired-sample t-test, there is no cause-and-effect relationship as the variable (doctors using TikTok to promote health) does not influence doctors in New York City to use social media to promote health awareness. In addition, there is a clear connection between Figures 1-4 for medical students and doctors, as the two measures did not affect each other.

A Pearson product-moment correlation coefficient test revealed a significant positive correlation between using TikTok to promote health awareness and telling others to do so ($p = 0.038$, less than 0.05, indicating statistical significance) (figure 5). Thus, a

Correlation ▼

Pearson's Correlations

Variable	Use TikTok or any other form of social media to promote health awareness.
1. Use TikTok or any other form of social media to promote health awareness.	n
	Pearson's r
	p-value
2. Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40
	Pearson's r
	p-value

* p < .05, ** p < .01, *** p < .001

Figure 5. A Pearson product-moment correlation coefficient was computed to assess the relationship between likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok and use of TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r = 0.330$, $n = 40$, $p = 0.038$]. Increases in the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok was correlated with increases in using TikTok to promote health awareness.

HEALTH PROMOTION ON TIKTOK

Paired Samples T-Test

Paired Samples T-Test					
Measure 1	Measure 2	t	df	p	
Use TikTok or any other form of social media to promote health awareness.	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	2.926	39	0.006	

Note: Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 6. A paired-samples t-test was conducted to compare the use of TikTok to promote health awareness and likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for the use of TikTok to promote health awareness ($M = 2.725$, $SD = 0.960$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(39) = 2.926$, $p = 0.006$.

paired-samples t-test supports the idea that there is a relationship between the two variables. As shown in Figure 6, a correlation revealed a p-value of 0.006, indicating a strong connection between using TikTok to promote health awareness and the likelihood that doctors and medical students would tell others to follow the same idea of promoting health on social media. Further analysis of the data set shows an average mean value of 2.725 for using TikTok to promote health awareness and 2.125 for telling others to follow the same process. These mean values imply that doctors and medical students would not use TikTok for any medical reasons and would not suggest anyone else do the same. Doctors and medical students disagree with these ideas due to the future risk of losing a

trustworthy relationship with their patients. Likewise, the reasoning behind these results is due to the dangers that are presented on social media. Therefore, the results from Figures 5 and 6 do not support past research findings, as health professionals were inclined to promote health even without viewing the success of promoting health on social media.

Other paired-samples t-tests were used to support these conclusions. For example, Figure 7 shows a significant relationship between the likelihood of telling others to use TikTok and that of downloading TikTok ($p = 0.048$). As shown in Figure 7, the mean values were 2.125 for the variables "likelihood that doctors and medical students would tell others to promote health through TikTok" and 2.500 for the

Paired Samples T-Test

Paired Samples T-Test					
Measure 1	Measure 2	t	df	p	
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	I will download social media and use it in the medical field. "Don't have social media"	-2.393	7	0.048	

Note: Student's t-test.

Descriptives

Descriptives

	N	Mean	SD	SE
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197
I will download social media and use it in the medical field. "Don't have social media"	8	2.500	0.756	0.267

Figure 7. A paired-samples t-test was conducted between the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok and whether doctors and medical students who do not have social media would download the application and use it in the medical field. There was a significant difference in scores for the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) and whether doctors and medical students who do not have social media would download the application and use it in the medical field ($M = 2.500$, $SD = 0.756$) conditions; $t(7) = -2.393$, $p = 0.048$.

HEALTH PROMOTION ON TIKTOK

Paired Samples T-Test ▼

Paired Samples T-Test				
Measure 1	Measure 2	t	df	p
I should use TikTok or any other form of social media to promote health awareness 2	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	2.686	38	0.011

Note: Student's t-test.

Descriptives

Descriptives	N	Mean	SD	SE
I should use TikTok or any other form of social media to promote health awareness 2	39	2.744	0.910	0.146
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 8. A paired-samples t-test was conducted to compare the use of TikTok to promote health awareness and likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for the use of TikTok to promote health awareness ($M = 2.744$, $SD = 0.910$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(38) = 2.686$, $p = 0.011$.

question of “whether participants without social media would download the application and use it in the medical field.” Therefore, there is a recurring theme that both medical students and doctors are reluctant to download TikTok to promote health. According to a second paired-samples t-test in Figure 8, a p-value of 0.011 resulted in both quantities being significant, which shows a cause-and-effect relationship between using social media to promote health awareness and telling others to do so. Therefore, unlike medical students, doctors were strongly influenced by knowing that health professionals are thriving on social media platforms.

The mean values in Figure 8 are similar to those in Figure 6. Therefore, these results corroborate the

conclusion that doctors and medical students would not promote health awareness on TikTok and are less likely to tell other health professionals to do the same. Thus, health professionals are less likely to promote health awareness on social media after viewing the success of health promotion videos on TikTok. Consequently, they would not download social media for the medical field. The reasoning behind this could be the dangers of social media, which are the justification for the results in other figures, but also due to past research, which has shown that social media has two sides: harmful as well as positive effects.

To evaluate my hypotheses, two paired-samples t-tests were carried out. A paired sample t-test in Figure 9 shows no significant correlation between medical

Paired Samples T-Test

Paired Samples T-Test				
Measure 1	Measure 2	t	df	p
Medical students should use TikTok to promote health.	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	-0.189	8	0.855

Note: Student's t-test.

Descriptives

Descriptives	N	Mean	SD	SE
Medical students should use TikTok to promote health.	9	2.556	0.882	0.294
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 9. A paired-samples t-test was conducted to compare whether medical students should use TikTok to promote health and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was no significant difference in the scores for medical students should use TikTok to promote health ($M = 2.556$, $SD = 0.882$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(8) = -0.189$, $p = 0.855$.

HEALTH PROMOTION ON TIKTOK

Paired Samples T-Test

Paired Samples T-Test					
Measure 1		Measure 2	t	df	p
Doctors should use TikTok to promote health.		Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	3.595	30	0.001
Note. Student's t-test.					

Descriptives

Descriptives				
	N	Mean	SD	SE
Doctors should use TikTok to promote health.	31	2.871	0.922	0.166
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 10. A paired-samples t-test was conducted to compare whether doctors should use TikTok to promote health and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for doctors should use TikTok to promote health ($M = 2.871$, $SD = 0.922$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(30) = 3.595$, $p = 0.001$.

students using TikTok to promote health awareness and telling others to do so, because the p-value is lower than 0.05, meaning no significance. Therefore, medical students were not impacted by the success of fellow health professionals using TikTok to spread health awareness on the platform or telling others to do the same. The mean values were 2.556 for medical students who believe that they should use TikTok and 2.125 for the likelihood that doctors and medical students would tell others to do the same. Although there is no chain reaction between these values, the idea of medical students having no desire to promote health on TikTok is still evident and prevalent. The second paired-samples t-test in Figure 10, between doctors using TikTok to promote health and telling others to do so, provided significant results ($p = 0.001$). The mean values for this figure differed for doctors who believe that they should use TikTok to promote health. For example, the mean value of around 2.871 was the same for whether doctors would follow the same procedure in promoting health on social media. Although the first test showed lower significance than the second, there is a clear connection that doctors and medical students have different motivations for promoting health on social media.

Figure 11. Table that summarizes most of the results from the figures above. This table corresponds the questions and the outcomes of the questions (p-value, Pearson's R, etc.)

*p-values ≤ 0.05

Questions	Rate your agreement with the following statement. Medical students should use TikTok to promote health. Vs. Are you aware that health professionals use social media, like TikTok, to promote health awareness?	Doctors should use TikTok to promote health. Vs. Are you aware that health professionals use social media, like TikTok, to promote health awareness?	Are you aware that health professionals use social media, like TikTok, to promote health awareness? Vs. On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok?	On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok? Vs. By knowing that promoting health through social media can benefit users, I will download social media and use it in the medical field. Only applies to those who don't use social media	As a health professional, I should use TikTok or any other form of social media to promote health awareness. (2nd set) vs. On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok?	Rate your agreement with the following statement. Medical students should use TikTok to promote health. Vs. On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok?	Rate your agreement with the following statement. Doctors should use TikTok to promote health. Vs. On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok?
Type of Test	Paired Samples T-test; correlation test	Paired Samples T-test; correlation test	Paired Samples T-test; correlation test	Paired Samples T-test	Paired Samples T-test	Paired Samples T-test	Paired Samples T-test
P-value	0.347; 0.005*	0.362; 0.015*	0.006*; 0.038*	0.048*	0.011*	0.855	0.001
Pearson's R Coefficient	0.839	0.435	0.330	N/A	N/A	N/A	N/A
Interpretation of Findings	Insignificant, significant	Insignificant, significant	Significant, significant	Significant	Significant	Insignificant	Significant

Discussion

Throughout this study, there were many significant findings. Although Figure 11 portrays insignificant findings, there was a consensus about how doctors and medical students in New York City contemplated promoting health on social media or TikTok. First, my hypotheses were wrong. Even though I hypothesized that medical students would be more inclined to promote health on TikTok due to being in a younger generation and that doctors would be less inclined to promote health on the platform due to being in an older generation, both doctors and medical students rejected the idea of promoting health on TikTok. Thus, my research rejects past research stating that health professionals widely use social media to advocate for better health towards others, as my research indicated that doctors and medical students in New York City reject the idea of promoting health on TikTok.

Limitations and Implications

Limitations

This study had several limitations. First, during the data collection, there were times when medical students forgot to take my survey. In addition, since I had to reject so many responses, some of the statistical analysis tests, as seen in Figure 8, would have had significant results if more medical students had been included. These limitations restricted my ability to conclude whether medical students from the New York City area were inclined to promote health on TikTok after viewing the success of health professionals on the platform.

Implications

The results also suggest some implications. One is that further studies can incorporate the conclusions of my research. As past research does not support my findings, this suggests that future research should discover different approaches to whether health professionals are inclined to promote health on TikTok after viewing the success of others on the platform. In addition, my research adds to the current body of knowledge as studies have yet to conclude that doc-

tors and medical students would not use social media to promote health, as most studies conclude that health professionals do use social media in this way. Furthermore, my research would impact doctors and medical students as they view the pros and cons of using social media for health-related reasons and choose whether to promote health by these means. For example, doctors and medical students could decide whether to promote health using TikTok or in hospitals and clinics. Lastly, as past researchers explained the issue of adolescents having limited knowledge of specific health topics, this research study can incentivize health professionals to promote health on social media to increase the health awareness of young adults.

Conclusion

My research study suggests that in New York City, doctors and medical students would generally not promote health despite the wide use of TikTok among other health professionals. These results could originate from dangers social media can promote, as data indicates that 26 of 40 medical students and doctors believe we should not promote health on the platform.

Future Directions

In further studies, there are many variables that other researchers can consider to gain different results. For example, a larger sample size of medical students would be helpful for future studies as my research has difficulty in obtaining a large enough sample of this target population. In addition, targeting a different region would be helpful to aspiring researchers in this field, as my research solely focused on residents in New York. If a different state or country was chosen, the results might differ. Therefore, by doing this, future researchers can confirm the study's results and uncover another research gap in the topic of health professionals using social media to promote health.

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Appendix

Paired Samples T-Test

Paired Samples T-Test				
Measure 1	Measure 2	t	df	p
Medical students should use TikTok to promote health.	- Use TikTok or any other form of social media to promote health awareness.	-1.000	8	0.347

Note: Student's t-test.

Descriptives

Descriptives				
	N	Mean	SD	SE
Medical students should use TikTok to promote health.	9	2.556	0.882	0.294
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152

Figure 1. A paired-samples t-test was conducted to compare whether medical students should use TikTok to promote health and whether they would use the platform to promote health awareness. There was no significant difference in the scores for whether medical students should use TikTok to promote health ($M=2.556$, $SD=0.882$) and to use TikTok or any other form of social media to promote health awareness ($M=2.725$, $SD=0.960$) conditions; $t(8) = -1.000$, $p=0.347$.

Correlation

Pearson's Correlations		
Variable	Medical students should use TikTok to promote health.	
1. Medical students should use TikTok to promote health.	n	—
	Pearson's r	—
	p-value	—
2. Use TikTok or any other form of social media to promote health awareness.	n	9
	Pearson's r	0.839**
	p-value	0.005

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2. A Pearson product-moment correlation coefficient was computed to assess the relationship between medical students who should use TikTok and use TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r=0.839$, $n=9$, $p=0.005$]. Increases in thinking that medical students should use TikTok was correlated with increases in using TikTok to promote health awareness.

Paired Samples T-Test

Paired Samples T-Test				
Measure 1	Measure 2	t	df	p
Doctors should use TikTok to promote health.	- Use TikTok or any other form of social media to promote health awareness.	0.926	30	0.362

Note: Student's t-test.

Descriptives

Descriptives				
	N	Mean	SD	SE
Doctors should use TikTok to promote health.	31	2.871	0.922	0.166
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152

Figure 3. A paired-samples t-test was conducted to compare whether doctors should use TikTok to promote health and use TikTok or any other form of social media to promote health awareness. There was no significant difference in the scores for whether doctors should use TikTok to promote health ($M=2.871$, $SD=0.922$) and to use TikTok or any other form of social media to promote health awareness ($M=2.725$, $SD=0.960$) conditions; $t(30)=0.926$, $p=0.362$.

HEALTH PROMOTION ON TIKTOK

Correlation ▼

Pearson's Correlations

Variable	Doctors should use TikTok to promote health.
1. Doctors should use TikTok to promote health.	n
	Pearson's r
	p-value
2. Use TikTok or any other form of social media to promote health awareness.	n
	Pearson's r
	p-value

* p < .05, ** p < .01, *** p < .001

Figure 4. A Pearson product-moment correlation coefficient was computed to assess the relationship between doctors who should use TikTok to promote health and use of TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r = 0.435$, $n = 31$, $p = 0.015$]. Increases in thinking that doctors should use TikTok was correlated with increases in using TikTok to promote health awareness.

Correlation ▼

Pearson's Correlations

Variable	Use TikTok or any other form of social media to promote health awareness.
1. Use TikTok or any other form of social media to promote health awareness.	n
	Pearson's r
	p-value
2. Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	n
	Pearson's r
	p-value

* p < .05, ** p < .01, *** p < .001

Figure 5. A Pearson product-moment correlation coefficient was computed to assess the relationship between likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok and use of TikTok or any other form of social media to promote health awareness. There was a positive correlation between the two variables [$r = 0.330$, $n = 40$, $p = 0.038$]. Increases in the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok was correlated with increases in using TikTok to promote health awareness.

Paired Samples T-Test

Paired Samples T-Test

Measure 1	Measure 2	t	df	p
Use TikTok or any other form of social media to promote health awareness.	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	2.926	39	0.006

Note. Student's t-test.

Descriptives

Descriptives	N	Mean	SD	SE
Use TikTok or any other form of social media to promote health awareness.	40	2.725	0.960	0.152
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 6. A paired-samples t-test was conducted to compare the use of TikTok to promote health awareness and likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for the use of TikTok to promote health awareness ($M = 2.725$, $SD = 0.960$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(39) = 2.926$, $p = 0.006$.

HEALTH PROMOTION ON TIKTOK

Paired Samples T-Test

Paired Samples T-Test		Measure 1	Measure 2	t	df	p
		Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	I will download social media and use it in the medical field "Don't have social media"	-2.393	7	0.048
Note: Student's t-test.						

Descriptives

Descriptives				
	N	Mean	SD	SE
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197
I will download social media and use it in the medical field "Don't have social media"	8	2.500	0.756	0.267

Figure 7. A paired-samples t-test was conducted between the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok and whether doctors and medical students who do not have social media would download the application and use it in the medical field. There was a significant difference in scores for the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M=2.125$, $SD=1.244$) and whether doctors and medical students who do not have social media would download the application and use it in the medical field ($M=2.500$, $SD=0.756$) conditions; $t(7)=-2.393$, $p=0.048$.

Paired Samples T-Test ▼

Paired Samples T-Test		Measure 1	Measure 2	t	df	p
		I should use TikTok or any other form of social media to promote health awareness 2	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	2.686	38	0.011
Note: Student's t-test.						

Descriptives

Descriptives				
	N	Mean	SD	SE
I should use TikTok or any other form of social media to promote health awareness 2	39	2.744	0.910	0.146
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 8. A paired-samples t-test was conducted to compare the use of TikTok to promote health awareness and likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for the use of TikTok to promote health awareness ($M=2.744$, $SD=0.910$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M=2.125$, $SD=1.244$) conditions; $t(38)=2.686$, $p=0.011$.

Paired Samples T-Test

Paired Samples T-Test		Measure 1	Measure 2	t	df	p
		Medical students should use TikTok to promote health	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	-0.189	8	0.855
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Descriptives

Descriptives				
	N	Mean	SD	SE
Medical students should use TikTok to promote health	9	2.556	0.882	0.294
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 9. A paired-samples t-test was conducted to compare whether medical students should use TikTok to promote health and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was no significant difference in the scores for medical students should use TikTok to promote health ($M=2.556$, $SD=0.882$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M=2.125$, $SD=1.244$) conditions; $t(8)=-0.189$, $p=0.855$.

HEALTH PROMOTION ON TIKTOK

Paired Samples T-Test



Paired Samples T-Test						
Measure 1		Measure 2		t	df	p
Doctors should use TikTok to promote health.		-	Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	3.595	30	0.001
Note. Student's t-test.						

Descriptives

Descriptives				
	N	Mean	SD	SE
Doctors should use TikTok to promote health.	31	2.871	0.922	0.166
Likelihood that you would tell other doctors/medical students to promote health awareness on TikTok	40	2.125	1.244	0.197

Figure 10. A paired-samples t-test was conducted to compare whether doctors should use TikTok to promote health and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok. There was a significant difference in the scores for doctors should use TikTok to promote health ($M = 2.871$, $SD = 0.922$) and the likelihood that doctors and medical students would tell their colleagues to promote health awareness on TikTok ($M = 2.125$, $SD = 1.244$) conditions; $t(30) = 3.595$, $p = 0.001$.

1. Do you give consent to participate in this survey? *

- ☒ I consent 
- ☐ I do not give consent 

Section 2

Demographic and Preliminary Info

2. What is your gender? *

- ☐ Male
- ☐ Female
- ☐ Non-binary
- ☐ Prefer not to say
- ☐ Other

HEALTH PROMOTION ON TIKTOK

3. What is your ethnicity? (click all that applies) *

- ☐ White
- ☐ American Indian or Alaska Native
- ☐ Black or African American
- ☐ Hispanic, Latino, or Spanish origin
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Asian
- ☐ Middle Eastern
- ☐ Prefer not to say
- ☐ Other

4. Are you a medical student or a doctor? *

- ☐ Yes, I am a medical student
- ☐ Yes, I am a doctor
- ☐ Neither a doctor nor medical student

5. What medical school do you go to? *

- ☐ Cuny School of Medicine
- ☐ NYU Grossman School of Medicine
- ☐ Columbia University Vagelos College of Physicians and Surgeons
- ☐ Any other medical school in NYC
- ☐ School outside of NYC

6. What is your specialty? *

Select your answer



7. Rate your agreement with the following statement. *

1 2 3 4 5

Medical students should use TikTok to promote health.



HEALTH PROMOTION ON TIKTOK

8. Rate your agreement with the following statement. *

	1	2	3	4	5
Doctors should use TikTok to promote health.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 3

Health Promotion and Social Media Use

9. Are you aware that health professionals use social media, like TikTok, to promote health awareness? *

- ☐ I am aware
- ☐ I am not aware

10. Do you use social media at all? *

- ☐ Yes
- ☐ No

11. Do you use any social media applications? If so click all that apply *

- ☐ Instagram
- ☐ TikTok
- ☐ Facebook
- ☐ Twitter
- ☐ LinkedIn
- ☐ Snapchat
- ☐ YouTube

12. When was the last time you used social media? *

- ☐ I recently used social media today
- ☐ I used social media yesterday
- ☐ I have not used social media for a week or two weeks

13. On a scale of 1 to 5, 1 representing the least often and 5 representing the most often, rate how often you use social media? *

1

2

3

4

5

HEALTH PROMOTION ON TIKTOK

14. On a scale of 1 to 5, 1 being the least possible knowledge and 5 being the most possible knowledge, rate your current knowledge about the social media application "TikTok"? *

1	2	3	4	5
---	---	---	---	---

15. Rate your agreement with the following statement. *

	1	2	3	4	5
I am concerned that adolescents and teens do not know where to go for any health-related info.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. From a medical professional's (@doctormike) health promotion video on TikTok, a user commented "I have Ehlers-Danlos syndrome!! First time I've seen a medical professional cover this on here! 🥳" After viewing the limited amount of health professionals on TikTok, rate your agreement with the following statements.

	1	2	3	4	5
As a health professional, I should use TikTok or any other form of social media to promote health awareness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
By knowing that promoting health through social media can benefit users, I will download social media and use it in the medical field. Only applies to those who don't use social media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

HEALTH PROMOTION ON TIKTOK

17. Doctors use TikTok to explain common health interventions. For example, @toppodiatry, a foot and ankle surgeon, posted a video of himself demonstrating different exercises one can do for plantar fasciitis (which causes heel pain). Considering that there are health professionals on TikTok that address health awareness, rate your agreement with the following statements.

	1	2	3	4	5
As a health professional, I should use TikTok or any other form of social media to promote health awareness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
By knowing that promoting health through social media can benefit users, I will download social media and use it in the medical field. Only applies to those who don't use social media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. On a scale of 1 to 5, 1 being less likely and 5 being the most likely, rate the likelihood that you would use social media to interact with your patients before the COVID-19 pandemic. **(for college students, this would apply to you in the future) ***

1	2	3	4	5
---	---	---	---	---

20. On a scale of 1 to 5, 1 being less likely and 5 being the most likely, rate the likelihood that you would use social media to interact with your patients during the COVID-19 pandemic. **(for college students, this would apply to you in the future) ***

1	2	3	4	5
---	---	---	---	---

HEALTH PROMOTION ON TIKTOK

21. Other than TikTok, would you use any other social media application to promote health? Click all that may apply. *

- ☐ Instagram
- ☐ YouTube
- ☐ Facebook
- ☐ Snapchat
- ☐ Twitter
- ☐ LinkedIn
- ☐ I would not use social media in general

22. Considering the dangers of promoting health on social media (especially TikTok), would you still use social media to promote health in order to increase the awareness of users as their health literacy is low. *

- ☐ I would still use social media despite the dangers
- ☐ I would not use social media due to the dangers that could be presented

23. On a scale of 1 to 5, 1 being the least likely and 5 being the most likely, rate the likelihood that you would tell other doctors/medical students to promote health awareness on TikTok? *

1	2	3	4	5
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Inefficiencies in the Baseball Labour Market: An Analysis of Roster Construction Strategies of the Cleveland Guardians and the Tampa Bay Rays for 2022 MLB Season

Will Houslander

Abstract: In this study, a three-step method was used to assess one main question: How have the Cleveland Guardians and the Tampa Bay Rays found playoff success despite their low payrolls? First, this study found the correlation between 29 different baseball statistics and MLB teams winning percentages during the 2022 season. The correlation was found using Pearson's correlation coefficient, specifically looking for statistics with strong correlations with r -values > 0.6 or > -0.6 . Ten statistics were found to have a strong correlation to winning percentage in 2022. Next, a log-linear regression analysis was used to analyze which of the strongly correlated metrics were the most undervalued in the baseball labour market. Lastly, step three discovered whether the Rays and the Guardians value the undervalued statistics identified in step two. The results of this study indicate that both the Guardians and the Rays found success through their strong pitching staffs.

Keywords: baseball, baseball analytics, sabermetrics, market inefficiencies, low payroll, payroll strategies

Introduction

Michael Lewis' 2003 book *Moneyball* details how low-payroll teams like the Oakland Athletics could succeed despite their low payroll (Lewis, 2003). Billy Beane and the Oakland Athletics front office found success by exploiting inefficiencies in player evaluation in the MLB. They discovered that other MLB teams were undervaluing players who possessed a great ability to get on base but struggled to attain a high batting average (AVG) and slugging percentage (SLG), which were prominent statistics in player evaluation in the early 2000s (Brown, et al., 2017). Oakland found great success using these tactics, and for that reason, all teams, no matter the payroll, adopted Oakland's Moneyball tactics by 2019 (University of Toronto, 2019). With all teams quickly increasing

their usage of Moneyball tactics, low-payroll teams such as the Oakland Athletics lost their competitive advantage, thus leading to high-payroll teams having vast success, as since 2004 all World Series winners have had an opening day payroll in the top half of the league in the year they won (Glaser, 2019). However, since 2016 both the Cleveland Guardians and the Tampa Bay Rays have made the playoffs at least three times in a row, all while keeping a payroll in the bottom half of the league (Baseball Reference, 2022). Out of 30 major league teams, Cleveland's payroll ranked in the bottom eight in three of their five playoff runs (Cot's Contracts, 2022). Meanwhile, Tampa Bay's payroll was even lower in all four of their postseason appearances. They consistently ranked in the bottom seven (Cot's Contracts, 2022).

Historically, researchers have directed their studies at discovering different ways that Michael Lewis'

Moneyball revolutionized the way MLB teams build their rosters. Caporale et al. (2013) discovered that *Moneyball* did not affect the teams' draft philosophy. Additionally, Chang and Zenilman (2013) studied the change in free-agent salaries since *Moneyball* and found that teams started paying players more based on Wins Above Replacement (WAR).

However, there has been little research on market inefficiencies in today's baseball market and if successful low-payroll teams like the Cleveland Guardians and the Tampa Bay Rays are exploiting these inefficiencies when constructing their rosters. Through a 3-step quantitative analysis, this study will aim to discover what statistics correlate the most to winning percentage, what market inefficiencies are present in today's baseball labour market, and whether the Guardians and the Rays leverage these inefficiencies. A three-step method was put in place to complete this study. The method will aim to answer the research question: What inefficiencies are there in today's baseball labour market and did the Cleveland Guardians and the Tampa Bay Rays value these statistics when constructing their rosters for the 2022 MLB season?

This study will help major league teams, agents, and writers know what statistics to look for when evaluating players. Additionally, this study will research ways that struggling organizations can still succeed with a low payroll, and will discover the proper way to utilize teams' limited money supply.

Literature Review

Correlation Between Statistics and Winning

A regression analysis conducted by Houser (2005) examined what baseball statistics correlated the most with a team's percentage of wins. The regression analysis included seven different statistics as explanatory variables. Just as Houser (2005) hypothesized, OBP along with WHIP had the highest correlation to a team's winning percentage. Furthermore, Frerker (2013) used Pearson's correlation coefficient to determine the correlation between a team's winning percentage in the 2012 MLB season and their strikeout-to-walk ratio (K/BB), on-base percentage (OBP), and home runs. Frerker (2013) discovered a positive strong correlation between a team's K/BB ra-

tio and its winning percentage as demonstrated by its 0.68 r-value. Both OBP and home runs had a r-value < 0.5, indicating that both have a moderately weak positive correlation. Step 1 of this study's method is based on Frerker's (2013) method; however, this study provides insight into more than three statistics. Similar to Frerker (2013), Fullerton et al. (2014) tested the importance of earned run average (ERA), errors per game, and on-base plus slugging (OPS) on a team's success in his econometric analysis of the 2013 MLB season. Fullerton et al. (2014) discovered that the most successful teams in the 2013 season were teams that found a solid balance between pitching, hitting, and fielding (Fullerton et al., 2014).

MLB Market Inefficiencies

Lewis' (2003) *Moneyball* provided awareness of market inefficiencies that were present in the baseball labour market and how the Oakland Athletics exploited those inefficiencies. Following the successful reception of *Moneyball*, Hakes and Sauer (2006) conducted a linear regression analysis to confirm Lewis's (2003) hypothesis that OBP was undervalued in the baseball labour market. This study successfully validates Lewis's (2003) hypothesis as it found that from 2000-2004, on-base percentage was undervalued; however, in the years after *Moneyball* was released, the market abruptly corrected itself and valued OPS appropriately (Hakes and Sauer, 2006). Hakes and Sauer (2006) provided an insightful analysis into how the baseball industry responded to the *Moneyball* hypothesis; however, it failed to account for the fact that players with less service time make less money, even though they may provide more value for teams. Unlike Hakes and Sauer (2006), this study included players' service time as a control variable in regression analysis to ensure valid results. Baumer and Zimbalist (2014) expanded upon Hakes and Sauer's (2006) study and tested whether the changes in the labour market valuations due to *Moneyball* tactics would be permanent. Baumer and Zimbalist (2014) discovered that the baseball labour market's immediate response to *Moneyball* was unsustainable. Baumer and Zimbalist (2014) mark *Moneyball* as the catalyst in accelerating the process of making high on-base players more valuable. However, in the end, the immediate responses in the baseball labour market were

just a part of the modest, long-term increase in high-OBP players in the MLB. Lastly, research done by Duquette et al. (2019) provides a modern-day view of the state of *Moneyball* 15 years after the book was published. Since the release of *Moneyball* in 2003, all major league baseball teams have shifted their payroll to align with its analytics (Duquette et al., 2019). Duquette et al. (2019) also discovered that the ability to draw walks may still be undervalued in the present-day labour market.

Moneyball's Impact on Baseball Operations

Since Michael Lewis' book was published in 2003, many studies have been done on how *Moneyball* tactics have impacted the way MLB front offices construct their teams. A study by Chang and Zenilman (2013) measured the impact of *Moneyball* on free agent salaries, and whether teams had started to award players based on different statistics. The focus of the study was on three specific years of free agency, 2000, 2005, and 2011. These years represent years before, immediately following, and eight years after the book was written. Chang and Zenilman (2013) discovered that front offices shifted their focus from players with great physical traits whom they valued highly pre-*Moneyball* to players who accumulate high WAR and OBP. In contrast, Caporale and Collier (2012) analyzed whether *Moneyball* affected a team's draft strategy. In Lewis's (2003) book, he advises that teams should focus more on drafting college players over high school players as they have more success in the MLB. Caporale and Collier's (2012) study challenges this theory, finding that the performance of college players in MLB is no better than the performance of high school players. Additionally, Caporale and Collier (2012) discovered that there had been no significant change in the team's draft strategy following *Moneyball*. After adopting the original *Moneyball* tactics, all major league teams transitioned to developing their own *Moneyball* theories, as evidenced by research conducted by Barrella (2018). Since 2012 the league has seen a 15% increase in the average number of relievers used per game. Barrella (2018) concluded that this rise is a result of teams realizing they can pay relievers much less than starters, even though they provide the same value as starters just on fewer innings.

Gap Analysis

Current research on how certain baseball metrics correlate with a team's winning percentage has provided insight into the relationship between certain statistics and winning percentage, but it is not without limitations. The two main limitations are that many papers have relied on outdated and flawed metrics, and many have used a limited variety of metrics. For instance, Houser's (2005) study focused on how flawed statistics like OBP, batting average, and fielding percentage correlate to a team's winning percentage. Due to flaws in these major statistics, the results of Houser's research are significantly hindered. This study aims to use newer and more accurate statistics such as ISO (isolated power) and K/BB (strikeout-to-walk rate) that better represent a player's value and are expected to yield more valid results. In addition, most studies have failed to use a variety of statistics when examining the correlation between team performance in certain metrics and a team's winning percentage. Many studies including Frerker (2013), and Fullerton et al. (2014) only looked into how three statistics correlate to winning. In contrast, this study examines how a team's performance in 29 different metrics correlates with their winning percentage in the 2022 MLB season. I used domain knowledge to select these 29 metrics (listed in Appendix B) as they fully encompass players' performance.

Current research on market inefficiencies in the MLB labor market has increased understanding of how certain statistics are undervalued. However, these studies have not examined whether teams are taking advantage of undervalued statistics. For example, Duquette et al. (2019) found that the ability to draw walks was undervalued, but did not investigate whether any teams, specifically low-payroll teams were exploiting this inefficiency. This study aims to address these limitations by examining whether the Cleveland Guardians and the Tampa Bay Rays have successfully capitalized on market inefficiencies to achieve more postseason success. The findings will provide valuable insights for struggling low-payroll teams seeking to improve their roster construction strategies.

Method

A comprehensive and in-depth study is needed to evaluate the market inefficiencies present in today's baseball labour market. This study consisted of three carefully designed steps that provided valuable insights into the current state of the baseball market and its inefficiencies.

Step 1:

Step one builds on previous research and helps better understand what factors contribute the most to a team's success. Previous research, such as Frerker's (2013) study on strikeout to walk ratio (K/BB), on-base-percentage (OBP) and home runs, has shown that certain skills contribute more to a team's success. To build on Frerker's (2013) research, I collected data from the 2022 MLB season and used Pearson's correlation coefficient to determine the strength of the relationship between a team's performance in each metric and their winning percentage. Pearson's correlation coefficient generates an r-value that ranges from -1 (perfect negative correlation) to 1 (perfect positive correlation). From here I was able to identify which statistics are most important to predicting success and help teams understand what skills to focus on when building their rosters. This method is the most suitable for step one because it provides teams with an easy means of fully understanding how different statistics correlate to winning. By using domain knowledge, I collected 29 different statistics that provide a comprehensive view of a player's performance and are most relevant when attempting to predict team success. A full list of the statistics used with definitions can be found in Appendix B.

To fully understand how these statistics correlate with teams winning percentages, I collected team performance for all 29 statistics and their winning percentage in 2022. The strategies and tactics used by teams to score and prevent runs tend to remain consistent from season to season, making it sufficient to evaluate the relationship between baseball metrics and winning percentages using data from a single season. In this study, I have chosen to focus on data from the 2022 MLB season to provide a comprehensive and up-to-date analysis. The winning percentage data

was collected from MLB.com, while the team performance statistics were collected from Fangraphs. Once all the data was collected, it was exported from Fangraphs and sorted into Google Sheets. Google Sheets was used to ensure that all the data collected is stored safely. The results for this step are presented primarily on graphs showing the correlation between the two variables. The results can be found in the "Findings Section" and "Appendix A."

Step 2:

Step two identified undervalued statistics in the current baseball labour market. To do this, I used a log-linear regression model similar to the one used by Baumer and Zimbalist (2014) in their study on the relationship between player salaries and performance metrics. My log-linear regression model used player salaries as the dependent variable, and all of the statistics used in step one as the independent variables. However, unlike step one, all statistics were individual player statistics from the 2022 MLB season. In total, three different log-linear regression models were run: one for position players, one for starting pitchers, and one for relief pitchers. Only arbitration-eligible players or free-agent-eligible players were included in the model, as they are the only players with some control over their salary. To create the regression model, I first collected data on player salaries from a reliable source, Cots Contracts (2022). Then, I collected individual player data on all of the statistics in step one from Fangraphs. When all the data was collected, I conducted a log-linear regression model using the following equations:

Position Player

$$\ln(\text{Salary}) = \beta_0 + \beta_1 \cdot \text{PA} + \beta_2 \cdot \text{G} + \beta_3 \cdot \text{BB/K} + \beta_4 \cdot \text{BB\%} + \beta_5 \cdot \text{K\%} + \beta_6 \cdot \text{ISO} + \beta_7 \cdot \text{Contact\%} + \beta_8 \cdot \text{Hard\%} + \beta_9 \cdot \text{LD\%} + \beta_{10} \cdot \text{Barrel\%} + \beta_{11} \cdot \text{GB\%} + \beta_{12} \cdot \text{IFFB\%} + \beta_{13} \cdot \text{Soft\%} + \beta_{14} \cdot \text{DRS} + \beta_{15} \cdot \text{UZR} + \beta_{16} \cdot \text{OAA} + \beta_{17} \cdot \text{Catcher} + \beta_{18} \cdot \text{Infielder} + \beta_{19} \cdot \text{Outfielder} + \beta_{20} \cdot \text{ArbEligible} + \beta_{21} \cdot \text{Free Agent}$$

Pitchers

$$\ln(\text{Salary}) = \beta_0 + \beta_1 \cdot \text{G} + \beta_2 \cdot \text{IP} + \beta_3 \cdot \text{BB\%} + \beta_4 \cdot \text{K\%} + \beta_5 \cdot \text{K/BB} + \beta_6 \cdot \text{K-BB\%} + \beta_7 \cdot \text{SwStr\%} + \beta_8 \cdot \text{CSW\%} + \beta_9 \cdot \text{HARD\%} + \beta_{10} \cdot \text{Soft\%} + \beta_{11} \cdot \text{LD\%} + \beta_{12} \cdot \text{Barrel\%} + \beta_{13} \cdot \text{IFFB\%} + \beta_{14} \cdot \text{GB\%} + \beta_{15} \cdot \text{O-Swing\%} + \beta_{16} \cdot \text{Contact\%} + \beta_{17} \cdot \text{ArbEligible} + \beta_{18} \cdot \text{Free Agent}$$

β represents the coefficient value. This indicates the fractional increase in a player's expected salary if the statistic corresponding to the particular β value increases by one unit while all other statistics remain constant. This regression analysis technique is found in papers such as Baumer and Zimablist (2014) and Hakes and Sauer (2006). Similar to Baumer and Zimablist (2014), I used control variables to attempt to include all possible factors that go into a player's salary. Variables were coded as 1 if they fell within the assigned category, and 0 if they did not. The control variables include:

1. ArbEligible - Is the player arbitration eligible? Their service time is between three and six years.
2. FreeAgent - Has this player ever been a free agent? Their service time is above six years.
3. Catcher - Is this player a catcher? Catchers are typically valued differently because fielding is more important than hitting for catchers.
4. Infielder - Is this player an infielder?
5. Outfielder - Is this player an outfielder?

Control variables 3-5 were only used in the position players regression model.

The control variable "DesignatedHitter" is not included to ensure there is not a problem with multicollinearity. Multicollinearity occurs when independent variables are correlated. Excluding a fourth category of "DesignatedHitter" avoids having correlation of all four control variables: for example, if a player was not an "Outfielder" they would have to fall into one of the other three categories. However, by excluding "DesignatedHitter," there is a possibility that a player falls into none of the three control variables. The results of this section showed how an increase of one statistical unit affects a player's expected salary. This information will help guide the team's decision-making regarding player acquisitions. The results of the regression models are presented through tables that can be found in the "Findings" section.

Step 3

Lastly, step three of my method aimed to determine whether successful low-payroll teams, such as the Cleveland Guardians and the Tampa Bay Rays, value the undervalued statistics identified in step two. To accomplish this, I collected data on the perfor-

mance of these teams across the 29 different statistics used in step one. I then analyzed whether Cleveland and Tampa Bay prioritized the undervalued statistics by examining which statistics they ranked in the top ten in 2022. If any of their top ten statistics aligned with the undervalued statistics, it would suggest that these teams were leveraging market inefficiencies in the baseball labour market to construct competitive rosters. Step three of this study sheds light on the strategies employed by successful low-payroll teams, providing insights that can inform how teams should approach the construction of their roster.

Findings

Step 1

Definitions of all statistics can be found in Appendix B

Position Players

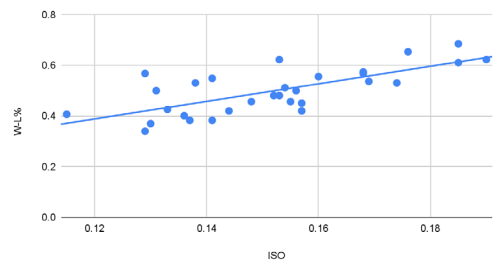
The analysis of MLB data from the 2022 season revealed that three position player statistics are strongly correlated with winning percentage. All three of the statistics had an r-value of greater than 0.6 or -0.6 which aligns with the definition I followed.

ISO ($r = 0.72$)

BB/K ($r = 0.69$)

DRS ($r = -0.66$)

W-L% vs. ISO

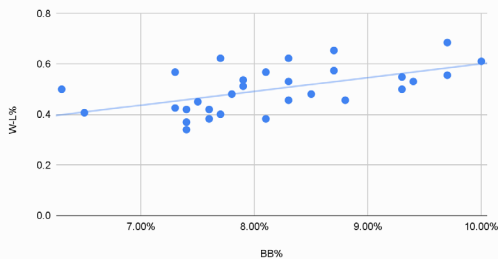


INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Additionally, I discovered that several other position players' statistics had a moderately strong relationship to teams winning percentages in the 2022 MLB season. These statistics include:

BB% ($r = 0.56$)
Barrel% ($r = 0.55$)
GB% ($r = -0.50$)
OAA ($r = 0.48$)
HARD% ($r = 0.44$)
K% ($r = -0.41$)

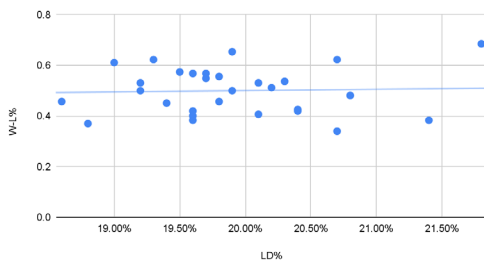
W-L% vs. BB%



Lastly, there were six statistics that I determined had a weak correlation to a team's winning percentage in 2022, as they all had an r-value of less than 0.4 or -0.4. These statistics include:

Soft% ($r = -0.33$)
Contact% ($r = 0.30$)
Bsr ($r = 0.21$)
UZR ($r = 0.16$)
IFFB% ($r = -0.1$)
LD% ($r = 0.043$)

W-L% vs. LD%

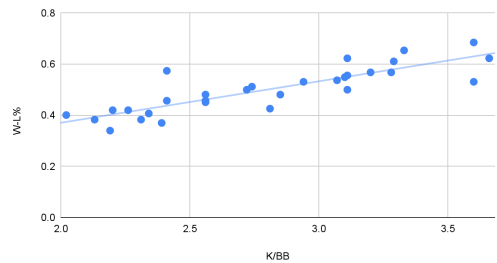


Pitchers

I found that seven different pitching statistics strongly correlated to teams winning percentages in the 2022 MLB season. These seven statistics are:

K/BB ($r = 0.85$)
K-BB% ($r = 0.84$)
K% ($r = 0.74$)
BB% ($r = -0.72$)
SwStr% ($r = 0.67$)
O-swing% ($r = 0.64$)
CSW% ($r = 0.64$)

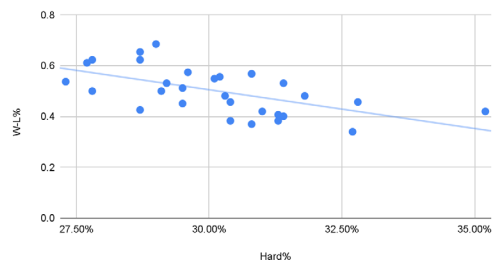
W-L% vs. K/BB



Next, I discovered that five pitching statistics exhibited a moderately strong correlation to teams' winning percentages in the 2022 MLB season. Those statistics were:

Soft% ($r = 0.59$)
Contact% ($r = 0.58$)
HARD% ($r = -0.58$)
Barrel% ($r = -0.54$)
LD% ($r = -0.44$)

W-L% vs. Hard%



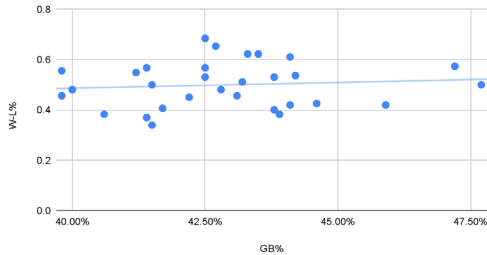
INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Finally, only two statistics showed a weak correlation to teams' winning percentages in the 2022 MLB season. These two statistics were:

IFFB% ($r = 0.34$)

GB% ($r = 0.098$)

W-L% vs. GB%



Appendix A provides graphs showing the correlations between each statistic and winning percentage.

Step 2:

Definitions of all terms mentioned are in Appendix C

Position Players

When looking into how position player statistics are valued in the MLB labour market, my log-linear regression model had an r^2 value of 0.61. Table 1 highlights how the position player statistics with a strong correlation to winning percentage are valued in the 2022 market.

Starting Pitchers

When looking into how starting pitcher's statistics are valued in the MLB labour market, the log-linear regression model had an r^2 value of 0.41. Table 2 shows how the starting pitching statistics with a strong correlation to winning percentage are valued in the 2022 market.

Relief Pitchers

When looking into how relief pitcher's statistics are valued in the MLB labour market, my log-linear regression model had an r^2 value of 0.16. Table 3 found how the relief pitcher's statistics with a strong correlation to winning percentage are valued in the 2022 MLB labour market.

	BB/K	ISO	DRS
Coefficient Value	0.75	0.01	-0.99
Coefficient s.error	0.49	0.001	1.47

Table 1 - How Position Player Statistics are Valued in the Baseball Labour Market

	K/BB	K-BB%	K%	BB%	SwStr%	O-Swing%	CSW%
Coefficient Value	12.99	4.35	-1.34	0.93	1.86	0.009	1.38
Coefficient s.error	7.72	5.02	3.78	2.27	5.24	0.008	3.33

Table 2 - How Starting Pitcher Statistics are Valued in the Baseball Labour Market

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

	K/BB	K-BB%	K%	BB%	SwStr%	O-Swing%	CSW%
Coefficient Value	-4.74	-0.38	-5.15	-1.24	1.44	0.02	1.75
Coefficient s.error	4.66	2.48	2.35	1.29	3.03	0.01	2.27

Table 3 - How Relief Pitcher Statistics are Valued in the Baseball Labour Market

Step 3:

Tampa Bay Rays 2022 Performance:

Position Player Performance:

In 2022, the Rays were not in the top ten of any of the 15 position player metrics that I used to analyze their performance.

Plate Discipline/Vision	Performance	League Rank
K%	23.20%	19th
BB%	8.30%	12th
BB/K	0.36	15th
O-Swing%	32.50%	13th
Contact%	75.40%	23rd
Batted Ball Data		
LD%	20.10%	11th
GB%	44.40%	23rd
IFFB%	35.50%	21st
Soft%	16.30%	13th
Hard%	28.90%	25th
Barrel%	6.10%	26th
Advanced Stats		
ISO	0.138	22nd
BSR	4	11th
DRS	15	14th
OAA	2	15th

Figure 1 - Tampa Bay Rays Position Player Performance in 2022 Season

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Starting Pitchers Performance

In the 2022 MLB season, the Tampa Bay Rays starting pitching staff was in the top ten in a staggering ten of the 14 pitching metrics I reviewed. A yellow highlight represents a top 10 finish in that metric.

Advanced	Performance	League Rank
BB%	5.60%	1st
K%	23.60%	10th
K-BB%	18%	4th
K/BB	4.23	1st
Batted Ball Data		
GB%	42.70%	14th
LD%	19.80%	9th
IFFB%	37.50%	14th
Hard%	29.90%	11th
Soft%	15.90%	18th
Barrel%	7.10%	8th
Put Away Stuff		
O-Swing%	36.40%	1st
SwStr%	12.70%	1st
Contact%	74.80%	4th
CSW%	29.10%	3rd

Figure 2 - Tampa Bay Rays Starting Pitchers Performance in 2022

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Relief Pitchers Performance

The relief pitchers for the Tampa Bay Rays ranked in the top ten of 7/14 pitching metrics in the 2022 season.

Advanced	Performance	League Rank
BB%	7.50%	1st
K%	23.10%	18th
K-BB%	15.70%	8th
K/BB	3.1	5th
Batted Ball Data		
GB%	42.30%	23rd
LD%	19.40%	13th
IFFB%	12.80%	2nd
Hard%	28.30%	11th
Soft%	17.70%	9th
Barrel%	7.60%	25th
Put Away Stuff		
O-Swing%	34.70%	3rd
SwStr%	11.90%	14th
Contact%	75.70%	21st
CSW%	28.70%	10th

Figure 3 - Tampa Bay Rays Relief Pitchers Performance in 2022

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Cleveland Guardians 2022 Performance

Position Player Performance

In the 2022 MLB season the Guardians excelled in 6/15 position player statistics; however, they were well below average in almost all of the 11 remaining statistics.

Plate Discipline/Vision	Performance	League Rank
K%	18.20%	1st
BB%	7.30%	28th
BB/K	0.4	9th
O-Swing%	34.20%	25th
Contact%	80.80%	1st
Batted Ball Data		
LD%	19.70%	18th
GB%	44.40%	22nd
IFFB%	11.20%	24th
Soft%	18.10%	27th
Hard%	26.30%	29th
Barrel%	4.90%	30th
ISO	0.129	28th
BSR	13.2	4th
DRS	79	3rd
OAA	19	6th

Figure 4 - Cleveland Guardians Position Player Performance in 2022

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Starting Pitching Performance

In the 2022 MLB season, the Cleveland Guardians had an average starting pitching staff as they finished in the top ten in 3/14 pitching metrics.

Advanced	Performance	League Rank
BB%	6.50%	7th
K%	21.30%	17th
K-BB%	14.80%	13th
K/BB	3.28	9th
Batted Ball Data		
GB%	40.30%	24th
LD%	20.50%	24th
IFFB%	39.20%	20th
Hard%	32.00%	22nd
Soft%	15.00%	26th
Barrel%	8.70%	25th
Put Away Stuff		
O-Swing%	34.40%	5th
SwStr%	11.20%	14th
Contact%	77.30%	14th
CSW%	26.60%	20th

Figure 5 - Cleveland Guardians Starting Pitchers Performance in 2022

INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

Relief Pitchers Performance

A huge reason for the Cleveland Guardians success in 2022 was because of their strong relief pitchers' performance. They ranked in the top ten of 11/14 pitching metrics.

Advanced	Performance	League Rank
BB%	8.60%	9th
K%	26.40%	6th
K-BB%	17.80%	6th
K/BB	3.08	6th
Batted Ball Data		
GB%	46.40%	4th
LD%	18.60%	5th
IFFB%	10.90%	11th
Hard%	28.70%	14th
Soft%	16.00%	7th
Barrel%	7.30%	21st
Put Away Stuff		
O-Swing%	33.70%	5th
SwStr%	13.00%	4th
Contact%	73.70%	6th
CSW%	28.70%	8th

Figure 6 - Cleveland Guardians Relief Pitchers Performance in 2022

Discussion

The main takeaways from my findings highlight five key items of importance:

1. The importance of power and plate discipline on team success;
2. The importance of pitchers limiting walks and getting swings-and-misses on team success;
3. Batted ball data is not important for team success;
4. Power and swing-and-miss abilities are undervalued;
5. Tampa Bay and Cleveland found success through strong pitching.

Importance of Power and Plate Discipline on Team Success

The strong positive correlation of $r = 0.69$ between a team's BB/K and their winning percentage indicates the importance of batters' plate discipline on the team's success. A high BB/K ratio indicates that a team's hitters are patient and can wait for the pitches they can hit or take walks when necessary. In addition, teams with a high BB/K have an easier time creating runs as they are less reliant on getting hits to drive in the runs. Additionally, the strong positive correlation of $r = 0.72$ between a team's ISO and their winning percentage also demonstrates the importance of extra-base power on their success. Teams who fail to generate enough extra-base power tend to struggle to generate quick and easy runs, whereas teams with a high ISO do not have to rely as much on stringing singles together to generate enough runs to win. My findings reveal a stark contrast to Murray's (2022) results, which indicate a moderate correlation between team success and ISO, and a weak correlation to BB/K. In contrast, my research demonstrates a strong correlation between both ISO and BB/K and team success. Overall, the strong positive correlations observed between batters' BB/K and a team's success, as well as between a team's ISO and their winning percentage, underscore the crucial role that patient, power-hitting batters play in the successful outcomes of MLB teams.

Importance of Pitchers Limiting Walks and Getting Swings-and-Misses on Team Success

The strong positive correlation of $r = 0.67$ and $r = 0.64$ between a team's performance in SwStr% and

O-swing% exemplifies the importance of generating swings-and-misses on an MLB team's success. A high SwStr% and O-swing% suggest that pitchers are inducing more swings-and-misses from opposing batters, which is a sign of strong pitch quality and can lead to more strikeouts. The strong correlation highlights the importance of effective pitching strategies that prioritize high quality pitches to get swings and misses. Next, my study revealed a strong positive correlation between a team's winning percentage and their performance in K/BB, with a coefficient value of $r = 0.85$. A high K/BB ratio is indicative of a pitcher's ability to control their pitches effectively, limiting walks while recording a high number of strikeouts. Consequently, teams with pitchers who possess these skills are more likely to achieve success. This study's findings align with those of Frerker (2013) and Murray (2022), demonstrating a consistent and robust association between a team's K/BB performance and their success. The consistency across different years reinforces my initial hypothesis that the strategies and tactics employed by baseball teams to score and prevent runs tend to remain stable over time.

Batted Ball Data is not Important to Team Success

For both batters and pitchers batted ball data has very little importance in determining team success. This is evident as batted ball metrics such as GB%, HARD%, and Soft% all had r -values < 0.6 for both batters and pitchers. The low r -values in all batted ball data for batters suggest that teams still can succeed even if they hit more ground balls, or do not hit the ball as hard as the best teams. For pitchers, the low r -values in all the batted ball data imply that while a team's performance in batted ball metrics is important to consider, it is not the only factor that should be taken into account when assessing a team's overall performance. Other variables such as opponents' skill, injuries, and fielding also play a significant role in determining a team's success. Once again, my study's findings align with those of Murray's (2022) study as they also found a moderate or weak correlation between all batted ball statistics including GB%, LD%, and HARD% on teams W%. As a result of the similarity of mine and Murray's (2022) findings, it can certainly be concluded that a team's batted ball data is not a good indicator of success.

Power and Generating Swing and Miss is Undervalued

Even though ISO showed the strongest correlation to teams winning percentage in 2022, it was also deemed the most undervalued statistic in the current MLB labour market. A one-unit increase in ISO only results in a 0.01% increase in a player's expected salary. Additionally, ISO's s.error of 0.001 would mean that the estimated coefficient for ISO has a high degree of precision. A low s.error suggests that I can comfortably conclude that ISO is the most undervalued position player statistic that is strongly correlated to the teams' winning percentages. The results of this analysis suggest that teams should place a greater emphasis on acquiring players with a high ISO, as they may be able to acquire players with high power production at a lower cost. Next, for both starting pitchers and relief pitchers, O-swing% was deemed to be the most undervalued metric in the baseball labour market. For starting pitchers, a one-unit increase in O-swing% resulted in only a 0.009% increase in expected salary. Additionally, the s.error for this coefficient was 0.008, indicating that the coefficient estimate is reliable. For relief pitchers, a one-unit increase in O-swing% resulted in a decrease of a player's expected salary by 0.02%. In addition, an s.error of only 0.01 suggests that I can trust these results. However, I may not be able to trust the results for the remainder of the log-linear regression for relief pitchers as it only has an R^2 value of 0.16. A low R^2 value indicates that many factors are missing from this regression analysis that are important in the valuation of relief pitchers. Overall, this analysis suggests that both ISO and O-swing% are undervalued statistics in the MLB labour market, and acquiring players with high values in these statistics may be a cost-effective strategy for teams. Additionally, while the estimated coefficients for these statistics have a high degree of precision and reliability, it is important to note that other factors may also be important in evaluating player performance and determining player value.

Tampa Bay and Cleveland Found Success Through Strong Pitching

In the 2022 MLB season, both the Cleveland Guardians and the Tampa Bay Rays found incredible success with their strong pitching staffs despite low payrolls (Baseball Reference, 2022). At this time, both

teams' payrolls were in the bottom eight of 30 (Sportrac, 2022). Tampa Bay placed a strong focus on their starting pitching as evident through their ten, top-ten finishes in the fourteen pitching metrics reviewed. Interestingly, the Rays did show signs of taking advantage of the market inefficiencies found in step two as they ranked first in O-swing% for starting pitchers. The Rays' strong performance in O-swing% suggests that they may have capitalized on the market inefficiency to acquire starting pitchers, with great ability to get swing-and-miss for a low price. This strategy is apparent in the Rays 2022 off-season signing of Corey Kluber for \$8 million. Before signing with the Rays, Kluber ranked in the 80th percentile in O-Swing% (Baseball Savant, 2022). And in 2022, with the Rays, he ranked in the 98th percentile in O-Swing% (Baseball Savant, 2022). While other teams focused on Kluber's flaws such as his low fastball velocity, the Rays may have been focusing more on his high chase rate. Next, in the 2022 season, the Cleveland Guardians focused heavily on having a strong bullpen. This is apparent through eleven top-ten finishes in the 14 pitching metrics observed. Similar to the Rays, the Cleveland Guardians also seemed to emphasize leveraging market inefficiencies as both their starters and their relievers ranked 5th in O-swing%. Alongside achieving pitching success, Tampa Bay and Cleveland have avoided signing players based on batted ball data. The batted ball variables for these two teams do not just rank outside the top ten in the league; they are very near the bottom. Efficient hiring not only means signing players with undervalued characteristics, it also requires avoiding players who are more expensive because of overvalued characteristics like their batted ball data. It can be concluded that low-payroll teams should prioritize pitching over offense when constructing their rosters as both Cleveland and Tampa Bay have consistently had success doing so. Overall, the success of the Cleveland Guardians and the Tampa Bay Rays despite their low payrolls in the 2022 MLB season suggests that there may be market inefficiencies in the baseball labour market that can be leveraged by struggling low-payroll teams to acquire talented players for a lower cost. This also indicates that low-payroll teams should prioritize pitching over offense when constructing their rosters.

Conclusion

Limitations

To evaluate the reliability of my findings, it is important to state the limitations of the study. Two main limitations exist: only one season of data was used, and I am unaware of the thought process of Tampa Bay's and Cleveland's front offices. For step two of my method, I used only one year of player statistics due to having limited time to complete this study. This limited me from knowing whether the undervalued statistics I found in the baseball labour market were consistent from previous years. Secondly, without actually consulting with people from the front offices of either Tampa Bay or Cleveland, I cannot conclude whether or not they were leveraging the market inefficiencies I discovered in step two of my method. I was only able to hypothesize based on my findings.

Implications

MLB teams, agents, and writers can all use this paper's findings to better understand how to properly evaluate players. I show that statistics such as ISO, BB/K, and DRS for position players and K/BB, O-swing%, and SwStr% for pitchers correlate the strongest to a team's success. Therefore, instead of using more traditional statistics such as BA, RBIs, or ERA to evaluate players, teams should focus more on players' performance in the statistics which correlate most strongly to winning. Additionally, my findings have helped discover further insight into how low-payroll teams can succeed in modern baseball. Struggling low-payroll teams like Pittsburgh, Cincinnati, and Baltimore are made aware of strategies that successful low-payroll teams like Cleveland and Tampa Bay have used to find success. One of these strategies includes focusing heavily on pitching, instead of focusing heavily on offence. This is because 7/10 statistics strongly correlated to winning percentage were pitching statistics. Additionally, both the Guardians and the Rays have found the bulk of their success through strong pitching staffs. In the future, low payroll teams will also now know that the best way to gain an advantage in team building is by searching for market inefficiencies and undervalued statistics in the labour market. Moreover, all MLB teams are now aware of

the market inefficiencies that are present in the current labour market. This information will allow the market to correct itself and grant current undervalued players the opportunity to get paid fairly.

Future Direction

Future studies should use data from more than one season when testing for market inefficiencies as Baumer and Zimablist (2014) did in their study. This will allow readers to understand how the labour market fluctuates, and if any statistics have consistently been undervalued. Furthermore, if possible, future studies could conduct interviews with front-office members from successful low-payroll teams to get added certainty about their team-building strategies.

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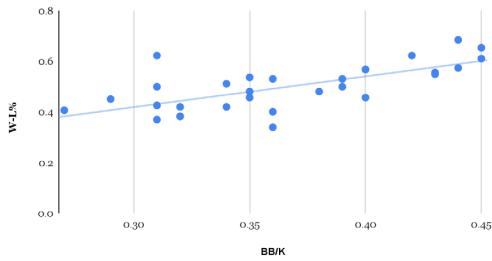
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Appendix A

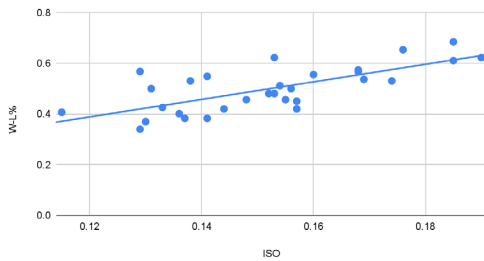
Position Players:

Strong Correlation Graphs:

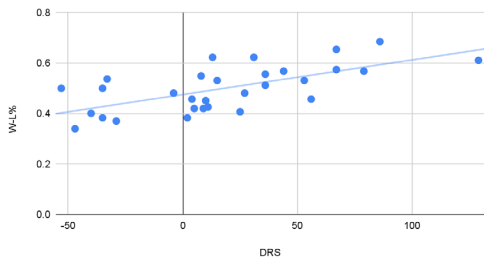
BB/K and W-L%



W-L% vs. ISO

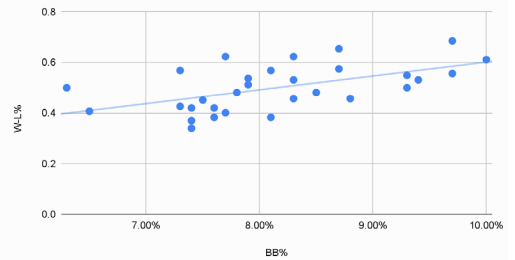


W-L% vs. DRS

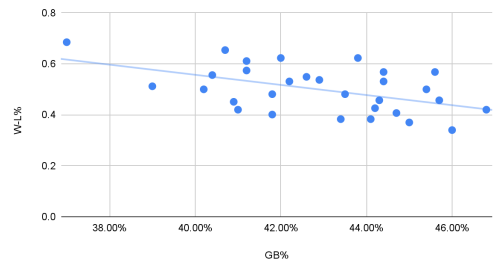


Moderately Strong Correlation Graphs

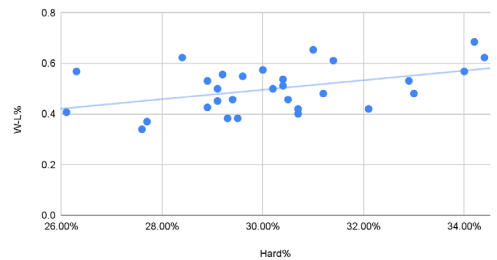
W-L% vs. BB%



W-L% vs. GB%

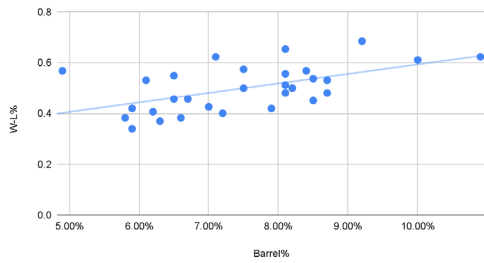


W-L% vs. Hard%



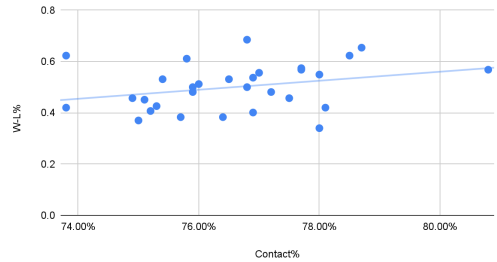
INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

W-L% vs. Barrel%

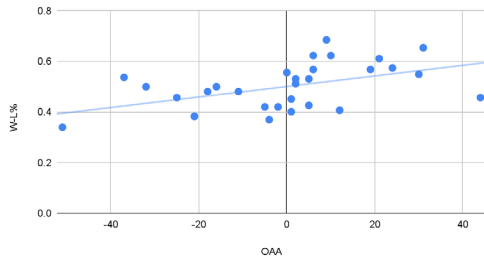


Weak Correlation Graphs

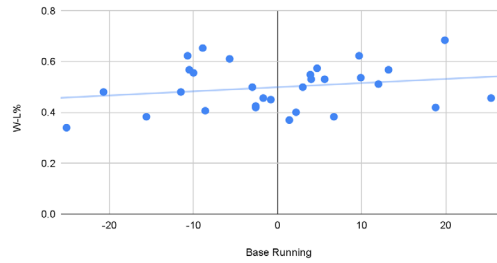
W-L% vs. Contact%



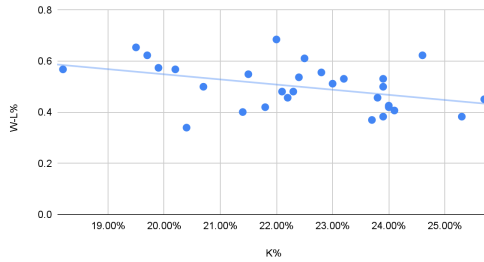
W-L% vs. OAA



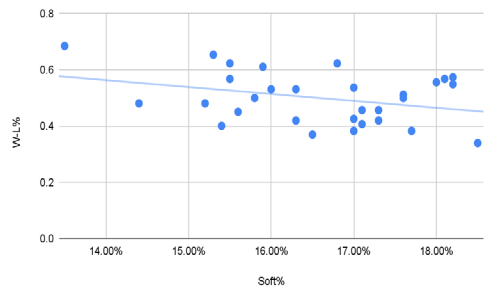
W-L% vs. Base Running



W-L% vs. K%

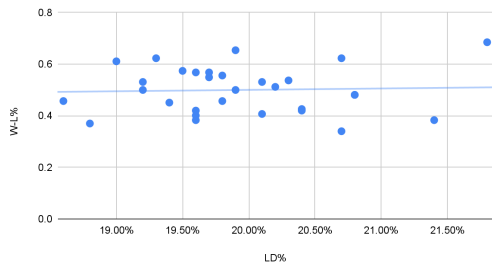


W-L% vs. Soft%

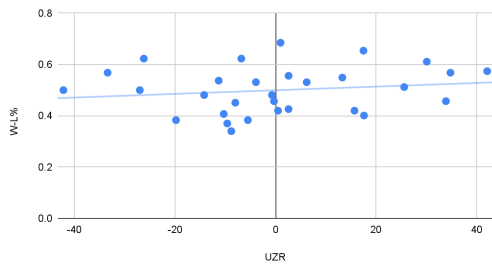


INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

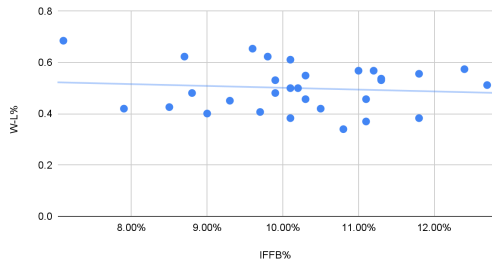
W-L% vs. LD%



W-L% vs. UZR



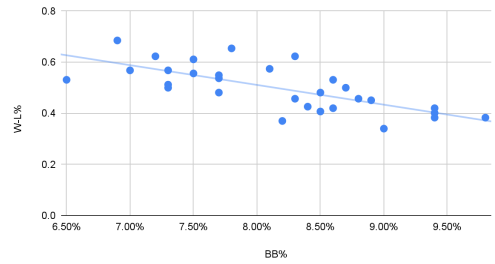
W-L% vs. IFFB%



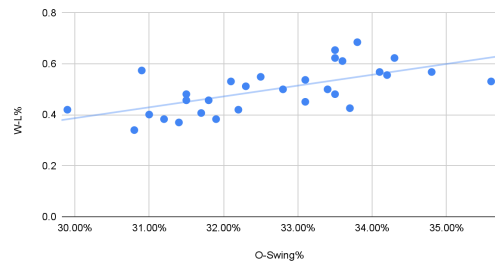
Starting Pitchers

Strong Correlation

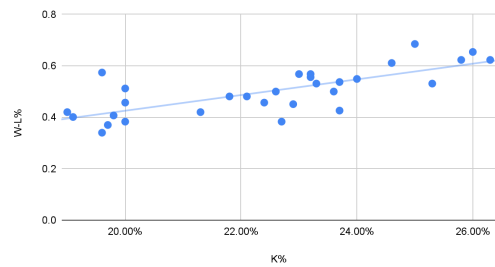
W-L% vs. BB%



W-L% vs. O-Swing%

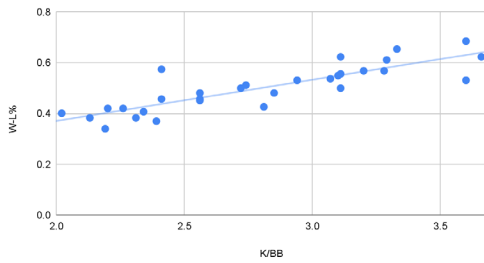


W-L% vs. K%



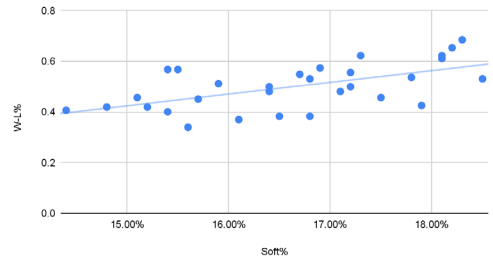
INEFFICIENCIES IN THE BASEBALL LABOUR MARKET

W-L% vs. K/BB

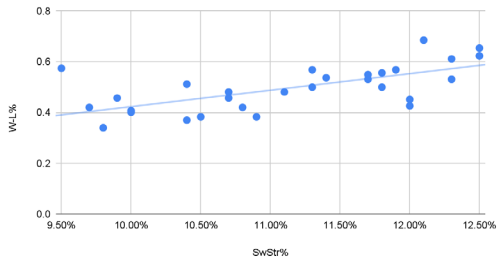


Moderately Weak Correlation

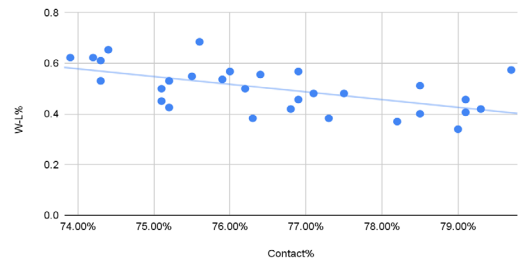
W-L% vs. Soft%



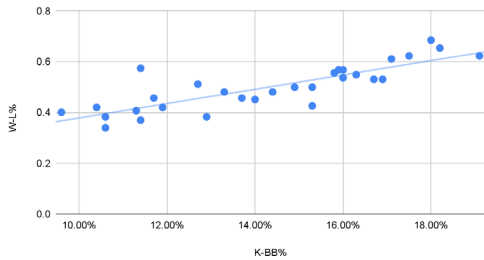
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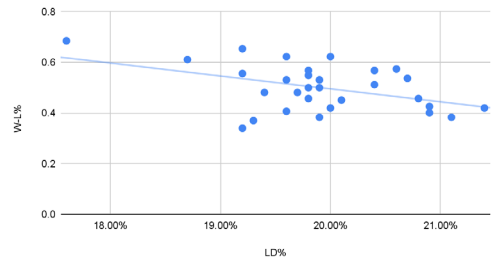
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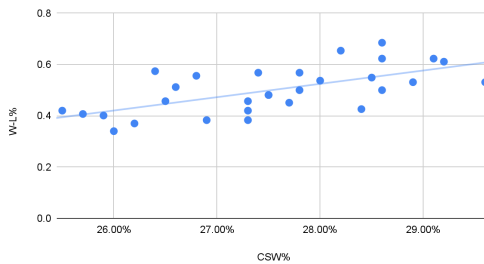
W-L% vs. K-BB%



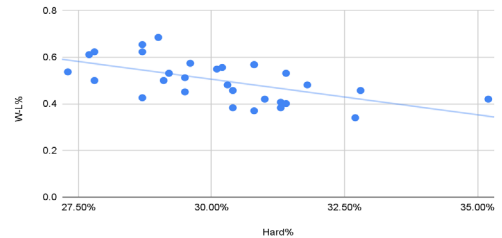
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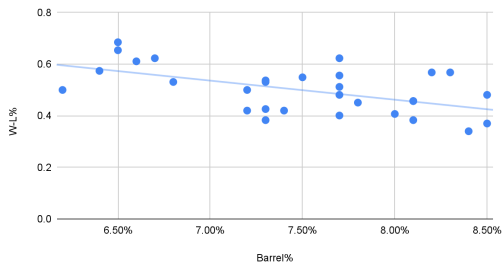
W-L% vs. CSW%



W-L% vs. Hard%

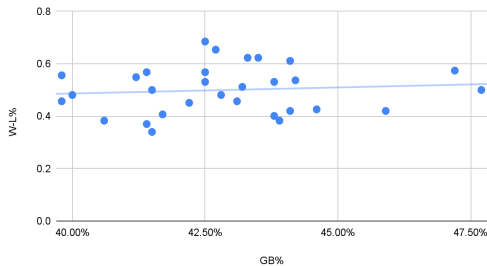


W-L% vs. Barrel%

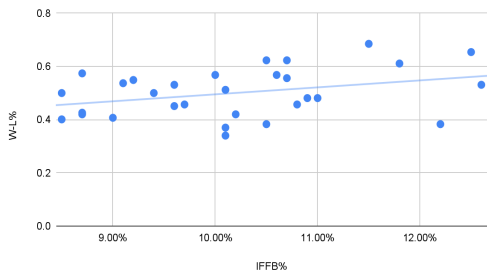


Weak Correlation

W-L% vs. GB%



W-L% vs. IFFB%



Appendix B

Definition of Variables (and their desired value)

Position Players:

Plate Discipline/Vision

1. K% (total strikeouts/plate appearances) – Lower K% is desirable.
2. BB% (total walks/plate appearances) – Higher BB% is desirable.
3. BB/K (total walks/total strikeouts) – Higher BB/K is desirable.

Batted Ball Data

1. LD% (total line drives/balls in play) – Higher LD% is desirable.
2. GB% (total ground balls/balls in play) – Lower GB% is desirable.
3. IFFB% (total infield fly balls/fly balls) – Lower IFFB% is desirable.
4. Soft% (percentage of soft-hit balls) – Lower Soft% is desirable.
5. HARD% (percentage of balls hit 95 mph +) – Higher HARD% is desirable.
6. Barrel% (total balls hit 98 mph +/balls in play) – Higher Barrel% is desirable.

Advanced Statistics

1. ISO (SLG – AVG) – Higher ISO is desirable.
2. Bsr (baserunning runs above average) – Higher Bsr is desirable.
3. OAA (outs above average) – Higher OAA is desirable.
4. DRS (defensive runs saved) – Higher DRS is desirable.
5. UZR (defensive runs above average) – Higher UZR is desirable.

Pitchers:

Advanced Statistics

1. BB% (walks/batters faced) – Lower BB% is desirable.
2. K% (total strikeouts/batters faced) – Higher K% is desirable.
3. K/BB (total strikeouts/total walks) – Higher K/BB is desirable.
4. K-BB% (K% - BB%) – Higher K-BB% is desirable.

Batted Ball Data

1. LD% (total line drives/total balls in play) – Lower LD% is desirable.
2. GB% (total ground balls/total balls in play) – Higher GB% is desirable.
3. IFFB% (total infield fly balls/total balls in play) – Higher IFFB% is desirable.
4. Soft% (percentage of soft-hit batted balls against) – Higher Soft% is desirable.
5. HARD% (percentage of balls hit 95 mph + against) – Lower HARD% is desirable.
6. Barrel% (total balls hit 98 mph+/total balls in play) – Lower Barrel% is desirable.

Put Away Stuff

1. O-Swing% (swings at pitches outside the zone /pitches outside the zone) – Higher O-Swing% is desirable.
2. SwStr% (swings and misses/total pitches) – Higher SwStr% is desirable.
3. Contact% (number of pitches on which contact was made/swings) – Lower Contact% is desirable.
4. CSW% (called strikes + swing strikes/total pitches) – A higher CSW% is desirable

All definitions are from Fangraphs (2014)

Appendix C

Definitions for Step 2 of Method

R²: r^2 is a percentage value that measures how well a linear regression model fits the observed data (Hamilton, 2015). **Example:** an r^2 of 0.61 means that approximately 61% of the variation in the dependent variable (Salary) is accounted for by the independent variables (All of the statistics) in the model. The remaining 39% of the variation is still unexplained and may be due to other factors that were not included in the model.

Coefficient Value: The coefficient value represents the percentage change in the dependent variable (salary) with an increase in one unit of the independent variable (all the statistics). **Example:** If a player had a salary of \$5,000,000 and increased their BB/K by one unit (up 0.01) their expected salary would increase by \$37,500.

Coefficient s.error: The coefficient s.error represents how much the coefficient value varies when running the model again with different datasets (Siegel & Wagner, 2022)

Investigating the Attitude-Behaviour Gap in Adolescent Plastic Consumption

Carys Doyle

Abstract : Since the mass production of plastic products began in the 1950s, it has been estimated that more than 6.9 billion metric tonnes of produced plastic have ended up in landfills and damaged ecosystems (Walker, 2021). Though there has been an increase in research surrounding the Green Gap - the difference between an individual's environmental values and their actual environmental behaviour - most studies ignore which attitudes and behaviours cause a decrease in plastic usage and instead focus on which behaviours and attitudes lead to the proper recycling of plastic products. Though there is an overlap between the environmental values that cause the proper recycling of plastic products and those that lead to a decrease in plastic usage, they are not the same and the conclusions drawn from one aspect of the Green Gap cannot be applied entirely to another (Barr, 2006). Additionally, such studies focus on adult participants, and neglect adolescents. However, Baludné et al. (2020) assert that understanding and researching the environmental values of adolescents, or society's future generation of consumers, is becoming increasingly important as we face a multitude of environmental issues such as climate change and environmental degradation. As a result, the present study intends to research the attitude-behaviour gap of plastic consumption among Canadian adolescents through a mixed-method approach. The study surveyed 41 participants to determine which social and familial factors most influence this attitude-behaviour gap. The results of this study indicate that there is an attitude-behaviour gap in adolescent plastic consumption and that the environmental values of an adolescent are more developed by the environmental values of their family members, causing social factors (such as the presence of peers) to act as situational factors to their attitude-behaviour gap.

Investigating the Attitude-Behaviour Gap in Adolescent Plastic Consumption

Since the 1950s, when the mass production of plastic products first began, it has been estimated that 9.2 billion metric tonnes of plastic have been produced, with more than 6.9 billion metric tonnes ending up in landfills or leaking into and damaging ecosystems (Walker, 2021). Despite Canada's reliance on plastic products and packaging, only 9% of plastic is properly recycled in Canada, creating detrimental impacts such as environmental degradation (Government of

Canada, 2020). As a result, Baludné et al. (2020) assert that understanding and researching the environmental values of adolescents, society's future generation of consumers, is becoming increasingly important due to the multitude of increasing environmental issues such as climate change, environmental degradation, and biodiversity loss. While these assertions are valid, the significance of the Green Gap must also be considered. The Green Gap refers to the difference between the environmental values of an individual and their environmentally supportive behaviour, which are actions taken to promote environmental sustainability (Schmitt, 2021). Though the Green Gap is relatively under-researched, most studies conducted on the Green Gap fail to investigate consumer plastic usage

and instead focus on behaviours and attitudes that lead to the proper recycling of plastic products. Although there is an overlap between the environmental values that cause the proper recycling of plastic products and those that lead to a decrease in plastic usage, they are not the same and the conclusions drawn from one aspect of the Green Gap cannot be applied entirely to another (Barr, 2006). Instead, understanding which factors contribute to the development of adolescent environmental values and which situational variables most cause this gap is integral to decreasing plastic consumption and finding ways to encourage environmentally supportive behaviour in adolescents. As a result, the present study intended to research the attitude-behaviour gap of adolescent plastic consumption, and which social and familial factors most influence this gap.

Literature Review

Understanding the Green Gap

Since the early 2000s, various researchers, such as Kennedy et al. (2009) and Temizkan (2022), have investigated the attitude-behaviour gap of plastic consumption. For example, a meta-analysis conducted by Heidbreder et al. (2019) studied scholarly journals on plastic consumption and the attitude-behaviour gap published up to September 2018. The study concluded that although recycling behaviour is well documented and studied, the specific behaviour of plastic avoidance is not. Moreover, in studies specifically addressing recycling behaviour, and looking more broadly at the Green Gap, plastic usage is rarely mentioned. In research that addresses the attitude-behaviour gap of plastic consumption, the quality of those studies varies significantly (Heidbreder et al., 2019). However, in studies that research the Green Gap, two main drivers of the gap are evident: environmental values and situational variables/contextual factors.

Environmental values include an individual's environmental education and environmental concern (Kennedy et al., 2009). Environmental values are also influenced by familial/household variables. Meyer et al. (2021) found that the Green Gap between individuals and families is affected by the eating habits and other environmental values of those they live with.

Similarly, Kennedy et al. (2009) determined that 25% of respondents felt constrained in developing environmentally supportive behaviour as a result of a lack of support from household members. However, Barr (2006) disagreed and determined that individuals with developed environmental values will alter their behaviours, whereas those who want to appease their family/household/society will not. Though Barr's conclusions do not encompass the many other factors that encourage buying behaviour and the Green Gap, they may be true in some situations. Additionally, a study by Roy et al. (2022) argued that a lack of environmental education, which influences environmental values, plays a significant role in the attitude-behaviour gap in plastic consumption. However, a separate study by Kennedy et al. (2009) determined that though environmental education is an important aspect of shrinking the Green Gap, the information taught must be carefully selected as an "abundance of contradictory information can play a significant role in limiting ESB [environmentally supportive behaviour]" (Kennedy et al., 2009, p. 154).

Situational variables are variables that disrupt the intended buying behaviour of an individual. This includes price, convenience, time, and social variables (Meyer et al., 2022). Environmentally friendly products tend to be more expensive and are therefore less accessible for many citizens. As a result, consumers are less likely to purchase these more environmentally sustainable products, while also developing a lack of confidence in the products' abilities (Temizkan, 2022). However, Walker et al. (2021) found that younger consumers were more willing to pay for more expensive environmentally sustainable products.

Therefore, there appears to be a discontinuity among buying behaviours; consumers prefer not to buy more expensive environmentally friendly products but will instead spend a smaller amount of money (which will add up to a significant amount over time) to purchase objects like plastic bags. An additional aspect of situational variables is convenience/time. Walker et al. (2021) determined that though Canadians show developed environmental values, their buying behaviours show a strong correlation between convenience and the food products they purchase, regardless of packaging. Similarly, Kennedy et al. found that lack of time was a restraint on environmentally sustainable behaviour. For example, it takes very little

time to turn off a light switch; however, taking public transit or properly recycling a product can be more time-consuming.

Plastic Consumption and the Attitude-Behaviour Gap

As mentioned previously, understanding the Green Gap surrounding plastic consumption is relatively under-researched despite the increasing awareness and concern of consumers in regard to the effect of plastics on the environment. Walker et al. (2021) determined that 73.4% of respondents supported the government's decision to ban single-use plastics for food packaging; however, these same participants have continued to use single-use plastics, thus demonstrating the attitude-behaviour gap. Similar to Green Gap research, Roy et al. (2021) and Mühlthaler et al. (2017) have demonstrated that two factors that influence the attitude-behaviour gap of plastic consumption are environmental values and situational variables. Moreover, their research did not consider the factors that affect the development of an individual's environmental values largely impacted by the environmental values of their family members and friends.

Additionally, very few studies have analyzed the attitude-behaviour gap of plastic consumption and when they do, these studies focus on the recycling aspect of these products, not the factors that influence their purchase. For example, past research has emphasized a lack of labelling, a lack of understanding of proper recycling, and a lack of accessible waste disposal as factors for the faulty recycling of participants (Barr, 2006; Norton et al, 2022; Roy et al., 2022). More specifically, studies that research the attitude-behaviour gap of plastic consumption focus only on adults or university students. For example, Temizkan (2022) studied university students and Barr (2006) studied the adult population of Exeter, England. As argued by Baludné et al. (2020), researching the attitude-behaviour gap of adolescent plastic usage is incredibly important as adolescents are society's future consumers, and they have the ability to alter consumerism and encourage it to be more environmentally sustainable and innovative. Therefore, understanding which factors affect the development of environmental values of adolescents (specifically familial and social factors) and encourage both unsustainable and sustainable

behaviour is integral to increasing adolescent environmentally sustainable behaviour, and subsequently decreasing environmental degradation.

The present study aims to extend the current understanding of the attitude-behaviour gap of plastic usage in relation to the environmental values and consumption behaviours of adolescents by understanding which social and familial factors most influence the attitude-behaviour gap of adolescent plastic consumption. Examples of social and familial factors include the environmental education and environmental values of an adolescent in comparison to those of their peers/friends and family members. This increased understanding could provide insight into the influence of environmental values and situational variables in relation to the environmental values of family members and peers on the attitude-behaviour gap of adolescents and help governments and environmental organizations improve the accessibility of environmentally friendly products and encourage environmentally supportive behaviour among adolescents.

Method

Apparatus and Study Design

To explore the attitude-behaviour gap of adolescent plastic consumption and determine which social and familial factors most influence this gap, an online survey containing both closed and open-ended questions was created to collect both quantitative and qualitative data. Existing research investigating the Green Gap has most commonly used online surveys to collect quantitative data such as Barr (2006), Norton et al. (2022), Mühlthaler (2017), and Temizkan (2022). Additionally, researchers such as Kennedy et al. (2009) combined both qualitative and quantitative approaches in their survey.

The majority of the survey questions were modelled on Kennedy et al.'s 2009 study as well as the Environmental Portrait Value Questionnaire (E-PVQ) based on Schwartz's Portrait Value Questionnaire. Like the work of Norton et al. (2022) and Temizkan (2022), the survey used a series of Likert Scale questions, asking participants to rate each statement between 1 and 5 with 1 being "I completely disagree" and 5 being "I

completely agree”; for example, “I feel pressure from family members to live a less environmentally friendly lifestyle.” Additionally, certain statements required multiple choice answers, such as, “Which strategy (if any) do you most often use to lower your plastic consumption?” In order to increase the validity of the responses to this question, participants were then asked to rate how often they use these techniques with answer options ranging from “Very Often (10/10 times I go shopping)” to “Rarely (4/10 times I go shopping)” to “Never”.

Additionally, the survey contained open-ended questions for participants to complete, asking them to reflect on their environmental behaviour and those of their family and friends, such as “In what ways do your family’s actions show their understanding of environmentally sustainable living?” Inspired by the ethnographic approach of Meyer et al. (2022), the survey also included “situational questions” asking participants to reflect on their choice of action in a given scenario on the topic of plastic usage providing insights into their practice of using plastic instead of their potentially biased self-reported values. This approach allows for the discovery of causative factors of habits and leads to accurate explanations for behaviour (Naidoo, 2012). The combination of qualitative and quantitative data will help validate research findings and strengthen the determined themes (Heale & Forbes, 2013). Please see the Appendix for the full questionnaire used.

After receiving approval from the Internal Review Board at the researcher’s host institution, the online survey was sent to the Administration of four high schools in urban locations in Ontario, Canada for distribution to their student populations aged 16 and over. Prior to completing the online survey, participants were asked to complete a consent form and were reminded of their rights as a participant. Participation in this study was voluntary, therefore not all students aged 16 and over in the sampled high schools completed the survey.

Data Analysis

In order to analyze the quantitative data collected, descriptive statistics (mean, median, mode, standard deviation, and variation) were used to compare the impacts of the environmental values of friends and

family on the reported environmental values of the individual/participant. For example, the responses of participants to questions such as “I feel pressure from family members to live a less environmentally friendly lifestyle” and their self-reported environmental values were compared. Responses to questions such as “are you aware that only 9% of plastic in Canada is properly recycled?” were then used to situate the environmental understanding of participants. Qualitative data was analyzed using an open/inductive coding approach to thematically analyze participant responses to the open-ended survey questions. The nature of an open-coding approach allowed for flexibility in determining themes and codes and the emergence of unexpected themes (Khandkar, n.d.). Additionally, such an approach enhances the validity of the analysis because the determined themes and codes are built directly from the raw data (Khandkar, n.d.).

Results

There were a total of 41 responses to the questionnaire. Qualitative and quantitative results were analyzed using the Attitude-Behaviour Context model, which asserts that attitude alone does not affect behaviour (such as environmental values) but that contextual factors also influence an individual’s behaviour (Guagnano et al., 2010). This model is supported by the results of Temzankan (2022) and Kennedy et al. (2009) who determined that the Green Gap, or more widely the attitude-behaviour gap of plastic consumption, is affected by environmental values (attitude) and situational variables (context).

Individual Environmental Values

When reflecting on their own environmental values and actions, participants used environmentally supportive behaviours such as reducing, reusing, and recycling their plastic products, while also working to educate others on the topic of environmental sustainability. Though many participants mentioned a “zero waste lifestyle” being the most effective environmentally sustainable lifestyle, they felt it was unattainable for the average citizen. Similar to the results of Thomas et al. (2022), participants felt that living an environmentally sustainable lifestyle—aside from a

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“zero waste lifestyle”—is not possible for themselves or their families due to the higher prices, lower accessibility and availability of non-plastic products, and the inability to encourage systemic or structural change. However, 42% answered that lowering their plastic consumption was a priority.

Additionally, many participants felt that meaningful climate action can only be taken by large corporations and governments, causing participants to more often support environmentally sustainable companies

and political parties in favour of environmental sustainability. However, this did not stop participants from completing what they referred to as “the little things”—eating less red meat, reducing plastic consumption, reducing water and electricity usage, etc.—as a form of climate action in the hopes they will accumulate to have a larger impact. Moreover, 45% of respondents answered that partaking in climate action was important to them (mean: $x = 3.23$, $s = 1.2$); however, similar to the qualitative data responses,

Table 1: Themes Determined From Participant’s Definition of an Environmentally Sustainable Lifestyle

Themes	Supporting Codes	Definition
Preventing Plastic Waste	Reducing plastic waste and food waste Using reusable products Using renewable resources Protecting existing ecosystems	Actions takings to reduce plastic consumption and prevent plastic waste
Limit to individual Impact	Feelings that complete environmental sustainability or net zero lifestyles is not feasible for the everyday citizen Economic limitations (cost of more environmentally sustainable products) Lack of accessibility and availability of environmentally sustainable products Feelings that Governments and large corporations have a larger say/will have larger environmental impacts than the individual	Factors that hinder the environmental impact of participants, including socio-economic and political factors
Other forms of Action	Educating yourself and others/being aware of your environmental impact Developing small environmental habits that will slowly add up to something bigger Eating less red meat Who they vote into power	Included other forms of environmentally supportive behaviour taken by participants that were outside of preventing plastic waste. More generally this theme refers to participant responses who answered “forms of climate action” as part of their environmental values but never stated how they enact it

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there was a high variance in results ($s^2 = 1.4$).

Note: The numerical data corresponds to participant responses to Likert Scale questions, with one being “I completely disagree” and 5 being “I completely agree”.

Table 2: Descriptive Statistics of the Collected Quantitative Data

Question	n	Mean	Median	Mode	Standard Deviation	Variance	Coefficient of Variation
I feel pressure from family members to live a less environmentally friendly lifestyle	41	2.3	2	2, 1	1.049	1.101	0.4626
I feel pressure from family members to live a more environmentally friendly lifestyle	41	2.7	3	3	1.0	1.0	0.37
I feel pressure from friends to live a less environmentally friendly lifestyle	41	2.2	2	1	1.1	1.2	0.51
I feel pressure from friends to live a more environmentally friendly lifestyle	40	2.5	3	3	1.1	1.2	0.43
Protecting the Environment is a priority of mine	41	2.8	3	3	0.91	0.83	0.33
Lowering my plastic consumption is a priority of mine	41	2.4	2	3	0.81	0.65	0.33
Partaking in climate action is important to me	41	3.5	4	4	1.0	1.0	0.30
When buying a coffee in a non-reusable plastic cup, I am concerned by the amount of plastic my order will create	41	2.4	2	3	0.94	0.89	0.40

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Environmental Values of Family Members

When reflecting on the environmental values and actions of their families, participants' responses centred around three themes. When discussing the environmental actions taken by their family members, the most common form of environmentally supportive behaviour was reducing, reusing, and recycling plastic products. Secondly, participants noted the steps their family took toward climate action as reducing greenhouse gas emissions, supporting environmentally sustainable companies, and growing their food. The most common form of environmental action was decreasing greenhouse gas emissions, educating themselves and others on the topic of environmental protection, and developing a more environmentally sustainable

diet, whereas actions such as growing their food and planting trees were cited less frequently. Some participants also felt that their families had little to no environmental values due to a lack of environmental education. When asked if they feel pressure from family members to live a less environmentally sustainable lifestyle, the mean participant response was $x = 2.3$, which means that participants feel low pressure from family members to live less environmentally sustainable lifestyles, whereas when they feel pressure from family members to live more environmentally sustainable lifestyles, the mean response was $x = 2.7$. This indicates that participants feel more pressure from family members to live more environmentally sustainable lifestyles than they do to live less environmentally sustainable lifestyles. However, in general, they feel little

Table 3: Overall Themes of Family Member Environmental Values

Final Themes	Supporting Codes	Definition
Preventing Plastic Waste	Reducing waste through reusable shopping bags, plastic water bottles, reusable lunch containers, going thrift shopping/buying clothing second hand	Actions taken by participant family members to reduce plastic consumption and prevent plastic waste
	Properly recycling plastic products	
	Reducing plastic waste and food waste	
	Reusing plastic bags and other plastic products	
Taking Action	Educating themselves and others on the topic of environmental sustainability	Forms of Environmental Action taken by Participant family members excluding plastic usage
	Supporting environmentally sustainable companies	
	Reducing Greenhouse gas emissions by taking the public transit, biking, or walking	
	Eating less red meat	
	Growing own food	
No actions	Not educated on the topic of environmental sustainability	Limited to no environmental action of participant family members
	Environmental action is not a priority	

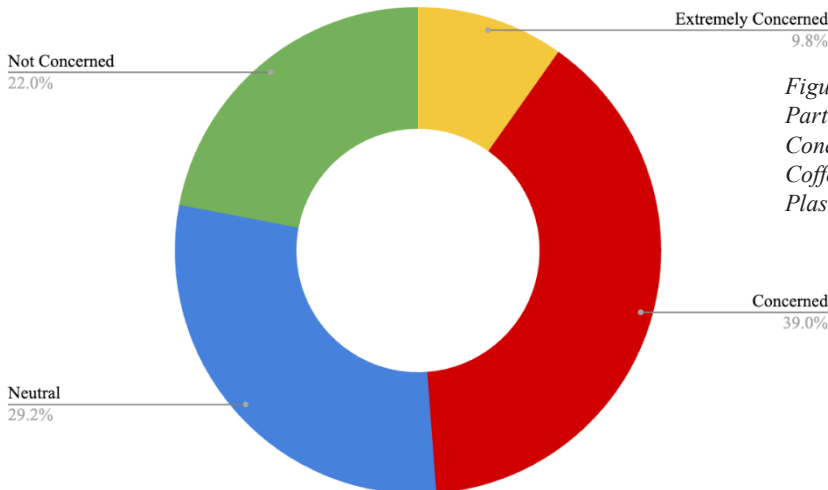
pressure to act either way with low variation amongst results ($s^2_{\text{less pressure}} = 1.1$ and $s^2_{\text{more pressure}} = 1.0$ respectively).

Environmental Values of Friends

The greatest contrast between responses occurred when participants reflected on the environmental values and actions of their friends. Though participants shared that their friends use reusable water bottles and lunch containers, many felt their friends and peers demonstrated weak or underdeveloped environmental values. An example of this would be participants referencing students who incorrectly sort their plastic waste, or others that purposefully use single-use plastic cutlery from the school cafeteria, so they do not have to return their reusable cutlery to the cafeteria after eating. Most notably, participants felt that the environmental values of their friends and peers aligned with what was most “mainstream” at the time. For example, participants compared the environmental actions of their friends in response to the growing concerns of fast fashion on social media or their increased environmental awareness and care when environmental activist Greta Thunberg rose to fame. Additionally, participants felt their friends were more likely to use single-use cutlery or buy from a fast fashion brand than go thrift shopping or use reusable cutlery. In contrast, some participants felt that their

friends did demonstrate environmentally supportive behaviour such as using reusable products and properly sorting waste, saying that they and their friends discuss environmental sustainability to educate each other.

When environmentally supportive behaviours were not demonstrated or peers did not discuss environmental sustainability with one another, participants felt unsure of the environmental values of their peers. The lack of in-person conversation surrounding climate change between friends and peers is also visible in the quantitative data collected. For example, 37% of participants said they and their friends discuss environmental sustainability once every month and 15% reported they never did. These results are similar to the findings of Thomas et al. (2022), whose participants also felt environmental action is rarely discussed amongst peers, and when discussed, participants felt these conversations and other environmental actions were inconsistently supported or more of a fad for other adolescents. When comparing these results to participant responses to the question “I feel pressure from friends to live less environmentally sustainable lifestyles” the mean response was $x = 2.2$, indicating that participants feel low pressures from their peers, with a low variation amongst results ($CV = 0.51$). Similarly, participants indicated that they also felt low pressure from friends to live a more environmentally



*Figure 1
Participant Levels of
Concern When Buying
Coffee in a Non-Reusable
Plastic Cup*

sustainable lifestyle, with again low variation amongst results ($CV = 0.43$, $x = 2.5$, $s = 1.1$).

Moreover, when comparing participant responses to their levels of concern when using a non-reusable plastic cup, 39% of participants answered they were concerned by the amount of plastic waste they will create. However, this does not align with the 88% of participants who said they would not return to collect their reusable cups in the event they forgot them when going to buy coffee. When asked whether their family members would mind how each participant reacted to this situation (whether or not they return to collect their reusable coffee cup), 72% of participants said their parents would have no preference as to how they responded to this situation while 28% said their parents would ask them to retrieve their reusable cup before continuing.

Discussion

This research attempted to understand two inquiries. The first was to determine if there is an attitude-behaviour gap in adolescent plastic consumption, and the second was to determine the relative impact of social and familial factors on this gap. From this research, three key findings have emerged. Firstly, that there is an attitude-behaviour gap regarding adolescent plastic consumption. The second key finding is that participants feel relatively low pressure from friends and family members to live more or less environmentally friendly lifestyles. Finally, the environmental values of an individual tend to be developed more by family members than friends, causing the environmental values of friends/social factors to act as situational variables/contextual factors to the behaviour of adolescents.

Environmental Pressure from Family Members

Quantitative responses of participants again demonstrated that they feel little to no pressure from family members to live more or less environmentally sustainable lifestyles (mean responses: $x = 2.7$, $x = 2.3$). Similar to the environmental pressure participants

feel from friends, participants indicated they feel more pressure to live more environmentally sustainable lifestyles from family members than they do to live less environmentally sustainable lifestyles. Moreover, participant responses surrounding the environmental values and the environmental values of their family members, when thematically coded, had a large overlap of values and actions taken to encourage environmentally supportive behaviour.

Most importantly, family members of private school adolescents appear to be working to educate their children on the topic of climate change and climate action through family discussions and their chosen lifestyles. For example, 9.8% of participants said they and their family never discuss environmental sustainability, whereas 15% of participants said they and their friends never discuss environmental sustainability. This indicates the importance of dialogue on developing environmentally sustainable values, as adolescents had environmental values more similar to those of their family members, with whom on average they discussed environmental sustainability more, than their peers. According to Stevenson et al. (2016), these increased conversations on the topic of climate change and environmental sustainability, even with high levels of skepticism, still lead to an increased level of climate concern, in line with the importance of dialogue present within participant responses. Further, when asked to define their idea of an environmentally sustainable lifestyle, participant responses demonstrated values similar to those of their family members. These include codes such as reducing waste (plastic, food waste, etc.), educating themselves and others, as well as reducing meat consumption. For example, participants stated that they and their family take public transit and walk as a form of transportation to decrease the greenhouse gas emissions their family creates, while others said that their family gardens/grows their food as a way of decreasing their environmental impact, and work to decrease their environmental impact through initiatives such as “meatless Mondays.” As a result, it appears that the environmental values of a family member are the largest determinant of an adolescent’s environmental values and lifestyle by instilling lifelong habits and values. This conclusion is similar to the results of Stevenson et al. (2016), who determined that discussions with family members surrounding the topic of

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climate change were more impactful and important to the adolescent than discussions with their peers on the same topic. Moreover, Stevenson et al. (2016) suggests that parents are the most influential factor in shaping the worldview of their children. Similarly, Mead et al. (2012) and Ojala (2013) determined that adolescent environmental values are most similar to those of their parents even in a time of adolescence when participants are still defining and shaping their values.

Environmental Pressure From Friends and Social Situational Variables

Though 39% of participants answered that they were concerned by the amount of waste they would create when using a single-use plastic coffee cup and

37% of participants said their environmental values included reducing their plastic waste, 88% of participants determined that they would not turn around to retrieve their reusable cup in the event they forgot it when going to buy coffee with their friends. Not only does this signify an attitude-behaviour gap in adolescent plastic consumption, but it also suggests that social factors, such as Peer Group Influence, play a significant role in the attitude-behaviour gap of adolescent plastic consumption. These conclusions are supported by the 54% of participants who indicated they would return to collect their reusable shopping bags in the event they forgot it when grocery shopping on their own, meaning that when comparing the two situations it appears the presence of friends is causing adolescents to act less sustainably.

These results indicate the presence of friends influ-

Table 4: Themes Determined From Participant Responses on the Environmental Actions of their Friends

General Themes	Supporting Codes	Definition
Preventing Plastic Waste	Recycling properly (majority of the time) Using reusable products (such as water bottles, lunch containers, etc.) Not littering	Actions taken by participant's friends to reduce plastic consumption and prevent plastic waste
Limited Environmental Action	Environmental action is not discussed by friends/no visible environmental values of friends Influence of societal standards Eco Anxiety - ever pressing fear of climate change, students not wanting to take action because it may make them uncomfortable Lack of interest/environmental action is not a priority Influence of social media: when fast fashion was a large topic on social media thrifting became popular Increased levels of climate awareness when Greta Thunberg rose to fame but no increased environmental action	Limited to no environmental action displayed by participant friends. Participants felt that factors such as societal norms and social media cause increased concern but no increase in environmental action.

ences the attitude-behaviour gap of adolescent plastic consumption, as participants are choosing to live less environmentally sustainably amongst peers, even though, relative to their responses, participants felt more pressure from both friends and family members to live more environmentally sustainably than less. Similarly, Seppälä et al. (2017) and Pfattheicher et al. (2016) determined a correlation between peer influence and the environmental behaviour of participants. More specifically, Pfattheicher et al. (2016) determined that relative levels of compassion affect the pro-environmental values of participants; this was supported by Seppälä et al. (2017) who concluded that different social situations affect the relative compassion of an individual. Therefore, according to Seppälä et al. (2017) and Pfattheicher et al. (2016), it can be concluded that social situations or Peer Group Influence affect the pro-environmental behaviour of adolescents. Similarly, based on participant responses, it appears that the influence of peers is widening the attitude-behaviour gap of adolescent plastic consumption, therefore, acting as contextual factors/situational variables to their attitude-behaviour gap, whereas family members are most influencing the environmental values of participants. A multitude of factors caused by the presence of peers could influence the attitude-behaviour gap of adolescent plastic consumption, such as societal expectations seen on social media, peer environmental values, as well as the relative time/convenience required for climate-conscious living. One reason was provided in participant responses who felt that their generation's definition of "accomplished" or the "end goal" involves higher levels of consumption as they involve higher levels of wealth and resources. It can then be inferred that though the peers of participants are not encouraging them to live more or less environmentally sustainable lifestyles, social norms, enforced by the actions of their peers, are.

However, more research is needed to affirm these trends amongst adolescents, and specifically why peers influence the attitude-behaviour gap of adolescent plastic consumption, especially because Tegethoffs (2021) found that peers did not influence the environmental behaviour of adolescents, whereas researchers such as Seppälä et al. (2017) and Pfattheicher et al. (2016) did. Additionally, when asked to reflect on their environmental values or respond to situational

questions, participants reported they would purchase the more environmentally sustainable product if it was not more expensive or time-consuming. These results are similar to those of Kennedy et al. (2009), Young et al. (2009), Tsakiridou et al. (2008), and Temizkan (2022) whose studies determined that "the high price of green products [and] their low availability" is one of the "biggest barriers to buying green products" (Temizkan, 2022, p. 11). However, these conclusions have only been confirmed for adult participants experiencing an attitude-behaviour gap and further research is required to confirm these trends for adolescent participants.

Limitations

This research did not compare the responses of participants in relation to their gender. However, according to the research of Stevenson et al. (2016) and Kennedy et al. (2009), female-identifying participants were more concerned about the environment and climate change than male-identifying participants. Additionally, Koessler et al. (2022) determined that the effect of Peer Group Influence on the environmental behaviour of adolescents changes as they age. For example, in their study, older adolescents were more likely to change their behaviour to be more in line with what they deemed to be "socially acceptable" in comparison to younger adolescents who did not (Koessler et al., 2022).

Additionally, this research studied the attitude-behaviour gap of adolescents across Ontario, using 41 participants from four urban high schools in locations that were accessible to the researcher, meaning that different conclusions may be drawn if a more diverse or larger participant pool was used. As a result, the conclusions drawn from this study may not accurately represent the attitude-behaviour gap of adolescents in different environments within Canada or other countries. It is also recommended that an ethnographic approach be used in further research to decrease the social desirability bias of participant responses, such as that of Meyer et al.'s 2021 study to further understand the impacts and implications of friends and peers as contextual factors on the attitude-behaviour gap of adolescents.

Conclusion

This study contributes to the current research and understanding of the attitude-behaviour gap of plastic consumption and its relation to adolescent behaviour. However, a lack of research on the attitude-behaviour gap of adolescent plastic consumption, or more broadly the Green Gap, remains. Such research is vital because adolescents are society's next generation of consumers, voters, and activists and their values and behaviours have the ability to shape the nature of societal environmentally supportive behaviour. This study confirmed that an attitude-behaviour gap exists in adolescent plastic consumption, and also determined that adolescents feel relatively low pressure from friends and family members to live more or less environmentally-friendly lifestyles. Additionally, the results of this study indicate that the environmental values of adolescents are developed more by family members than friends, causing the environmental values of friends/social factors to act as situational variables to the behaviour of adolescents (such as the time or cost of a more environmentally sustainable product). This indicates the importance of familial values on the developing environmental values of adolescents, and trends within participant qualitative responses indicate the importance of dialogue amongst peers and family members to increase environmental awareness and share environmental values. Moreover, participant responses demonstrate that adolescents feel pressure from society to live more environmentally sustainable lifestyles. As a result, it is recommended that additional research be conducted to better understand this trend amongst participant responses, or research working to confirm the results of this study and better understand the effect of Peer Group Influence on the attitude-behaviour gap of adolescents and why the presence of friends or peers can alter the environmentally supportive behaviour of an adolescent with strong environmental values. The attitude-behaviour gap of adolescent plastic consumption is not only visible but also has detrimental effects on our environment, and as a result, continued research on the attitude-behaviour gap of adolescent plastic consumption can greatly help encourage more frequent environmentally supportive behaviour.

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Appendix

Survey Questions

Quantitative Likert Scale Questions
1 = I disagree completely, 5 = I completely agree
<p>Protecting the environment is a high priority of mine</p> <p>Lowering my plastic consumption is a high priority of mine</p> <p>Partaking in climate action is important to me, and I actively partake in environmental action</p> <p>When placing an order for takeout, to be packaged in plastic, I am extremely concerned about the amount of plastic waste my order will create</p> <p>When buying a coffee in a non-reusable plastic cup, I am extremely concerned about the amount of plastic waste my order will create</p> <p>I feel pressure from family members to live a less environmentally friendly lifestyle.</p> <p>I feel pressure from family members to live a more environmentally friendly lifestyle.</p> <p>I feel pressure from friends to live a less environmentally friendly lifestyle.</p> <p>I feel pressure from friends to live a more environmentally friendly lifestyle.</p>

Qualitative Survey Questions
<p>What are your environmental values?</p> <p>Can you tell me about your definition of an environmentally sustainable lifestyle?</p> <p>Describe the environmental values of your family.</p> <p>In what ways do your family's actions show their understanding of environmentally sustainable living?</p> <p>Describe the environmental values of your friends.</p> <p>In what ways do your friend's actions show their understanding of environmentally sustainable living?</p> <p>You and your friends are walking, and one asks to quickly go to Shoppers Drug Mart as they need to buy shampoo. You realize you also need to buy shampoo. You and your friend pick up your items, and you head to self-checkout. Your friend reaches for a plastic bag to carry their item. It's your turn, you are wearing a backpack that could hold your shampoo. What do you do?</p> <p>You and your friends want to go get coffee, and on your walk over you remember that you have a reusable coffee cup in your locker. What do you do? (it's a five-minute walk back to your school)</p> <p>Follow-up question: What do you think your family would want you to do in this situation? Would they care?</p>

Questions Used to Situate the Environmental Education and Behavior of Participants
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1. Which strategy do you most often use to lower your plastic consumption? (can select multiple)
 - Using reusable bags
 - Shopping at zero-waste stores
 - Choosing items that have recycled packaging over similar items that do not
 - Living a zero-waste lifestyle
 - None of these
 - Other
2. How often do you use the strategies listed above to lower your consumption
 - Very often (10/10 times I go shopping)
 - Often (8/10 times I go shopping)
 - Usually (6/10 times I go shopping)
 - Rarely (4/10 times I go shopping)
 - Never
3. If I forget my reusable bag in the car when grocery shopping I will....
 - Go back to my car and pick up the bags to carry my purchases
 - Instead buy plastic bags for my items
4. How often do you and your friends discuss environmental sustainability?
 - Every day
 - Every other day
 - Every three days
 - Every 5 days
 - Once a week
 - Every 2 weeks
 - Once a month

5. How often do you and your family discuss environmental sustainability?

- Every day
- Every other day
- Every three days
- Every 5 days
- Once a week
- Every 2 weeks
- Once a month

6. Are you aware that only 9% of plastic in Canada is properly recycled?

- Yes
- No

The Effects of Melatonin and Catalase Supplements on the Survival of α -Synuclein-Expressing *Saccharomyces cerevisiae* Cells

Laura Houghton

Abstract

Importance: Parkinson's disease is only one of several conditions classified under Lewy Body Disease, which is characterized by the build-up of the alpha-synuclein protein in neuronal cells. This causes cellular dysfunction and ultimately, cell death. As such, research on this protein is both critical and ongoing.

Objective: The purpose of this study was to explore the effects of melatonin and catalase supplements on alpha-synuclein-expressing *Saccharomyces cerevisiae* cells under oxidative stress created by adding H₂O₂.

Design: A mixed-methods research approach and experimental research method were used to investigate changes in cell growth, survival, and morphology.

Results: It was determined that the supplements do not have any significant effect on either cell growth or morphology and that melatonin helps to reduce cell death in more severe conditions of oxidative stress.

Conclusion: This effect is most likely because of melatonin's dual ability to both detoxify reactive oxygen species and initiate increased production of antioxidant enzymes like catalase.

Keywords: oxidative stress, melatonin, catalase, *S. cerevisiae*, α -synuclein, hydrogen peroxide

Literature Review

Introduction

Across the world, more than 50 million people are currently suffering from a neurodegenerative disease.¹ Alzheimer's Disease (AD) is the most common, followed by Parkinson's Disease (PD) and Dementia with Lewy Bodies (DLB).² All three are progressive conditions,² and PD and DLB are both considered to be forms of Lewy Body disease.³ DLB begins with cognitive symptoms, such as loss of memory, but progresses later to more physical symptoms. PD, on the other hand, is generally more of a movement disorder leading, most notably, to tremors and muscle rigid-

ity; although it sometimes progress to PD dementia, which includes more cognitive symptoms.⁴ The Lewy Body disease that underlies them both is characterized by the build-up of protein clumps, known as aggregates or Lewy Bodies, in the cytoplasmic regions of neurons.² Such aggregates inhibit cellular communication and neuronal functioning, leading to the symptoms discussed above. The protein alpha-synuclein has been shown to be the main component of these Lewy Bodies⁵ and has thus been the focus of much research over the past couple decades. Despite this, researchers are still working to unlock the specific factors that cause it to form aggregates as well as different molecules and conditions that could prevent or reverse this aggregation.

Alpha-synuclein

The alpha-synuclein protein is found in many parts of the cell, including the cytoplasm, synaptic vesicles, the plasma membrane, lysosomes, lipid rafts, and nuclei.⁶ It is generally agreed that alpha-synuclein is most likely a regulatory protein involved in several different necessary processes, including “neurotransmitter release [and] vesicle trafficking,” among others.² It contains 140 amino acids,⁷ and its behavior and functioning can be affected by many different factors, including oxidative stress.⁸

Overview of oxidative stress

Oxidative stress is a cellular condition created by the imbalance of reactive oxygen species (ROS) and the cell's various antioxidant defenses.⁹ Superoxide and hydroxyl radicals are the most common examples of ROS,¹⁰ and are produced by the mitochondria during aerobic cellular respiration.¹⁰ Hydrogen peroxide (H₂O₂) can also be included in this group, but that categorization is slightly more nuanced because H₂O₂ is a byproduct of the breakdown of superoxide ions by the enzyme superoxide dismutase, rather than a molecule produced directly by the mitochondria.¹¹ Regardless, it is still capable of causing immense cellular damage. Typically, the production of ROS is balanced by antioxidant defenses within a cell, which include both enzymatic and non-enzymatic components.¹² Non-enzymatic antioxidants can include both endogenous molecules, which originate inside the cells, and exogenous molecules, which originate outside the cells.⁹ Enzymatic antioxidants most commonly include superoxide dismutase⁸ and catalase,¹¹ which work to detoxify and/or destroy ROS. When balance is maintained, ROS play an important role as ‘2nd messengers,’ activating cellular signal transduction pathways, facilitating calcium signaling and the actions of growth factors and cytokines.¹³ Since this type of cellular communication is crucial to the growth and proper functioning of cells, the complete eradication of ROS would not be an ideal solution.

Oxidative stress as an agent of disease

Most studies show a connection between oxidative stress and cellular damage. The ROS imbalance leaves

proteins, lipids, DNA, and other macromolecules more vulnerable to oxidative modification, which affects their structure and can eventually lead to cell death.¹⁴ One potential problem specifically with protein modification is protein aggregation, such as that observed in both LBD and PD. A 2019 article by Lévy, et al. presented a clear evaluation of the link between oxidative stress and protein aggregation by analyzing several different studies that tested it. They concluded that oxidative stress can be both a cause and result of protein aggregation and that the misfolding of proteins, which can be caused by oxidative stress, makes them significantly more prone to aggregation.¹⁵ The concept of a connection between oxidative stress, protein modification, and protein aggregation is not a new one, though. In 2003, Ischiropoulos and Beckman came to a similar conclusion. Through their analysis of multiple studies, they gave credence to the idea that oxidative stress can cause the nitration of proteins and noted that, in a variety of diseases, including DLB and AD, the proteins built up in neurons have been nitrated at much higher rates than normal.¹⁴ They also emphasized the plausibility of this link between oxidative stress and neurodegenerative diseases by noting the high susceptibility of neurons to oxidative stress.¹⁴

Mitochondrial theory of aging

Even with such a connection, the tie between all of these concepts still seems to be missing. Since the diseases discussed above are predominantly found in older populations, that tie must involve aging; more specifically, the mitochondrial theory of aging.¹⁶ This theory states that mitochondria become less functional as time passes, in large part because excess ROS that have not been cleared away continue to build up over time and cause damage to the mitochondria.¹⁶ This is a vicious cycle because damage to the mitochondria can cause increased production of ROS and a decreased ability to detoxify them, which leads to even more damage,¹⁶ indicating that increasing antioxidant defenses could help to curb oxidative stress and its damaging effects.

Melatonin

One such antioxidant defense is melatonin, which is present in all organisms that perform aerobic respi-

ration and is both chronobiotic and cytoprotective.¹⁷ This means that it can both modify the phase and amplitude of biological rhythms and reduce mild inflammation, which is why it is commonly used to help treat sleep disorders and is of interest as an antioxidant.¹⁷ In cells facing oxidative stress, melatonin can help by both working to detoxify ROS and by stimulating the production of antioxidant enzymes, such as catalase and superoxide dismutase.¹⁸ A 2017 study by Vázquez, et al. examined the effects of melatonin on the yeast species *Saccharomyces cerevisiae* when exposed to oxidative stress and found that melatonin mitigated cell damage by decreasing the accumulation of ROS and helped prolong the up-regulation of genes related to antioxidant defenses.¹⁸ Additionally, many studies over the past few decades have investigated melatonin in the context of protein aggregation, including one by Lahiri in 1999, which concluded that melatonin helps prevent the development of the amyloid precursor protein, which contributes to protein aggregation in patients with AD.¹⁹

Catalase

As mentioned earlier, catalase is one of the body's most important antioxidant enzymes. Its job is to break down H₂O₂ into oxygen and water,¹¹ which it can do extremely efficiently.²⁰ Like melatonin, it is found in nearly all organisms that perform aerobic respiration.¹¹ Because of its strong antioxidant properties, catalase, like melatonin, has been highly investigated in the context of neurodegenerative diseases thought to develop partially due to oxidative stress. It has also been hypothesized that a lack or decreased functioning of catalase can contribute to the formation of those diseases.¹¹ Martins and English studied these ideas in 2013 by adding H₂O₂ to different knockout *Saccharomyces cerevisiae* strains in both YPD media and nutrient-free buffer and concluded that expression of the CCT1 gene, which codes for catalase, was essential for cell survival but was only fully functional in the nutrient-rich media.²⁰ While studies like this advance the claim that catalase is extremely important in antioxidant defenses, some studies suggest otherwise. A 2001 study by Ilizarov, et al. found that the supplementation of manganese superoxide dismutase had a significantly greater impact on the survival of cells under oxidative stress than did catalase and sug-

gested that the breakdown of superoxide anions, not H₂O₂, was the rate-limiting step.²¹ Thus, a debate exists about whether or not catalase supplementation has a significant effect on cell survival.

Research gap and question to be addressed

Despite the wide variety of studies that have been done on both melatonin and catalase, there has been a lack of studies comparing the two within the same experiment. Additionally, the protective effects of melatonin against damage by oxidative stress and protein aggregation have yet to be studied together, and there have been very few investigations into the effects of catalase on protein aggregation. It is imperative that these gaps be addressed, however, because “a better understanding of the role of oxidants in neurodegeneration,” along with factors that may mitigate them, “still holds a largely unfulfilled potential to reduce the burden of both acute and chronic neurodegeneration.”¹⁴ This leads to the research question: To what extent do melatonin and catalase supplements affect the survival of alpha-synuclein-expressing *Saccharomyces cerevisiae* cells when exposed to oxidative stress? It was hypothesized that under this condition, catalase would have a greater protective effect than melatonin because of catalase's direct role as an antioxidant enzyme versus melatonin's less direct role as a promoter of enzyme production. The main purpose of this experiment was to combine several ideas that had previously been expressed independently of each other, as well as to encourage the continuation of research into both melatonin and catalase.

Methods

Research approach

This study used a mixed methods approach to quantify cell survival under different levels of oxidative stress, as well as to observe the cells for changes in size and shape. This allowed for direct comparison of the experimental groups by putting them all on the same scale and removing ambiguity and subjectivity. Additionally, it allowed for visual observations of changes in shape, which can be difficult to quantify.

THE EFFECTS OF MELATONIN AND CATALASE SUPPLEMENTS ON CELL SURVIVAL

Almost all studies in this field use quantitative data.^{2-3,5-7,8,18-20} and several others make use of both quantitative and qualitative data.^{3,21}

Research method

An experimental research method, performed entirely in a lab, with the use of cell cultures, was employed to obtain both the qualitative and quantitative data. Using a laboratory setting increased control over the conditions to help keep variables like temperature more constant. This study did not have the capability to run human trials, so a model organism was used instead to make the study more feasible. Many studies, such as those by Hodara, et al. and Weston, et al., utilized multicellular organisms in their studies (mice and zebrafish, respectively); however, certain limitations, including a lack of resources and experience, prevented the use of such organisms in this study.^{2,7} Fortunately, though, the use of cell cultures has been well established as a reputable method for experimentation in this field and has been used by a plethora of different studies.^{3,6,18,20,22}

Subject selection

The yeast species *Saccharomyces cerevisiae* was used in this study to examine the effects of catalase and melatonin supplements on oxidative stress-induced cell death. This species was selected for several reasons, including practicality. Yeast cell cultures are relatively easy and inexpensive to care for, and they grow quickly.²³ More importantly, though, *S. cerevisiae* has been established by many studies as an appropriate model organism for studying Parkinson's disease and alpha-synuclein.^{5,22-23} The specific strain used in this study was w303 Δ hsp104 303GAL-a-syn-YFP;304GAL-a-syn-YFP, modified to express the alpha-synuclein protein and gifted generously by the Jackrel lab at Washington University.

Protocol

The following protocol, adapted from a 2019 article by Tran and Green,²⁴ was used to obtain data.

Both liquid and solid yeast media were made according to a recipe from the Grimes Lab at the University of Delaware (Appendix A), and the solid me-

dia was distributed equally among 40 sterile plates. A single yeast colony from the starter plate was removed with a sterile inoculating loop into 100 μ L of liquid media and resuspended by pipetting. This was then added to 149.9mL of liquid media and left to grow in a shaking incubator at 30°C and 220 rpm until it reached an OD600 value of 0.4-0.5 (approximately 24-26 hours).

40mL of yeast cell culture were placed in a 100mL flask and labeled as Group A. 108mL of the remaining cell culture were induced with 12mL of a sterile 20% galactose solution and incubated for 4 hours at 30°C and 220 rpm. The 120mL of induced culture was divided evenly into three 100mL flasks, labeled as Groups B, C, and D, respectively. A 5mM catalase supplement (0.017g) was applied to Group C, and a 5mM melatonin supplement (0.046g) was applied to Group D. The 10mL volumetric flasks and graduated cylinders were labeled, and H₂O₂, followed by yeast/media solution from the appropriate 100mL flasks, was added to each one to achieve a total volume of 10mL and the specified concentration (Appendix B). The samples were incubated at 30°C and 220 rpm for 30 minutes.

1mL was removed from each sample, placed into an appropriately labeled 1.5mL microcentrifuge tube, and centrifuged for 2 minutes at 12,200 rpm. Supernatants were removed, and cell pellets were resuspended in 1mL distilled water. A 96-well plate was used to create a dilution series of each experimental group, with the rows, from top to bottom, representing the dilutions 100%, 10%, 1%, 0.1%, 0.01%, and 0.0001%. One column was used for each of the twelve groups. Next, 200 μ L from the appropriate microcentrifuge tube was added to each of the wells in row A, and 20 μ L from each of these wells was added to 180 μ L of distilled water in row B and mixed with a pipette. This was then repeated for rows C-F. Three media plates were labeled for each experimental condition. On each plate, 5 μ L was added from each well in the appropriate column, going clockwise in a circle around the plate. After drying, the plates were inverted and stored at 30°C, and for the following five days, pictures were taken of each plate.

Protein isolation and western blot assays were performed for each experimental group, according to protocol from both Edvotek and Cell Signaling Technology. Buffers, gels, membranes, and antibodies were

generously provided by both companies. Since these assays did not yield any results, a more detailed protocol has been omitted.

Yeast cells from each subgroup were resuspended in 100 μ L distilled water, and 10 μ L was placed on a slide, stained with 2 μ L methylene blue, and visualized for shape, size, and viability.²⁵ Three pictures were taken for each of the microscope slides, and a 36-square grid was laid over each picture. In order to acquire numerical data, six boxes were counted for each picture, meaning eighteen boxes total were counted for each experimental condition. The number of alive and dead cells was recorded for each of these, and a ratio of dead to alive cells was calculated. These ratios were averaged for each condition, and standard errors were calculated. These average ratios were plotted on graphs in various combinations to visualize relevant results.

Validity

Internal validity was ensured through the use of control samples and a relatively constant environment. Control samples were maintained throughout the experiment as uninduced samples that did not receive any supplements. Since these cells were not induced to begin producing alpha-synuclein, they were not expected to show any results for the western blot, therefore making them an effective negative control. To prevent contamination, the yeast media, as well as all glassware used, was autoclaved prior to use, and all steps up until the western blot, with the exception of incubation, were performed in a biosafety cabinet. Materials such as serological pipettes, micropipette tips, and microcentrifuge tubes were all sterile and unopened prior to use. Additionally, the use of methylene blue stain, which only enters dead cells, for visualization provided criterion validity.²⁵

Limitations

Unfortunately, this study had some limitations. The most substantial limitation was the fact that a high school lab was used. While this setting did allow for the regulation of most environmental factors, it fell short in a few areas, including humidity control. Additionally, some professional-grade equipment that

would have helped add more control to the study, such as a western blot transfer apparatus, was not available. This apparatus is typically used in western blotting to transfer proteins from the PAGE gel to the nitrocellulose membrane with the use of an electric current and adds consistency because the same amount of current can be applied to each transfer. The lack of this device could have been one of the reasons why the assay performed in this study was unsuccessful.

Results

Summary

The purpose of this study was to investigate the impacts of melatonin and catalase supplements on the growth and survival of alpha-synuclein-expressing *S. cerevisiae* cells under oxidative stress. Cells were grown on media plates in a dilution series, and their growth over a period of five days was observed. Samples from the plates were stained with methylene blue and visualized at 1000x optical zoom. The numbers of dead and alive cells were counted, and a ratio was calculated to provide quantitative data. The main findings were as follows:

1. Uninduced cells generally had more growth than induced cells.
2. Neither the addition of a supplement, nor the addition of oxidative stress had any observable effect on cell morphology.
3. In general, increased oxidative stress, as measured by H₂O₂ concentration, corresponded to higher percentages of dead cells.
4. Neither catalase nor melatonin had a statistically significant effect on cell death when oxidative stress was not present.
5. At higher levels of oxidative stress, melatonin, but not catalase, lead to a statistically significant decrease in cell death.

Uninduced vs. induced cells

Of the four treatment groups, Group A, the control, was the only group that was not induced by galactose exposure, which means the cells in this group should not have been expressing alpha-synuclein. Based on

Table. Largest Dilution Factor at which Growth was Observed After 5 Days

H2O2 Concentration (mM)	A - Uninduced, No supplement	B - Induced, No supplement	C - Induced, Catalase supplement	D - Induced, Melatonin supplement	Mode
0	104 103 104	103 104 104	104 103 103	104 104 103	104
2	104 104 104	103 104 103	104 103 103	103 104 103	104/103
4	104 103 103	102 103 103	103 104 104	103 103 104	103
Mode	104	103	103	103	

visual observations, none of the groups showed any growth on the first day after being plated. On the second day, though, a difference in growth was seen between Group A and the rest of the treatment groups. Of the nine plates (three for each H₂O₂ concentration) from Group A, eight showed growth. In comparison, only three plates from Group B, two plates from Group C, and two plates from Group D showed growth. A slight difference was also observed between Group A and the rest of the groups in terms of the largest dilution factor at which growth was observed after the five-day observation period.

This table shows the largest dilution factor at which cell growth was observed after five days for each of the thirty-six plates. Across all three H₂O₂ concen-

trations, growth was observed most frequently at the 104-dilution factor for Group A, but for all of the non-induced groups, growth was observed most frequently at the 103-dilution factor.

Cell morphology

Based on visual observation of the cells at 1000x magnification, there were no noticeable differences in cellular morphology between the four main treatment groups and the different H₂O₂ concentrations. The cells observed were generally circular in shape, and while there appeared to be some slight variations in cell size within each sample, a consistent difference between groups was not observed.

Figure 1. 1000x Microscope Images from Each of the 12 Experimental Conditions

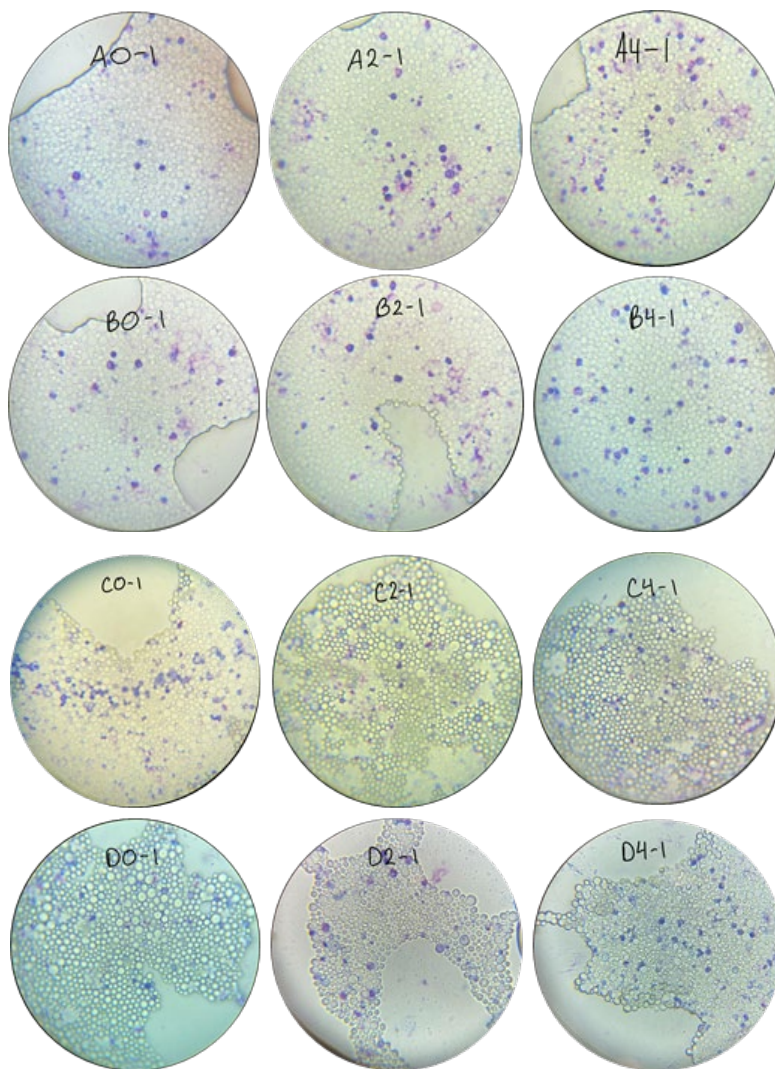
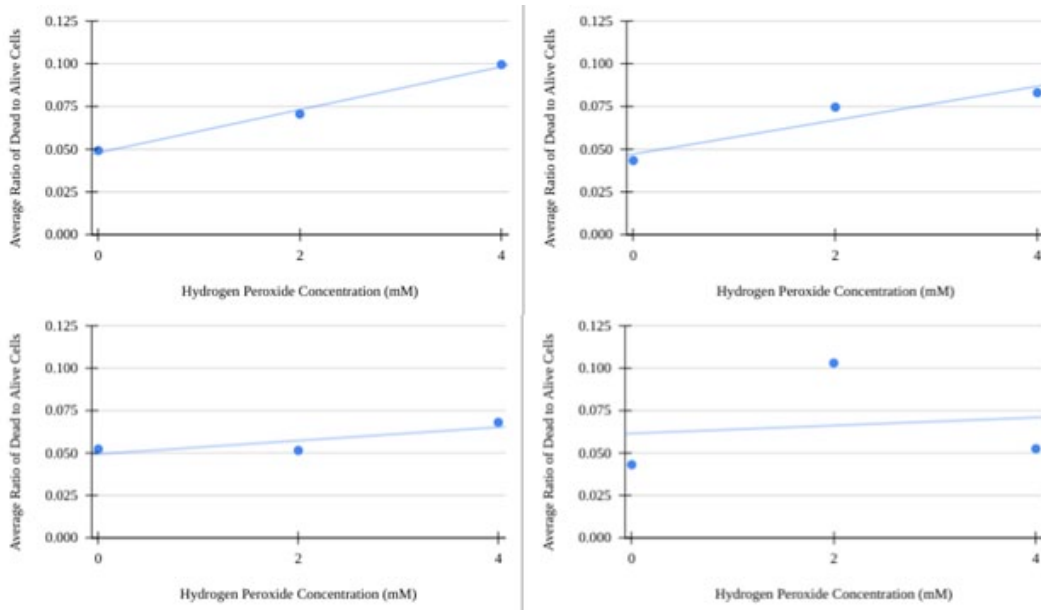


Figure 1 shows one of three images taken for each of the twelve experimental conditions (three different H_2O_2 concentrations for each of the four main treatment groups). As stated above, no consistent morphological differences between the groups were observable.

Oxidative stress and cell growth

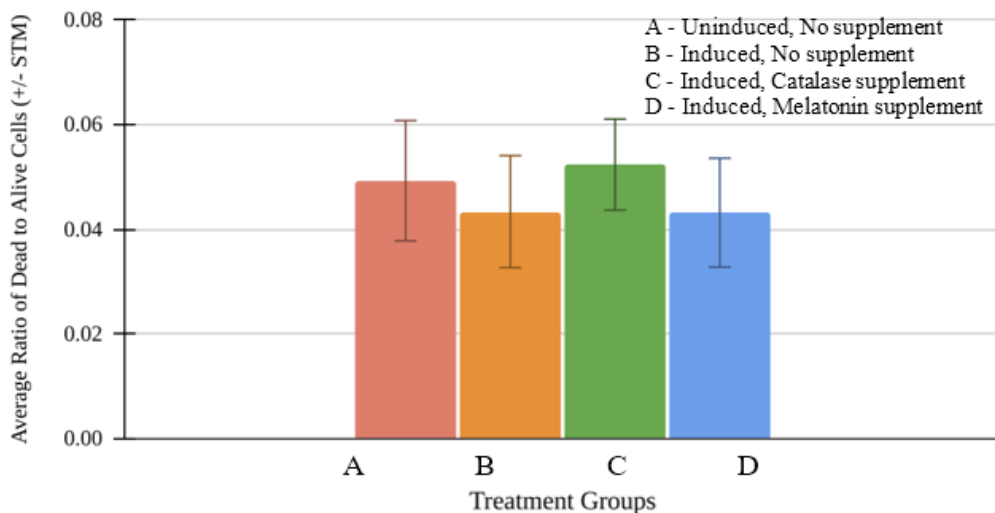
Overall, across all four treatment groups, a higher level of oxidative stress, as represented by a higher concentration of H_2O_2 , corresponded to a greater ratio of dead to alive cells. Any cells that appeared blue/purple were counted as dead because of the entrance

Figure 2. Effects of H₂O₂ Concentration on the Ratio of Dead to Alive Cells



of the methylene blue stain, and any cells that appeared white were counted as alive.

Figure 2 shows four different graphs, one for each of the four main treatment groups, indicated by the letter labels in the top left corners. The points plotted for each of the three H₂O₂ concentrations indicate the averages of the eighteen total boxes counted from the microscope pictures for that concentration, and the lines represent the linear lines of best fit. In each of the four graphs, it can be noted that the slopes of these lines are positive, indicating a positive correlation between increased oxidative stress and increased cell death.

Figure 3. Effects of Melatonin and Catalase Supplements on Yeast Cell Death at 0mM H₂O₂

Supplements in the Absence of Oxidative Stress

Focusing in on the 0mM concentration, which represents a lack of oxidative stress, it was observed that neither melatonin nor catalase supplements affected the ratio of dead to alive cells.

Figure 3 shows the ratio of dead to alive cells at 0mM H₂O₂, along with the standard error for each, which was calculated by averaging the cell counts from each microscope view. There is no discernable pattern in the ratios of cell death between these four treatment groups, meaning that the supplements did not have an effect in this condition.

Supplements in the Presence of Oxidative Stress

Conversely, at the 4mM concentration, the highest H₂O₂ concentration tested, the results indicated a statistically significant difference between treatment groups B and D, the induced cells with no supplement and the induced cells that received the melatonin supplement.

Figure 4 is very similar to Figure 3, with the only major difference being that it shows the cell survival at

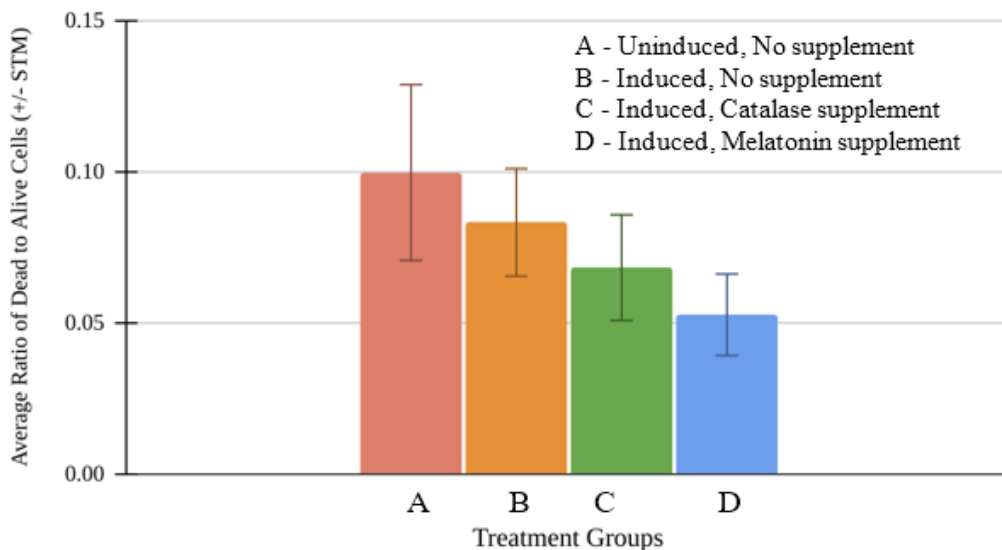
4mM H₂O₂, instead of 0mM. Compared with Group B (Induced, No supplement), Group C (Induced, Catalase supplement) did not show a statistically significant decrease in cell death ($p=0.2278$); however, Group D (Induced, Melatonin supplement) did show a statistically significant decrease ($p=0.0284$).

Discussion

Significance

One major implication of this research is that its preliminary findings line up with several ideas in the surrounding literature. For instance, as discussed in the literature review, oxidative stress has been heavily linked to cellular damage and as a result, cell death.^{9-14,16} The results of this study, which showed a trend of increasing cell death as H₂O₂ concentration increased, support this idea. Additionally, multiple studies had already suggested that melatonin has protective effects against oxidative stress,¹⁷⁻¹⁸ and this study, which showed that melatonin helps reduce cell death at 4mM H₂O₂, provides additional evidence for this.

This study also found, however, that neither mela-

Figure 4. Effects of Melatonin and Catalase Supplements on Yeast Cell Death at 4mM H₂O₂

tonin nor catalase have an impact on cell survival at 0mM H₂O₂, an idea which is supported by the role of both of these supplements in the body. Since they are both important for antioxidant responses,¹³ it follows that in the absence of oxidative stress, they would tend to be present at lower levels within the cells, and even if supplemented in excess, they would not have much of a function to perform. In the case of catalase, H₂O₂ is needed as a substrate, so if this substrate is not present, no reaction will take place. Similarly, one of melatonin's functions is to detoxify ROS, but if ROS are not present, it cannot perform this function. Thus, at low H₂O₂ concentrations, neither supplement is able to have an impact.

While it was initially hypothesized that catalase would have a greater effect on cell death because of its more central role in the cellular oxidative stress response, the results supported the opposite idea, showing that melatonin supplementation leads to a decrease in cell death at higher levels of oxidative stress, while catalase does not. One potential reason for this is melatonin's ability to both induce the production of more antioxidant enzymes and also directly detoxify ROS.¹⁸ While it is not as intrinsically involved in the cell's natural antioxidant response as catalase, these

results suggests that its dual action may allow it to have a greater impact.

Alternative explanations

Additionally, there are a few alternative explanations that could relate to the conclusions of the present study. The first, and most significant, is that the concentrations of melatonin and catalase added to the samples were not optimal. As determined by a 2017 article by Vázquez, et al., 5μM would have yielded the most favorable results for melatonin.¹⁸ Unfortunately, because of limitations in laboratory equipment, a 5mM concentration had to be used instead, with the theory that any effects would be heightened and thus, easier to observe with limited technology. It cannot be overlooked, though, that this concentration may have been too high and could have caused some adverse effects. Also, a lack of previous studies focusing on catalase meant that dosing guidelines for catalase were not available. The amount of catalase that was added was intended to be roughly the same concentration as the melatonin, but this was most likely not the ideal concentration to use. The fact that neither of these supplements were in their optimal concentra-

tion range could be a reason for the observed difference in effect between the two.

Another fact to keep in mind is that catalase is somewhat of a secondary enzyme in the antioxidant process, as it breaks down H₂O₂, instead of superoxide ions, for instance.²⁰ This should not have had much impact on the actual experimental results because the oxidative stress was created with H₂O₂, not superoxide ions; however, it could diminish the applicability of the results in a more complete disease model.

Limitations

Despite the controls that were set in place for this experiment, the results do have several limitations. For starters, the sample size was very small. Due to both time and monetary constraints, only one experimental replicate was able to be performed. This means that any potential errors and/or outliers present throughout the experiment may not have been able to be identified and accounted for. It also means that, while the p-value was low for melatonin in this experiment, there was really not enough data for this value to hold much weight without further testing. Additionally, the method used for collection of quantitative data relied on human observation and counting, which is inherently error prone. The boundaries between the different cells were not always as clear as would have been ideal, so over or under counting could have been a factor in the results. For example, the average ratio of dead to alive cells for Group D at 2mM H₂O₂ (as shown in Figure 2) did not fit the trend shown by the linear line of best fit. This could be due to several reasons, but inconsistencies in counting as a result of human error was determined to be the most likely cause. As such, this point was considered to be an outlier in the data.

Finally, the most significant limitation in this experiment was the fact that protein expression could not be verified in the induced cell groups. This verification would have come through the western blot, but as that assay did not yield results, there is no such verification. Thus, there are two ways to interpret the results. One is as described above, with the assumption that the induced cells were expressing alpha-synuclein, while the other operates under the assumption that none of the cells were expressing alpha-synuclein, thus making groups A and B functionally the same.

This view does not invalidate the experiment's results, though, as it does not take away the protective effect demonstrated by melatonin; it only removes the alpha-synuclein component.

Further research

The results of this study are neither entirely conclusive nor all-encompassing, which means that much more research in this area is needed in order to properly understand these supplements and their effects. First off, a replication of this experiment performed in triplicate is needed to yield results that can truly be quantified. Also, since the western blot in this experiment did not yield results, a replication of the experiment in more ideal conditions that give the western blot a greater chance of success would be highly beneficial. Additionally, future research should include a wider range of H₂O₂ and supplement concentrations tested. Doing so would not only enable researchers to see the effects of these supplements at a greater variety of oxidative stress levels, but also to see how increasing or decreasing the amount of supplement added could amplify their positive effects and/or introduce negative ones. Finally, future studies could also change the time of supplement administration by pretreating the cells instead of applying the supplements at the same time as the H₂O₂.

Research like this will provide better insight into the ways in which both of these supplements work in cells, as well as whether or not they may truly be effective in helping cells recover from oxidative stress. If this is found to be the case, this research will also begin to shape ideas of appropriate and effective doses, and the same principles may be able to be expanded to other diseases that are also linked to mitochondrial aging, oxidative stress, and/or protein aggregation, such as Alzheimer's disease, Huntington's disease, and frontotemporal lobar degeneration, among others,¹ providing novel therapies to help slow, or reduce the effects of, their progression.

Conclusion

The results of this study did not support the initial hypothesis that the introduction of a catalase supplement would have a greater protective effect than a melatonin supplement on yeast cells under oxidative stress. In fact, the results showed the opposite, most likely due to melatonin's dual antioxidant capabilities. The study did fill a gap, though, in the direct comparison of catalase and melatonin, which is important because of their similar functions in the body. Additionally, this study aimed to fill the gap for both melatonin and catalase with regards to their effects on alpha-synuclein aggregation under oxidative stress; however, this question was not successfully answered because of the failed western blot, meaning that further studies are needed to reach a conclusion. Regardless, this study supports the idea of using melatonin supplements to help mitigate the effects of diseases linked to oxidative stress, such as Parkinson's disease and Dementia with Lewy Bodies; although extensive dosage and efficacy testing are still necessary.

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Appendix A

Liquid yeast media (2 liters)

- 1.6 liters of distilled water
- 13.4 grams of a yeast nitrogen base without amino acids (generously provided by the Grimes lab at the University of Delaware)
- 1.74 g CSM-His powder (Sunrise Science #1006-010)
- 400 mL of 10% sterile filtered Raffinose solution (added after autoclaving)

Solid yeast media (1 liter)

- 0.8 liters of distilled water
- 6.7 grams of a yeast nitrogen base without amino acids
- 0.87 g CSM-His powder
- 20 grams of agar
- 200 mL of 10% sterile filtered Raffinose solution (added after autoclaving)

Note: This media was distributed into 40 sterile plates with 25 mL each

Appendix B

Graduated cylinders

- Labeling: A-0 mM, B-0 mM, C-0 mM, D-0 mM
- No H₂O₂ added (0 mM)

Volumetric flasks

- Labeling: A-2 mM, A-4 mM, B-2 mM, B-4 mM, C-2 mM, C-4 mM, D-2 mM, D-4 mM
- 2.04 μ L 30% H₂O₂ added to each flask labeled with 2 mM
- 4.08 μ L 30% H₂O₂ added to each flask labeled with 4 mM

Mental Healthcare Providers' Perceptions on the Effectiveness and Viability of Telepsychiatry in Allegheny County Jail

Tiffany Habib

Abstract: Prior research has considered the lack of mental healthcare services offered to the inmates in Pennsylvania, Allegheny County Jail. However, there is limited research on how telepsychiatry impacts the mental health services provided in this jail, leading to the question: What are local mental healthcare workers' opinions on the effectiveness and viability of telepsychiatry in Allegheny County jail? The researcher used a convergent parallel, mixed method Google Forms survey to obtain this data. This study found that while most providers preferred in-person care over telepsychiatry, they conceded that this system can be beneficial for the inmates at this local jail. Providers' willingness to work with the jail also increased when using this system. These findings demonstrate that using telepsychiatry within Allegheny County Jail is necessary because it could alleviate the severe understaffing and lack of mental health services in not only this local jail, but jails across the nation.

Keywords: Telepsychiatry, Jails, Mental healthcare services, Understaffing

Literature Review

Introduction

In the United States, the healthcare system in correctional facilities is notorious for being inadequate and unsuitable for the incarcerated. The nationwide incarceration rate is found to be the highest in the world (Statista, 2021). To be specific, as of 2019, 2.1 million people were in jails (Gramlich, 2021). Additionally, over half of the inmates in these jails have been diagnosed with a mental illness (Collier, 2014). Due to the large number of incarcerated people in the United States, the mental healthcare services provided to the inmates are scarce, insufficient, and has led to a lack of available mental healthcare staff (Gonzalez, 2014). Thus, to help prevent this high incarceration rate in the United States, improvements must be made to the mental health services provided to the inmates (Wilper et al., 2009).

The medical field has seen recent technological ad-

vancements that have bridged the gap between healthcare providers and the incarcerated. The adoption of a medical system called telepsychiatry can provide jails with access to the necessary mental health services. Telepsychiatry is useful when providing mental health services to patients in isolated areas, where inmates reside (Hubley et al., 2016). However, there is a lack of research on the efficiency and viability of telepsychiatry in jails from the perspective of the provider, and no research done specifically in the Pennsylvania, Allegheny County jail. This leads the researcher to question: What are local mental health care workers' opinions on the effectiveness and viability of telepsychiatry in Allegheny County Jail?

Key Terminology

Telemedicine- A remote medical system used to diagnose and treat patients through different kinds of technology or video calls (Haleem et al., 2021).

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Telepsychiatry- A specific branch of telemedicine which provides psychiatric services across long distances using technology (Iris telehealth).

Jail- Houses “pretrial defendants” who are unable to make bail and shorter-term felonies (Schlanger, 2003).

Prison- Houses long term defendants (Schlanger, 2003).

Correctional Facilities- A general term for prisons and jails.

Deinstitutionalization- Deinstitutionalization is a set of new policies and treatments that caused the number of mentally ill people to radically decrease in mental hospitals between 1955 and the present (Raphael et al., 2014).

Telepsychiatry Overview

Telepsychiatry first originated in the very late 1950’s. It originated in order to increase access to medical resources for areas with isolated populations (Hyler S.E & Gangure, 2002). In recent years, telepsychiatry has been used in various areas such as schools, clinics, and jails. While telemedicine is not a relatively new medical discipline, it has become a “necessity” after the Covid-19 pandemic (The American Journal of Surgery). The Covid-19 pandemic made this system a necessity due to the social distance needed between the patient and provider. Due to this pandemic, there has been increased research on the effect of this medical system on the patients.

A series of advantages have been cited about the effectiveness of telepsychiatry for patients. For instance, increased access to medical services is the main advantage when using telepsychiatry (Gutske et al., 2004). Other advantages include convenience and cost effectiveness for patients. *The World Journal of Psychiatry* even claims that telehealth care is comparable to in-person care (Hubley et al., 2016). In a study done by the Office Journal of the National Comprehensive Cancer Network, patients demonstrated that they had a high level of satisfaction with telehealth care, but preferred office visits over telehealth care.

Disadvantages are also cited by patients about telehealth. A main disadvantage cited is the effect of the patient-provider relationship when using technology. One study found that there were challenges in building rapport and having therapeutic alliances.

The study also cited communication issues and limited provider attention (Andreadis, 2023). This seems to be a common theme found by many patients and studies. Patient-provider relationships are essential for the provider to achieve in order to start treating the patient (Wampold, 2015). This is why technology influencing the relationship between the patient and the provider is a major drawback when using telehealth.

Although there is significant research on the overall effectiveness of telepsychiatry, there is limited research on its potential to address healthcare challenges in jails.

History of Healthcare in Jails

In the 1950’s, there was a surge of inmates with mental illnesses in correctional facilities. This can be attributed to the deinstitutionalization of asylums, which caused an influx to the national incarceration rate (Raphael et al., 2014). This surge of inmates with mental illnesses was a huge problem for the American healthcare system. Previously, jails were not equipped for such a massive amount of people. Also, healthcare in jails and prisons was not recognized as a human right until the 1970’s. This led to the massive mistreatment of inmates in jails all across the U.S. However in 1976, the U.S Supreme Court acknowledged that improper healthcare in jails violates the Eighth Amendment, which states that no cruel and unusual punishment is warranted in correctional facilities (Cornell Law School). Following the acknowledgement of inadequate healthcare in jails, providers and security guards had to balance between security of the inmates, and proper provision of healthcare (U.S Department of Justice).

Problems with the Healthcare system in Correctional Facilities

The acknowledgement that the lack of healthcare services within jails violates the U.S constitution somewhat improved access to healthcare services to jails. However, even with this acknowledgement, there are still numerous issues with the healthcare system in the U.S. Jails function as health care providers for a large part of the population, due to the high incarceration rate in the U.S, meaning that the

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issues in providing mental health services must be addressed (Butler 2014). While more than half of the inmates in jails have some sort of mental illness, about 10 to 25% of inmates suffer from severe mental illness (Collier, 2014). There are many underlying reasons as to why many incarcerated people have mental health issues. For instance, underlying reasons such as poverty, racism, and substance abuse can all trigger mental health disorders (Johnson, 2020). A large portion of the prison and jail population do not receive mental health services because of the severe understaffing of mental health workers (Gonzalez 2014). A research study by the National Library of Medicine reinforced this notion when interviewing formerly incarcerated adults who stated that they struggled to access mental health services due to “cumbersome procedures” and “inadequate staffing” (Canada et al., 2022). This survey reinforced prior research done on the inadequacy of mental health services in jails all over the country.

Suicide is also a very prevalent issue and the leading cause of death in correctional facilities across the nation (US Department of Justice). The rate of suicide among incarcerated people is known to be higher in jails than it is in prisons (Thornburn). Suicide in jails can again be attributed to a lack of mental healthcare staff. For example, a study done in the New York City Department of Correction reveals that ninety-one percent of inmates who committed suicide, did so when they were alone and without supervision (US Department of Justice). Another study in the Maryland prison system reveals that the suicide rate in the specific correctional facility studied is higher than that in the community as a whole (Thornburn). Therefore, consideration of the mental health staffing is necessary in order to prevent suicide in correctional facilities across the nation.

Problems with the Allegheny County Jail

The official Allegheny County Jail website reports that 40% of its inmates are on some type of medication for mental illnesses (Allegheny County, 2022). However, the amount of people on medication is not an accurate representation of the amount of people experiencing mental health issues. Recently, the University of Pittsburgh published a survey about the Allegheny County Jail inmates which revealed many

existing problems with the healthcare system in this local jail. Through this survey, many respondents disclosed that they had a “high level of dissatisfaction with medical care in the jail” (Farmer, 2022). Other recent articles have made an appearance in the local media about the number of unnecessary deaths due to suicide Allegheny County Jail has experienced. The Pittsburgh National Institute of Journalism confirmed that 13 men have died since the Covid-19 pandemic (Hailer, 2022). These deaths have shocked the Pittsburgh community, with a series of newspapers reporting these deaths in detail, claiming that these deaths are due to mental health staffing shortages. Brittany Hailer, from the *Pennsylvania Capitol Star News* also reports that severe understaffing has reduced the amount of mental health treatments in the jail, which has made suicide a very prevalent issue (Hailer, 2022). Thus, the suicide rate and the survey published by the University of Pittsburgh show the many existing issues in the healthcare system in the Allegheny County Jail.

Advantages of Telepsychiatry in Correctional Facilities

Telemedicine has been focused on providing healthcare to places that have staffing shortages or are in remote areas (Collins et al., 2019). For example, the US Department of Justice states that an experiment in the late 1990s demonstrated the feasibility of telemedicine in correctional facilities (Ashcroft et al., 2002). Telepsychiatry can “positively impact” the quality of mental health care in jails by providing access to medical staff and increasing communication between the doctors and inmates (Office of Justice Programs, 1998). For example, a study by the Ohio State University in 1994 investigated the effects of telemedicine and implemented this system for Ohio prison inmates. The University concluded that physicians and inmates were generally satisfied with health care through telemedicine (Mekhjian et al., 2009). Additionally, a semi-structured interview with a healthcare provider claimed that access to services is one of the main advantages of telepsychiatry (Hubley et al., 2016). A study by Deslich et al (2013) further found that access to services is a definite advantage of telepsychiatry. Already, jails are implementing this new system to provide better access to mental health

services for their inmates. For example, in a study cited by Michelle Amartey, California began using telepsychiatry in its local jails to combat staffing shortages, which proved to be highly effective (Amartey, 2022). The local Pennsylvania, Allegheny County Jail has already begun implementing telepsychiatry in its healthcare system. It provides professional visits with mental health workers through the use of technology, in order to provide access to mental health services (Allegheny County). There has been an increased usage of telepsychiatry in numerous jails throughout the nation, demonstrating that this system may be a viable option for improving healthcare within jails (Batastini et al., 2016).

Disadvantages of Telepsychiatry in Correctional Facilities

While many studies in the field cited advantages to telepsychiatry use in jails, this medical system can pose significant disadvantages. For example, a study on patient and provider perspectives on telehealth revealed that most providers were dissatisfied with telehealth. A possible reason could be the lack of professional relationships between the provider and inmate (Angus et al., 2005). In correctional facilities specifically, a strong patient and provider relationship is essential in order to ensure that the inmates receive the best quality of care (SAMHSA). Already many studies about telehealth in general have proven that the quality of the patient-provider relationship is affected through the use of technology for treatment (Andreadis, 2023; Angus et al., 2005). Thus, these findings pose severe drawbacks to the telepsychiatry system and its use in correctional facilities.

Another study by the American Psychological Association demonstrates that patients largely preferred in-person care over telepsychiatry (Batastini et al., 2016). This could be due to possible concerns over a lack of security for patient data when using technology (Watson, 2020). In a semi-structured interview done by Deslich et al (2013), Thistlewaithe, a mental healthcare provider, cited that one of the main drawbacks of telepsychiatry is technological limitations (Deslich et al., 2013). Thus, while telepsychiatry does provide benefits on correctional facilities, there are also many severe drawbacks in this system.

Assumptions

To effectively continue the study of the impact of telepsychiatry in correctional facilities, the researcher must assume that mental health is a prevalent issue for the inmates in correctional facilities (Collier 2014). The United States has the highest incarceration rate in the world, and the majority of inmates have mental illnesses, validating this assumption (Statista, 2021; Thornburn, 1995).

The researcher must also assume that the healthcare system in jails is not efficient, nor provides adequate mental healthcare services. Jails have long received substandard mental healthcare services due to severe understaffing, and this impacts the healthcare system of the jail as a whole (Gonzalez 2014). This may be due to a lack of human health resources which would lead to challenges with local recruitment and retention of mental health staff.

Lastly, the researcher must finally assume that telepsychiatry has already been implemented within the Allegheny County Jail in order to be able to research the effectiveness of this system within the jail.

Justification

Healthcare is a human right and due to the many recent news stories and surveys exposing the healthcare system in Allegheny County Jail, this issue is now receiving new light on mainstream media. Healthcare and specifically mental health services should be provided to all humans regardless of the punishment. If healthcare services are not provided, then this is a violation of the Eighth Amendment which demands that there be no cruel or unusual punishment towards inmates (Cornell Law School). Inmates have a right to care and increasing access to such care should be a priority. Also, telepsychiatry has become a necessity in recent years (The American Journal of Surgery). Telepsychiatry has been found to provide healthcare to otherwise remote areas; however, there is a lack of research on provider comfort levels and willingness to engage with inmates, specifically in the Allegheny County Jail. Therefore, due to the recent inquiries into the healthcare system in Allegheny County Jail, and the recent addition of telepsychiatry in this local jail, this leads the researcher to the question: What are local mental health workers' opinions on the effectiveness and viability of telepsychiatry in Allegheny County Jail?

Method

Purpose

The purpose of this study was to collect data on the perceptions of local mental healthcare providers on the effectiveness and viability of telepsychiatry in Allegheny County Jail. Analyzing these responses aided the researcher to understand the advantages and disadvantages of the implementation of telepsychiatry in this local jail.

The method chosen was to use an online Google Forms survey to collect data. This is a convergent parallel, mixed method. This type of method was chosen to gain access to a large population of mental healthcare providers while also understanding the motives behind each of their answers. Also, both the survey multiple choice questions and the open-ended questions led to analysis in comparing the two sections which made a convergent parallel mixed method the most effective. This method also provided a larger variety of mental health workers who were able to answer the survey. For example, there were responses from mental healthcare providers who worked in Allegheny County Jail and providers who had no affiliation with the jail. This allowed for a wider range of data to be collected and allowed the researcher to gain statistically significant findings (see Appendix A for survey).

Sample Procedure and Characteristics

Participants

In order to participate in this study, respondents must have been a mental healthcare provider that lives or works in the Allegheny County area. Participants were limited to Allegheny County because this study asked questions directly about Allegheny County Jail, and widening the participant pool would not be practical. They were also limited to this area to ensure that the participants were able to answer specific questions related to the Allegheny County Jail. While the use of telepsychiatry is important to the study, the goal of this study was mainly to explore the effectiveness and

viability of telepsychiatry. In order to do this, provider willingness to use this system must be gauged. Thus, the use of telepsychiatry was not an essential requirement for participation. Participants were recruited through the use of texts, emails, word of mouth, QR codes, phone calls, and personal contacts who worked with the jail.

Ethicality and IRB Approval

This study was approved by the Institutional Review Board. All personal information-collecting features on the Google Forms survey were turned off, to maintain anonymity. On the survey, a consent and debriefing form was attached. All responses were anonymous and kept in a Google Folder that only the researcher and the project director had access to. After one year, all personal records will be destroyed to ensure participant anonymity.

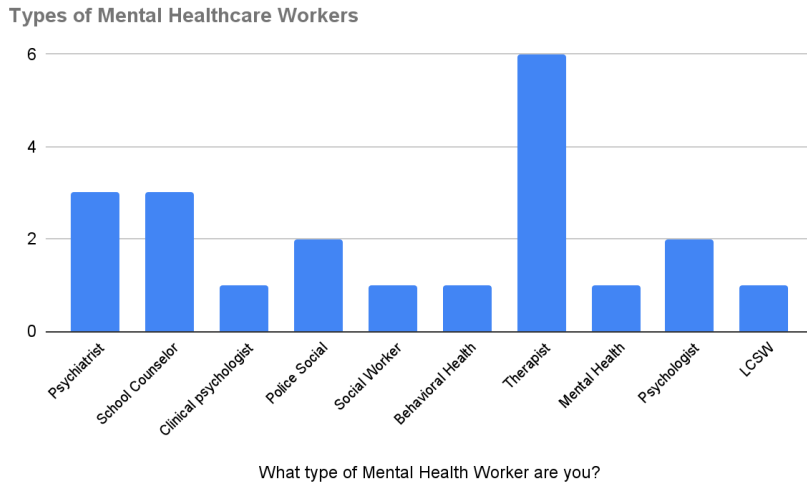
Survey Design

The survey began with informed consent and demographics for the researcher to gauge the provider's age differences, and what type of mental healthcare worker they are. After this, they were asked about different work habits such as where and when they use telepsychiatry or their knowledge of Allegheny County Jail. After these questions, there was a section provided only to participants who answered that they had affiliation with the Allegheny County Jail. This section was about the specifics of the mental healthcare services provided and the medical system used in the jail. After this, participants were asked about the advantages and disadvantages of implementing telepsychiatry in Allegheny County Jail. They were then debriefed about the survey, and offered a link to send the survey to any others that fit the description (See Appendix A for the survey).

The survey questions were adapted from two different peer reviewed research studies to maintain the validity and credibility of the questions. One of the sources was a study by Deslich et al., (2013). Some of the questions in the survey were adapted from the semi-structured interview provided in this study. Some of the questions were paraphrased and multiple-choice answers were added. Also, some questions were used in the open-ended section; however, they

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Figure 1
Types of Mental Healthcare Workers



were used to ask specific questions about Allegheny County Jail. The other study was by the Mayo Clinic in Florida (Malouff et al., 2021). This study researched physician satisfaction with telemedicine in general. While this study has no relation to telepsychiatry in correctional facilities, the questions were adapted from this survey because the structure of this survey was somewhat similar to the survey questions made by the researcher. This furthered the credibility of the questions asked by the researcher. The questions were then reviewed by the Institutional Review in order to ensure that the wording of the questions was unbiased and clear.

Findings and Analysis

General Findings

In total, there were 23 respondents; however, one participant did not consent to participate in the study. Another participant was not a mental healthcare worker, which was a requirement to participate in this study. Therefore, only 21 responses could be used for research purposes. Of the 21 responses, only 3 participants worked in the Allegheny County Jail.

The survey contained a section specifically for mental health workers who worked in Allegheny County Jail; however, it was excluded due to the lack of respondents that worked in the Jail. This caused the primary objective of this study to be revised to learning generally about mental health provider attitudes toward telepsychiatry, with a secondary objective of learning perceptions within the jail.

A series of multiple-choice questions were asked to gauge the different perceptions of the mental health workers. The questions primarily consisted of multiple-choice answers to gain a clear understanding of each participant's perceptions.

As shown in Figure 1, therapists were the most common type of mental healthcare worker in this study; six therapists participated. Other types of mental health workers that participated included psychiatrists, school counselors, clinical psychologists, etc. All participants either worked or lived in Allegheny County, which was a requirement of participation.

As shown in Figure 2, the majority of participants never use telepsychiatry while working, and only two participants always use telepsychiatry. As seen in Figure 3, of the 21 participants, only three (14.3%) work with the Allegheny County Jail. The other 18 participants have no affiliation with the jail. This figure dem-

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Figure 2

Demographics/Work Habits of Participants

Note: One participant refrained from answering this particular question

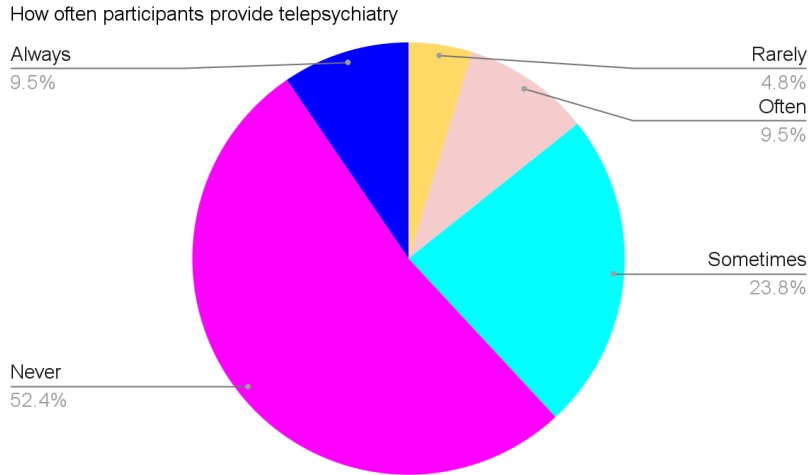
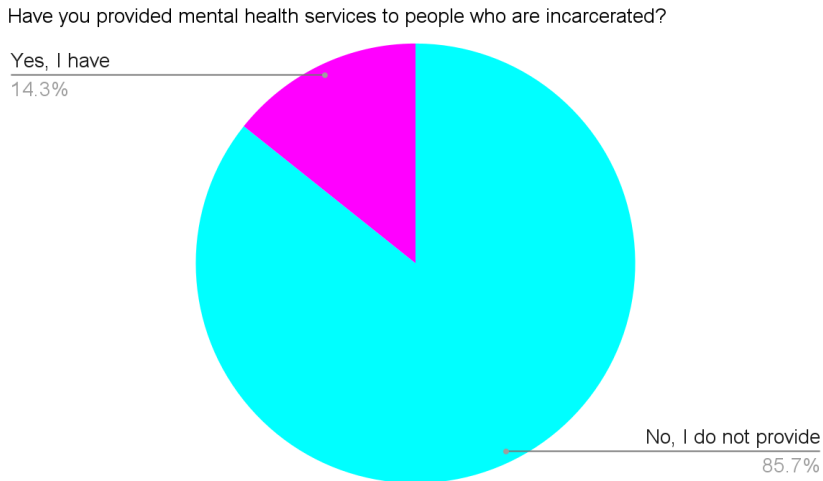


Figure 3

Percentage of Participants who have provided Mental Healthcare Services to Allegheny County Jail

Note: The lack of mental healthcare workers that provide services to inmates is a limitation that will later be addressed in this paper.



onstrates the lack of mental health workers who utilize telepsychiatry and that most mental health workers surveyed have no affiliation with Allegheny County Jail. The lack of mental health workers that use tele-

psychiatry in Allegheny County limits this study because it may cause unreliable and inaccurate opinions regarding telepsychiatry use in Allegheny County Jail. Also, the majority of mental healthcare workers did

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not work with Allegheny County, which also could account for inaccurate data. These inaccurate opinions could take place since the mental healthcare workers who are not affiliated with the jail may base their opinions from word of mouth or the mainstream me-

dia. A section of the survey asking about the specific conditions in Allegheny County Jail was excluded due to this limitation.

As shown in table 1, around 50% of participants who do not work in Allegheny County Jail know little

Table 1

Participants Knowledge of the Mental Healthcare Services provided in Allegheny County Jail

Note: This Figure does not include responses from participants who worked in Allegheny County Jail.

Knowledge of Mental Healthcare Services	Frequency of Occurrence	Percent of Occurrence	Sample Quote(s)
Participants have an average amount of knowledge	1	5.5%	"Average Amount"
Participants used to be familiar with the services	2	11%	"I used to be familiar with the services, but have not been in that field for many years." "A little. I was more familiar 10 years ago."
Participants have a negative perception of the services	2	11%	"I have heard that it is not necessarily their main priority and that services are sometimes provided by those not technically working in the mental health field." "I do not know a lot, but I do not hear many good remarks about it. I hear that it is poor and limited."
Participants have little to no knowledge about the services	9	50%	"I don't know anything about it." "Little to none specific to the Allegheny County Jail."
Participants have "some" knowledge of the services	3	16.6%	"Some"
Participants have specific knowledge of the services provided at Allegheny County Jail	3	16.6%	"I know the intake process for mental health screenings." "I have provided therapy to patients upon release from prison and collaborated with a psychiatrist who provided medication management to patients while incarcerated at the Allegheny County Jail"

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Figure 4a

All Participants' Opinions on the Quality of Patient Care when using Telepsychiatry

Note: This figure showcases all participants' responses.

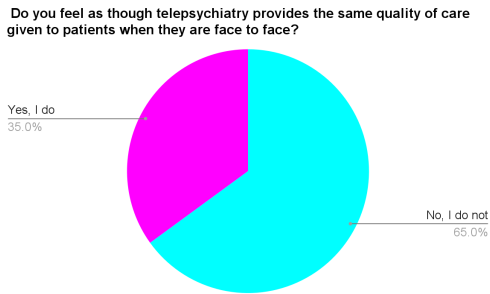
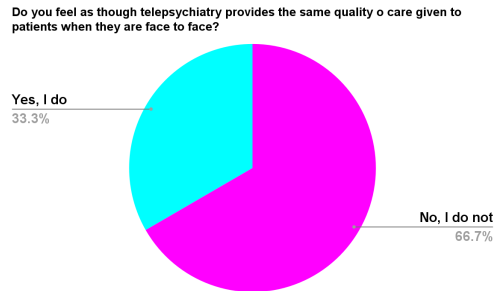


Figure 4b

Participants with Experience in Telepsychiatry Opinions on the Quality of Patient Care when using Telepsychiatry

Note: This figure showcases responses only from participants who have experience with telepsychiatry.



to nothing about the mental health services provided there. Only 16.6% of participants had specific knowledge regarding the jail and the mental health services provided in this local jail. This demonstrates that there may be a lack of awareness in this population surrounding the mental health treatment of inmates, which is one of the main reasons for increasing mental health disorders in jails (Flegel & Stanbrook, 2010). Also, some mental health care workers remarked on negative perceptions of the mental health services provided in Allegheny County, demonstrating the participants' existing negative biases of the services provided in Allegheny County Jail. These negative perceptions could be due to several things, such as word of mouth and media coverage.

Figure 4a shows that most participants (65%) do not believe that telepsychiatry provides the same quality of care as in-person care. In contrast, the rest of the participants believe that telepsychiatry offers the same level of care. Similarly, in figure 4b, about the same percentage of participants who have used telepsychiatry at least once (66.7%) do not believe that telepsychiatry provides that same quality of care as in-person care. This demonstrates that most participants generally believe that in-person services provide a better quality of care, regardless of whether they have used telepsychiatry or not. These results demonstrate that there could be a lack of willingness to use telepsychiatry by mental health workers which supports the results of a study claiming that many healthcare

Figure 5

Number of Participants that prefer in-person care over telepsychiatry.

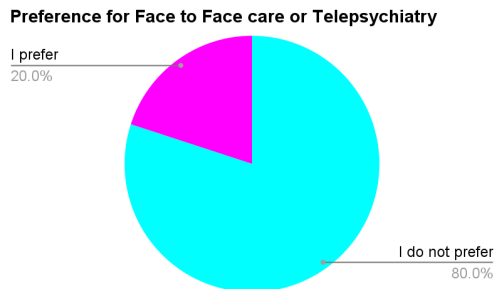
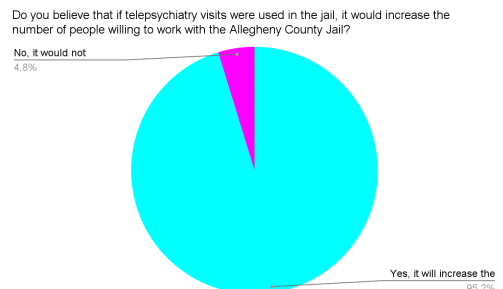


Figure 6

Provider Willingness to work with Allegheny County Jail using Telepsychiatry Visits



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search done in the field that most physicians seemed primarily satisfied with the usage of telepsychiatry (Hoff & Rim, 2022).

Figure 6 shows that the majority of participants (95.2%) believe using telepsychiatry visits in Allegheny County Jail would increase the willingness of mental health workers to work with the jail. Only one respondent negated this. This chart contrasts the responses shown in Figure 5, where most participants preferred in-person care over telepsychiatry. This demonstrates that while most participants prefer in-

person care over telepsychiatry, they concur that this system may be necessary to use regarding the inmates. The participants' responses show that telepsychiatry may positively affect the willingness of mental health workers to work with the jail.

Table 2 depicts that the most common advantage cited by participants is that access to services for patients would increase. This seems to be a common advantage in most studies on telepsychiatry within correctional facilities (Hubley et al., 2016; Canada et al., 2022). Following this, in order of most frequent

Table 2

Open- Ended Responses (Notable Advantages of Telepsychiatry in Allegheny County Jail)

Advantages of Telepsychiatry in Allegheny County Jail	Number of Occurrences	Percent of Occurrences	Sample Quote(s)
Access to care for patients would increase	9	50%	<p>"More access to care for patients"</p> <p>"The main advantage would be the number of inmates able to access services"</p> <p>"Telepsychiatry can help address the need for access. You can have a therapist in Arizona working with a person in Allegheny County."</p>
Less risk/more safety is provided for the mental health workers	5	27%	<p>"Advantages, mainly access without risk."</p> <p>"Advantages would be less risk to the individuals providing the service physically"</p> <p>"There are also risks associated with an outsider coming into the jail through manipulation by the inmates, threat of harm, potential for abuse."</p>
Convenience for mental health workers providing telepsychiatry	4	22%	<p>"An advantage would be allowing more flexibility and availability for the therapist to work with the inmates."</p> <p>"Less travel time to and from appointments for the psychiatrists."</p>
Lower costs for the services provided at the Jail	2	11%	<p>"Decreases the cost of services to the jail. Through an independent contractor, the jail saves money while being able to provide services to their inmates."</p>

Note: Three participants refrained from answering this question.

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advantage to least would be: (2) telepsychiatry reduces the risk for psychiatrists and provides more safety to them, (3) it provides more convenience for the mental health workers, and (4) it reduces the costs for the services provided in the jail. These findings further support the idea made by mental health practitioners that the usage of telepsychiatry lowers the costs of services and also increases access to the care provided to the

inmates (Deslich et al., 2013).

As shown in Table 3, the main disadvantage cited by participants is that it affects the professional relationships able to be made between a doctor and a patient. It also can lead to difficulty and the possibility of misreading body cues. However, the *Journal of Telemedicine and Telecare* contradicts these statements and finds that telehealth usually does not affect doc-

Table 3
Open- Ended Responses (Notable Disadvantages of Telepsychiatry in Allegheny County Jail)

Disadvantages of Telepsychiatry in Allegheny County Jail	Number of Occurrences	Percent of Occurrences	Sample Quote(s)
Lack of patient-doctor relationships/ possible Misreading of body language	9	50%	<p>"I do think that for the benefit of the inmates, face to face contact is more beneficial for the rehabilitation and treatment of said inmate."</p> <p>"Not being able to full read and react to body language,"</p> <p>"With this population I think there is so much to be gained from in-person observation that would be missed. That said, less than ideal is better than no treatment!"</p>
Technological limitations	2	11%	<p>"Technological limitations of a user interface"</p> <p>"Disadvantages also include service interruptions that may occur over Telehealth."</p>
Misuse of services	2	11%	<p>"Disadvantage, potential misuse of services."</p> <p>"Disadvantages include breaches of confidentiality"</p>
Inmates are more isolated	3	16.6%	<p>"Disadvantages- lack of human contact, more isolated"</p> <p>"Having an outsider come into the hospital allows the inmates a different break in their monotonous day."</p> <p>"Especially within the jails, I think that safe space with another human is crucial."</p>

tor-patient relationships (Miller, 2003). Nevertheless, this was one of the main concerns of mental health-care workers in Allegheny County. Following this, three participants cited that inmates are more isolated, two cited potential misuse of services, and another two cited technological limitations as disadvantages of the telepsychiatry system in Allegheny County Jail. However, as one participant stated, “less than ideal [treatment] is better than no treatment!” Another participant shared this view saying, “Telehealth is better than no mental health support at all.” Most participants concur that while telepsychiatry is not an ideal system of medicine, it is a viable and necessary system to use in jail systems. This also relates to Figures 4 and 6. While most participants selected that they have a preference for face-to-face care rather than telepsychiatry, it was almost a consensus in Figure 6 that the use of telepsychiatry would increase the amount of mental health workers willing to work with the jail. Also, out of the 18 participants, eight participants only cited advantages of telepsychiatry, six cited advantages and disadvantages, and four participants only cited disadvantages. This also further demonstrates that while most participants expressed a preference for in-person care, they viewed telepsychiatry as necessary for the inmates and believed that it conveyed more advantages than disadvantages. These statements and the charts suggest that most mental health workers in the Allegheny County area view telepsychiatry as a non-ideal but necessary system.

Limitations

The method chosen by the researcher did pose a few limitations. First, while there was some qualitative data on the Google Forms survey, most questions were multiple choice, which limits the understanding of the mental health workers’ motives for choosing each answer. Additionally, many mental health workers working in Allegheny County were not willing to take the time to complete the survey, leading to a mediocre sample size. However, in order to maintain validity, the researcher based the survey questions off of a similar study addressing telemedicine, but not specifically in jails (Malouff et al., 2021). The researcher also based some other questions in the survey off Deslich et al., (2013), which used a semi-structured interview

in order to understand the effects of telepsychiatry in jails. More studies about the usage of telepsychiatry with incarcerated people are needed in order to corroborate these findings nationwide.

Another limitation is the minimal amount of data collected by the researcher for people affiliated with Allegheny County Jail. Although the researcher distributed the survey to contacts at the jail and emailed people who worked with the jail, only three responses were received from participants who work at the jail. This discredited a substantial section of the survey since a representative sample was not surveyed. Also, this limited the understanding of the technology offered, the amount of mental health staffing in the jail, and the types of mental healthcare services provided there. Consequently, the conclusions derived from the data are more general toward the mental health community in Allegheny County as a whole, rather than a specific section geared towards people who work in the jail. This could skew data specifically for questions regarding the Allegheny County jail since participants were answering based on secondary knowledge and not prior experience. In future studies, to avoid this limitation, there must be a representative sample including a greater number of mental health workers who work with the Allegheny County jail.

Conclusions and Real-World Implications

This study sought to explore the effectiveness and viability of telepsychiatry in Allegheny County Jail. Overall, the findings suggest that while the majority of mental health providers prefer in-person care over telepsychiatry, they mostly concur that using telepsychiatry is necessary within the jail. Also, participants demonstrated that willingness to work in the jail may increase if telepsychiatry was generally used in jails.

From a societal standpoint, this implication is beneficial for the incarcerated. If mental health providers have increased willingness to work with jails, this may be able to alleviate the severe understaffing of mental health providers in jails. With more mental health providers willing to work with the incarcerated, telepsychiatry may allow the healthcare systems in the jails across the nation to improve. It may also allow for more access to healthcare services for inmates, which

is one of the main advantages mental health care providers cited.

However, more research is needed in order to gain an effective understanding of the efficiency of telepsychiatry, not only in Allegheny County, but across the nation. Along with mental health workers' perceptions of telepsychiatry, it would be beneficial to examine the effectiveness of telepsychiatry within the jail system with providers who specifically work with the local jail, rather than general mental health providers. The perspective of the inmates themselves is also critical to understanding the effectiveness and viability of this system within jails across the nation. Also, with a larger sample size, researchers could take into account how the age of the provider or the location of the jail impacts the willingness of the provider to use telepsychiatry.

Overall, these suggestions aim to further research in the field and to help grow the understanding of the factors that allows telepsychiatry to be an efficient and viable system in jails. These suggestions also offer explanations on what factors contribute to a provider's willingness to use this system as a whole. Using this information could help to alleviate the grave issues in this nation's mental health policies for inmates and contribute to the improvement of mental health services in correctional facilities across the nation.

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Appendix A: Survey

Opinions on Telepsychiatry in the Allegheny County Jail

Opinions on Telepsychiatry in Allegheny County Jail Consent Form

You are being asked to take part in a research study of the opinions of local mental health workers on telepsychiatry in Allegheny County Jail. We are asking you to take part because you provide psychological service in the Allegheny County area. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

What the study is about: The purpose of this study is to learn the opinions of local mental health workers on telepsychiatry in Allegheny County Jail. You must be a mental health worker who has lived or worked in the Allegheny County area, in order to complete this survey.

What we will ask you to do: If you agree to be in this study, a Google Form will be utilized. This Google Form will include questions about the effectiveness and viability of telepsychiatry, your work habits, and your personal experiences with telepsychiatry and the Allegheny County Jail. This interview will take about 10 minutes to complete. With your permission, we would like to keep your responses on a Google Folder only accessible by the researcher and the advisor.

Risks and benefits:

There is a risk that you may find some of the questions about your work conditions and the healthcare of inmates to be sensitive. There are no benefits to you other than understanding the newer technologies in medicine. The researcher hopes to gain insight on your opinions about the viability and effectiveness of telepsychiatry in Allegheny County Jail. Overall, this research may be used to understand mental health workers opinions on this topic and possibly finding improvements that can be made based on these opinions.

Compensation: There will be no compensation provided upon the completion of this survey.

Your answers will be confidential. The records of this study will be kept private. In any sort of report, we

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make public we will not include any information that will make it possible to identify you. Research records will be kept in a Google Folder, accessible only by the researcher and the advisor. After one year, any records will be deleted.

Taking part is voluntary: Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. None of the questions are mandatory to answer, and you are allowed to skip any questions you do not wish to answer. If you decide to take part in this survey, you are free to withdraw at any time.

If you have questions: The researcher conducting this study is Tiffany Habib. If you have questions upon completion of this survey, you may contact Tiffany Habib at hti075@hamptontalbots.org. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at Roos@ht-sd.org

You may return to this page at any time while taking this survey.

Have you understood the above information and consent to participate in this study?

Yes, I do consent to participate in this study.

No, I do not consent to participate in this study.

Demographics

What is your age?

18-29

30-49

50-64

65 and above

What type of Mental Health Worker are you?

Psychologist

Psychiatrist

Clinical psychologist

Mental Health Counselor

Therapist

Other...

Definitions

For the Purpose of this study:

Telemedicine is the remote treatment of patients usually through different kinds of technology or video calls (Haleem et al., 2021).

Telepsychiatry is a more specific branch of telemedicine which provides psychiatric services across long distances through the use of technology (Iris Health).

Work Habits

The following should be based on your own personal experiences in treating patients.

Do you provide telepsychiatry during work?

Yes, I do utilize telepsychiatry during work.

No, I do not utilize telepsychiatry during work.

How often do you provide telepsychiatry while working?

Never

Rarely

Sometimes

Often

Always

Where do you work when providing telepsychiatry?

At home

At the clinic

In the office

I do not use telepsychiatry.

Other...

Have you provided mental health services to people who are incarcerated?

Yes, I have provided mental health services to people who are incarcerated.

No, I have not provided mental health services to people who are incarcerated.

If you answered no to the previous question, how much do you know about the mental health services in Allegheny County Jail?

If you answered yes to the previous question, what kind of work do you do with people who are incarcerated?

Have you worked with the Allegheny County jail?

Yes, I have.

No, I have not.

Mental Health Services provided in Allegheny County Jail

These questions should be answered based on experience.

What types of mental health services are provided at Allegheny County Jail?

Telehealth visits

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Counseling
Prescribing Medication
Medical supervision
Other...

Do most inmates have access to technology in order to do telepsychiatry?

Yes, they do have access to the technology needed to do telepsychiatry.

No, they do not have access to the technology needed to do telepsychiatry.

Are there enough mental health workers staffed at Allegheny County Jail?

Yes, there are enough mental health workers staffed at this jail.

No, there are not enough mental health workers staffed at this jail.

Since its implementation, has telepsychiatry increased the number of mental health services provided at Allegheny County Jail?

Yes, it has increased the mental health services at the jail.

No, it has not increased the mental health services at the jail.

There were no notable differences in the mental health services provided at the jail.

I do not know.

Usage of Telepsychiatry

Has telepsychiatry saved time when meeting with your patients?

Yes, it has.

No, it has not.

Do you feel as though telepsychiatry provides the same quality of care given to patients when they are face to face?

Yes, I do.

No, I do not.

Do you prefer telepsychiatry or traditional face to face care?

I prefer telepsychiatry over face-to-face care.

I do not prefer telepsychiatry over face-to-face care

Telepsychiatry in Allegheny County Jail

Do you feel as though there are enough mental health services provided to the inmates?

Yes, I do feel like there are enough mental health services provided.

No, I do not feel like there is enough mental health services provided.

Do you feel as though there are enough mental

health services provided to the inmates?

Yes, I do feel like there are enough mental health services provided.

No, I do not feel like there is enough mental health services provided.

Do you believe that if telepsychiatry visits were used in the jail, it would increase the number of people willing to work with the Allegheny County Jail?

Yes, it will increase the number of people willing to work with Allegheny County Jail.

No, it would not increase the number of people willing to work with Allegheny County Jail.

Are there any notable advantages or disadvantages of using telepsychiatry in Allegheny County Jail?

Debriefing

Project Title: Opinions on Telepsychiatry in Allegheny County Jail

Principal Investigator: Tiffany Habib

Department/Course: AP Research

Contact Information: hti075@hamptontalbots.org

Thank you for participating in this study.

Taking part is voluntary.

Although you have already completed this Google Form survey, your involvement is still voluntary, and you may choose to withdraw the data you provided prior to debriefing, without any penalty. Withdrawing your submission will not adversely affect your relationship with Hampton High School, the researchers, or any of our affiliates.

Privacy/Confidentiality

If you agree to allow us to use your data, here is how we will maintain confidentiality of the information. Your response will be kept in a Google Folder accessible only by the researcher and the advisor.

The main researcher conducting this study is Tiffany Habib at Hampton High School. If you have questions later or would like to know about the results of the study, you may contact Tiffany Habib at hti075@hamptontalbots.org. Or contact their faculty advisor Shannon Roos at Roos@ht-sd.

If you have any questions or concerns regarding your rights as a subject in this study, you may contact

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the Institutional Review Board (IRB) for Human Participants at Hampton High School.

I understand the purpose of my participation in this study, and I give consent that my responses may be used in this study.

Yes, I do give you permission.

No, I do not give you permission.

The Commerce-Art Dichotomy in Cinema: A Thematic Analysis of Interviews of Filmmakers in the Canadian Film Industry

Wolf Virgo

Abstract: Many scholars argue that the artistic merit of films is diminishing as directors opt for producers' more business-oriented approach. However, research discussing the impact of commercial success on filmmaking lacks focus on directors and their perspectives. This study seeks to understand the effect of commercial success on directors' artistic visions for films. Using semi-structured interviews with Canadian filmmakers, this study aimed to learn from filmmakers by gaining direct access to their perspectives. This study found that while many directors are keen to add "commercial elements" to their films, this is generally in the hopes of appealing to a wider audience, not to generate commercial success alone. Moreover, most directors value artistic recognition from critics above the desire to garner commercial success. The findings of this study can be used to inform critics and audiences about how commercial pressures impact the artistic elements in a film.

Keywords: Commercial success, artistic merit, director artistic vision, popular appeal, critical recognition/acclaim

Introduction

Cinema provides avenues of cultural and artistic commentary to society. The contemporary film industry has been marked by immense growth in the scale of box office results. In 2002, Sony's *Spider-Man* cost about \$175 million to make and received \$403 million in domestic earnings (Simonton, 2009). With so much potential for commercial success, numbers like these are becoming benchmarks for many filmmakers (Simonton, 2009). As motion pictures become more profitable, the sunk investment becomes larger to ascertain the greatest benefits. Moreover, as film success hinges more and more on popular appeal, filmmakers now focus heavily on marketing as they try to uncover what kind of film will gross the highest return (Simon-

ton, 2009). Furthermore, gaining a track record of commercial success means that directors will add value to their subsequent projects through name recognition alone (ex. "A Steven Spielberg Film") (Carmen-tay, 1989). However, as scholars like Turnbull (2022) point out, the Canadian film industry has always been in the shadow of the US. The industry faces difficulty competing in terms of box office results and commercial success as a whole (Finn, Hoskins, & McFayden, 1996). In short, reduced potential for commercial success elicits questions surrounding what success means in Canada and how filmmakers can attain it.

With the growing impact of popular appeal on commercial success, it seems that filmmakers would feel increasing pressure to appeal to consumers. The duality of film as a product attaining profit and as an

art occasionally positions directors and producers at odds with each other (Hadida, 2010). Producers mainly aim to put out a product that appeals to consumers, thus, reaping the greatest box office results, while directors hope to fully realize their artistic visions for films (Hadida, 2010). As Hadida (2010) explains, cinema's growth as a business hinders the artistic value of motion pictures as filmmakers struggle to find a balance between business and art. To tackle the concept of art vs commerce, the question must be asked: has the growth in the commerciality of cinema inclined directors and producers to alter their artistic vision for motion pictures in the Canadian film industry?

Through the use of a qualitative study, involving interviews between directors and producers, this study will aim to understand how filmmakers feel impacted by the potential for commercial success. Further, this study will encompass a wide range of genres from the popular sphere including action/adventure, drama, and horror. These findings will be used to either confirm or deny Hadida's (2010) thesis. This study seeks to understand whether the artistic value has diminished due to increased pressure on directors to appeal to the masses. This study can be used to inform experts' judgement on the extent to which films are yielding artistic value to commercial pressures.

Literature Review

Industry background

Understanding the relationship between commercial success and artistic recognition of motion pictures is vital in assessing its effects on filmmakers. Hadida (2010) offers insight into the competing visions of directors and producers and how they manifest in cinema, and further describes how commercial success often comes at the expense of artistic merit as directors sacrifice their artistic visions in favour of some producers' more business-oriented approach. This could be because depictions of commercial performance in the creative industries are more straightforward than those of artistic merit, meaning that box-office success is more quantifiable than recognition from critics (Hadida, 2015). While Hadida's (2010) thesis provides a reference point for the current industry

predicament, they lack qualitative substantiation for their claims. Offering a contrast to Hadida's (2010) perspective are Alvarez et al. (2005) who explain how art and business are complementary forces in cinema. Art adds exclusivity and innovation to cinema while business rewards film directors capable of attracting audiences and yielding profits (Alvarez et al., 2005).

Simonton (2009) describes how marketing has become an integral aspect of filmmaking strategy. Producers often seek out ways to craft films that will attract popular appeal and, thus, garner greater box office returns (Simonton, 2009). Despite their input into producers' marketing decisions, Simonton's (2009) analysis lacks research into how those marketing decisions impact directors. Using a two-path model, art versus commerce, Holbrook and Addis (2008) research how reviewer-and-consumer evaluations and "buzz" respond to a film's marketing clout (i.e. production budget, opening screens, and opening box office) (p. 87). They find that "big-budget wide-release films with marketing clout" seem to generate popular buzz along a commerce-oriented path (commercial success), yet they lack distinction by critics and consumers along an art-related path (Holbrook & Addis, 2008). This means that film producers are tasked with choosing between opposing strategies for a film release (Holbrook & Addis, 2008). While Holbrook and Addis (2008) attempt to understand the relationship between marketing and commercial success, their research does not address directors' inclinations to follow either a commerce or art-related path.

As Hadida (2010) explains, producers and directors operate as CEOs who incur sunk costs as part of the film process. These sunk costs come in the form of intellectual capital (copyright), as well as financial costs like hiring teams and equipment (Hadida, 2010). Moreover, these often-large-scale investments mean that producers run the risk of considerable financial losses to attain above-average performance (Hadida, 2010). The "precarious nature of the film industry," as Simonton (2009) describes it, further incentivizes producers to use marketing strategies that focus on releasing films that appeal to the masses to reap the greatest return on investment. Ebbers and Wijnberg (2012) add to this dialogue surrounding investment by studying the effects of cultural and commercial reputations (of producers and directors) on investors' willingness to invest. Producers with a reputation for

commercial success attracted greater investment from contributors (Ebberts & Wijnberg, 2012). Conversely, directors with a reputation of artistic recognition (by professional critics), tend to receive a lower level of investment (Ebberts & Wijnberg, 2012). Nevertheless, Ebberts and Wijnberg's (2012) research lacks input into whether these investment dynamics create conflict between directors and producers, especially when considering the effects of expert judgment. Simonton (2009) suggests a similar phenomenon, explaining how a producer's box-office success in prior films predicts better-than-average box-office results for their current film.

Expert judgement and commerciality

Scholars like Hofmann et al. (2017) have researched the effects that movie stars have on the economic success of films. Consumption capital describes many consumers' selection of stars depending on their knowledge of and associations with that star (Hofmann et al., 2017). Moreover, Hofmann et al. (2017) indicate that consumers often watch films with certain stars for the purpose of sharing their opinion of that star's performance with other fans of that star. As they explain, success at the box office—rather than artistic merits—initiates the accumulation of consumption capital (Hofmann et al. 2017). Zuckerman and Kim (2003) provide another layer to this question of expert judgment's influence on popular appeal. They analyzed the box-office success of 396 feature films released in 1997 to understand whether there is a correlation between critic classification of films “as fit for the mass market,” and popular appeal (p. 27). They find that very few critics prefer major releases, rather more display a strong preference for independent releases (Zuckerman & Kim, 2003). Nevertheless, classification as an independent hinders a film's chances of breaking out into the larger market, thus lowering the film's cumulative box office gross (Zuckerman & Kim, 2003). While Zuckerman and Kim (2003) open the possibility for independent films to succeed in the mass market due to expert favourability in judgment, it remains clear that “reception from critics—both in terms of the number and valence of the reviews made—increases a film's share of the broad market” (p. 54). Providing additional insight into this query is Holbrook (1999) who finds that critics gravitate

toward more challenging artworks of more elevated complexity and intellectual tax. Thus, there is a weak but significant propensity for consumers and critics to share mirrored preferences (Holbrook, 1999). While Hofmann et al. (2017), Zuckerman and Kim (2003), and Holbrook (1999) all add value to this discussion surrounding expert judgment and popular appeal, they lack producer and director perspectives on the impact of film classification by critics.

Director artistic vision

Alvarez et al. (2005) studied the ways that many directors act in the market to achieve optimal distinctiveness. Optimal distinctiveness is the balance between conformity to receive funding, and differentiation to achieve artistic recognition (Alvarez et al., 2005). Through studying three successful European directors, Alvarez et al. (2005) find that in the quest for optimal distinctiveness, directors not only break away from conventional cinema, but often manage the malleability of art and business through their production hub, close collaboration with a committed producer, and/or personally synthesizing creative and production roles. A clear caveat of this study is that optimal distinctiveness was only studied in directors with an already established standing of commercial and artistic success, and thus may not be representative of film directors as a whole. Most directors do not have the freedom to seek optimal distinctiveness as it may come at the expense of either artistic value or commercial success.

Parallels in methodology

The only paper whose methodology closely mirrors this study is that of Durand and Hadida (2016) who analyze the extent of logic combination in cinema. They explain logic combination as an occupation merging responsibility and/or taking on the roles of another occupation. Through a mixed method approach of quantitative analysis of variables and qualitative, semi-structured interviews with 12 key persons in the film industry (directors, producers, cinema experts, and financiers), Durand and Hadida (2016) attempt to uncover the extent to which directors and producers merge roles effectively and whether artistic and commercial value is affected by this logic com-

bination. While Durand and Hadida (2016) serve as a methodological reference point for this study, their interviews lack depth with little focus being put on them in their paper. The vast majority of Durand and Hadida's (2016) research consists of a quantitative analysis of 983 films released between 1988 and 1997 in France. Moreover, they do not provide a detailed report of the questions asked and answers given and lack a thorough analysis of the interviews conducted. In short, while this study can use Durand and Hadida (2016) to inform its method, a gap remains and directors' views are still not represented in this field.

Gap

The current research surrounding commercial success and films focuses mainly on quantitative analysis of feature films over the past 20 years. Moreover, there is a general lack of focus on filmmakers and their perspectives. Most studies infer filmmakers' feelings based on data, rather than gaining direct access to their experiences. Studies like Zuckerman and Kim (2003), Holbrook and Addis (2008), and Ebberts and Wijnberg (2012) add valuable insight into how factors like critics, consumers, and investors impact the commercial success of a film. However, very few studies have discussed the impacts that commercial pressure from consumers and investors and artistic pressure from critics have on filmmakers and their art.

Methodology

Study Design

This study involved semi-structured interviews of directors and producers in the Canadian film industry. The goal was to see how commercial success and the pressures to attain it impacted directors and producers and their artistic visions for films. The responses of the participants were analyzed using thematic analysis to see if any trends or patterns emerged. Thematic analysis is one of the most commonly used methods in qualitative papers and it is employed by many scholars. One such scholar, Langhorne (2020), used thematic analysis after conducting semi-structured interviews with five school principals to uncover their experiences in managing the mental health of their

students. After recording and transcribing the questions asked and answers given in various appendices, Langhorne (2020) then created four thematic analysis tables (one for each theme) where he included quotes from each principle that fit the theme, ultimately using these themes and quotes to compare with his research question. Similarly, this study used four thematic tables that aimed to represent the issue of art and business in film by tying in factors like popular appeal and critical acclaim/expert judgment. The thematic tables are in Appendix C. This study hypothesized that common themes would include the growth in the commercial success of films, the effect on artistic vision, pressures to appeal to consumers, and critical appeal. This is because each theme closely relates to the questions asked of the participants. A theme was determined to be present if more than half of the responses referenced that particular theme. As seen in Appendix C, specific quotes from various interviews are featured and additional subthemes, called codes, are used and referenced by those quotes. The analysis process extrapolates to the greater film industry while continually comparing with scholars like Hadida (2010). This is the most suitable method for the research question because, unlike other papers that infer directors' feelings based on quantitative data, this study will convey views directly from directors and producers. The analysis will provide insight into how the commerciality of cinema has impacted directors and producers and the art they produce.

Participants

Eight filmmakers (5 directors; 3 producers) were interviewed across many genres (horror, drama, action/adventure). This sample size was derived from an anchor paper by Durand and Hadida (2016), who interviewed 12 key members of the film industry. However, this study took into account the time constraints and the availability of many directors and producers. To obtain interviews, this study used connections to the Canadian film industry through a family member of the author. Emails were sent out to all interviewees regardless of personal connection. After receiving confirmation of the interviewee's interest in the study, follow-up emails were sent about scheduling. Informed consent forms were also sent out to each participant. Most of the interviews took place virtu-

ally on Zoom as the interviewees hailed from across Canada. A phone was used to record the interviews for the few in-person interviews. Since most of the interviews took place on Zoom, the recording feature was used. Notes were jotted down as the answers were given. The interviewees were asked a series of questions that varied from their relationships with their film partners, to the rise in the profitability of films, and pressures to appeal to consumers or critics. A total of seven questions were asked, four of which were the same for both directors and producers while two questions were producer-specific and three were director-specific. These questions can be seen in Appendix A. All questions addressed various aspects of the research question and were assumed to align with certain sections of the thematic tables.

Ethical Review

Each interviewee was sent an informed consent form which asked them whether they wish to remain anonymous for the study. The letter of consent sent to interviewees is seen in Appendix B. Interviews took place mostly on Zoom with each one taking around 20 min. This time frame took into account the availability of directors and the number of questions the interviewees were asked. Lastly, this study received IRB approval.

Findings

In the five interviews with directors, an emerging theme discussed what commercial success means in Canada and how the funding process is fundamentally different from that of the United States. Across the five interviews, one main question asked was “What is your definition of commercial success in Canada?” While this question elicited varied responses, one central theme emerged: money is easy, but results are scarce. As one director explains, the public process of acquiring funds through Telefilm Canada is much easier and more subsidized than in the US. However, since the Canadian market is much smaller than the US market, it is much harder to quantify commercial success. He explained that if you make the film with all Canadian money, you will have to start paying the money back to funders immediately. Building

on this point, award-winning Canadian independent filmmaker, Bruce McDonald, illustrates how very few films make their money back and that commercial success in Canada often means just breaking even. McDonald clarifies that “nobody really knows what financial success is” in Canada. Conversely, one director wants to break the mould of what commercial means, arguing that anything can be “commercial” if it is marketed correctly. She explains how “more genre gets made than less genre,” meaning funding is more likely to occur if a film fits a specific genre rather than one that is more malleable. Contrary to what most directors have voiced, one director highlights the regulation present in the Canadian system and how it has hurt her chances of receiving funding. She explains how “the Canadian system is a very closed shop” and “definitions of what constitutes Canadian content are so narrow.” Moreover, regulatory bodies like the Canadian Radio-television and Telecommunications Commission (CRTC) regulate what films are classified as Canadian films based on factors like the amount of money spent in Canada. Without meeting these qualifications, many Canadian films are shut out of funding and distribution within Canada. Lastly, one director takes a more innovative approach, arguing that with the advent of streaming platforms like Netflix and HBO, there is more value from both a director and consumer standpoint. He explains how the business model for streamers is so different and that independents like him can tap into a broader range of communities through these services.

One central theme among the interviewees was the change in attitude toward the business side of their films. Many directors explained that their first feature films were created without the audience in mind. For Maxime Desmons, it was about telling an LGBTQ theatre story through art, unaware of the niche genre that he entered into. However, ten years after his first feature, Desmons discusses what he would change to appeal to a larger audience. “Rather than to be completely dark, I would go back to the script, the music, and [change] the way of shooting it, which was very rough,” explains Desmons. He emphasizes that adding “more life” to his first feature would have attracted a larger audience rather than appealing to a specific niche. Building on this theme of altering attitudes towards business, Bruce McDonald reflects on success later in his career. McDonald describes how art always

came first at the beginning of his career. He tells me that as a young director, especially as an independent filmmaker, it is best to follow your heart and make something that genuinely interests you. Nevertheless, he realized that as he got older, the commercial aspect of filmmaking became more important. Looking back, he would add more “commercial elements” into his films like changing the script and looking to cast a star. He looks to find these elements to draw larger audiences and increase the likelihood of his films performing well commercially. McDonald believes that focusing on business within the filmmaking process is a way of practicing your craft as a director. Other directors focus less on attaining commercial success. One director emphasizes her desire to have her films connect with as many people as possible. She explains that “you want as many people to be heard” through your films. Another director focuses on a community approach to film marketing, seeing value in reaching out to never-before-tapped markets to tell their stories. Moreover, this director is less concerned with the dollar amount that his films garner. “It’s an ego thing,” he explains. “If you know people watched the movie and you know people were moved by it, then that has to be enough.” Award-winning independent film Producer Damon D’Oliveira explains that the lower your budget, the more leeway you have regarding artistic freedom. Moreover, he gives insight into the difficulty of getting greenlit because of a lack of cast (prevalence of stars). He believes there is so much more noise as an independent, meaning it’s harder for your films to gain traction. “You want a happy distributor but you also want to stay true to your vision,” he explains in discussing the dynamics of artistic vision vs commercial success. Producer Julia Rosenberg also adds that “cast is a huge determinant of commercial viability”.

Lastly, directors emphasized the importance of exposure and the dichotomy between critical acclaim and popular appeal. Many directors identified critical recognition as the main engine toward broader success. Independent filmmaker Maxime Desmons tells the story of how his first feature garnered critical success but was not broadly popular until he translated the film into English from French. This change helped tap into a different market, specifically Anglophones who wanted insight into LGBTQ stories through a French lens. Bruce McDonald also added a commercial angle to this, explaining how “artistic success

can be the stepping stone to making future investors more inclined to invest.” This means that having that first major critical success makes commercial success more possible in the long run. McDonald emphasizes the importance of finding an equal balance of critical and commercial success. One director highlighted the importance of critical recognition in his career. He explains how the “word-of-mouth buzz that comes out of festivals” allows his movie to be seen by a wider audience. He illustrates how it’s hard to find a community audience base without “that critical push” so that people can see the value in an independent film. Another director explains how she is more concerned about garnering critical acclaim because it can help promote and market the film. Producer Julia Rosenberg believes that commercial success in Canada is notoriety. When discussing the effects of critics on film she explains how if the ideas are there, success will come.

Discussion

After performing eight semi-structured interviews with directors and producers in the Canadian film industry, a thematic analysis of the findings and the implications is required. Four common themes were identified including the value of commercial success, seeking commercial success, the importance of critical reception, and the value of artistic vision. The analysis of these key themes provides insight into whether filmmakers are altering their artistic visions for films in favour of commercial success.

The value of commercial success in Canada

Scholars Finn, Hoskins, and McFayden (1996) highlight the difficulty that English Canadian films have in competing with American films in terms of box-office results, and thus, the standard for commercial success is significantly less in Canada. Turnbull (2022) illustrates how in Canada, “filmmaking has floundered in the shadow of Hollywood” (p. 110). Dreves (2013) argues that publicly subsidized film industries are economically non-viable because artistic merit “often carries greater weight for producers than economic considerations or potential market success”

(p. 255). Since public funders like Telefilm Canada look to fund distinctively Canadian films (with artistic merit), many Canadian films don't appeal to international markets (Finn, Hoskins, & McFayden). Further, Canadian films are just not built to succeed outside of Canada because of the culturally distinct subjects they mention, alienating foreign markets (Lorimer, 1981). Films that receive Telefilm funding, despite being more artistically recognized by critics, were less likely to be commercially successful overall (Finn, Hoskins, & McFayden, 1996). The findings of this study are consistent with Finn, Hoskins, and McFayden's (1996) analysis as many directors voiced the lack of potential for commercial success in Canada. Turnbull (2022) emphasizes the role of the government in Canadian filmmaking and how it can be both life support for the industry, and a major headache. This sentiment is also borne out in this study's findings as filmmakers share conflicting views on the benefits of a publicly funded film industry. Many filmmakers acknowledge the importance of Canada's publicly funded model for films and how it has personally helped them in their careers. Funding bodies like Telefilm made it easier for them as independent filmmakers in helping to get their careers started. Thus, it seems that filmmakers generally accept the tradeoffs of the Canadian film industry. The feelings expressed by filmmakers indicate that while definitions of commercial success are warped due to a large-scale public presence, the Canadian film industry allows for greater creative freedom and an easier path to receive funding.

Seeking commercial success

A key aspect of the findings of this study was changing attitudes toward commercial success. Scholars like Elberse (2007) find that star participation positively affects movies' revenues, specifically that stars can be "worth" millions. Many filmmakers in this study express an increasing focus on the cast as an avenue toward commercial success, concurrent with Elberse's (2007) conclusion. The sentiment that cast, specifically stars, is so desired shows that filmmakers value popular appeal to generate commercial success. On the contrary, some filmmakers also clarify that the push to cast stars is in the hopes of appealing to a wider audience, not to perform financially. These contrasting motivations exemplify the "art vs commerce"

divide present among filmmakers in Canada. Other commercial elements highlighted by filmmakers include marketing strategies. The value placed on marketing by both producers *and* directors indicated that reaching a larger audience was a top priority among filmmakers. Mohammadian and Habibi (2012) find that word of mouth, movie reviews, television commercials, press ads, movie posters, radio advertisements, and film websites were key marketing strategies that led to commercial success (in box-office settings). However, filmmakers' indication that these measures were overwhelmingly used to attract a wider audience (not necessarily for commercial gain) once again shows a lack of value placed on commercial success alone.

The importance of critical reception

Many filmmakers emphasized the value critics have in their careers. As previously established, critics seem to gravitate toward more complex and "artsy" films (Holbrook, 1999). Conversely, Youngblood (1992) shows that historically, critics criticized art "for not speaking to the masses" (p. 93). The propensity for Telefilm to fund films with greater artistic merit shows that Holbrook's (1999) findings are consistent with what filmmakers have voiced in this study. The expression of many directors valuing critical recognition above commercial success shows that Canadian filmmakers see immense value in artistic merit. Moreover, this shows that directors may not be altering their artistic visions in favour of commercial success. Despite some filmmakers demonstrating a desire to add more "commercial elements" to their films, it is abundantly clear that staying true to the director's artistic vision in the hopes of receiving critical acclaim is the number one priority among directors.

The value of artistic vision

In interviews with former members of the International Film Festival Rotterdam (IFFR) De Valck (2014) finds that film festivals work to platform independent "niche" films with artistic merit. Further, there is little space for "selling out" to commercial pressure within the film festivals (De Valck, 2014, p. 56). The findings of this study are consistent with De Valck's (2014) analysis as many directors see the potential for word-

of-mouth promotion from festivals as motivation to stay true to their art. Scholars Pogrebniak et al. (2021) provide insight into director self-fulfilment. They find that directors of the 20th century stayed within their vision and did “not change [it] for the better or for the worse” (Pogrebniak et al., 2021, p. 1104). Carmentary (1989) adds to this dialogue by explaining how directors have become stars in their own right, having the final say on all aspects of production during filming. Thus, directors demonstrating a desire to stay true to their artistic vision shows a trend toward “director self-fulfilment” in the Canadian film industry.

Limitations

The process of collecting interviews for this study was not easy. Despite missing the goal of 10-15 interviewees, performing eight interviews is adequate when compared with the 12 done by Durand and Hadida (2016). The initial goal of 10-15 interviews was based on Durand and Hadida’s (2016) number and no interviewees had been confirmed at the time that goal was set. The goal was expected to be met through family connections alone; this was not the case. Time constraints and filmmaker availability were major factors in missing the goal. There was a short window of time for performing these interviews. I also had difficulty scheduling all the interviews as I tried to work around the availability of some filmmakers. As many of them are constantly working on new projects, it was hard for them to find time. Additionally, the interviewees of this study, while generally representing a diverse range of perspectives and backgrounds, lack a diversity of experience. Nearly all interviewees had at least 20 years of industry experience which could have elicited biased responses. Moreover, producer voices could have been more represented in this study to add more diverse perspectives including film production, licensing, and distribution. One reason for the lack of producers interviewed was based on the view that directors should occupy more space in this paper so that issues of artistic vision could have greater representation. Lastly, additional research is needed on certain findings. For example, the question of whether filmmakers’ marketing strategically highlights the more commercial elements of films (as opposed to artistic elements) is still unclear. Thus, future research

is needed to understand how directors apply artistic visions and so-called “commercial elements” to their films. These next steps would provide insight into how directors and producers alter their creative visions for films.

Conclusion

Through the use of interviews with eight filmmakers from the Canadian film industry, four main themes surrounding the art vs commerce divide were identified: the value of commercial success in Canada, seeking commercial success, the importance of critical reception, and the value of artistic vision. Previous research informed this study on how growing commerciality and marketing in films have come at the expense of artistic merit. The findings of this study help to inform critics and consumers on how filmmakers balance art and commerce, gaining direct access to director and producer perspectives. This study sought to understand whether Canadian filmmakers were altering their artistic visions for the purpose of appealing to the audience in the hopes of generating commercial success. This study finds that the lack of potential for commercial success in Canada coupled with a general desire (by filmmakers) to receive critical recognition means that filmmakers are staying true to their artistic visions. Despite some filmmakers adding more “commercial elements” to their films, these efforts were by and large in the hope of reaching a wider audience, not to generate commercial success.

Future directions

This study added to the existing literature by providing conflicting results to those of scholars like Hadida (2010) and Simonton (2009) who argue that artistic merit is diminishing. Thus, it is recommended that future research be conducted in other publicly funded film industries around the world to see if filmmakers there are preserving artistic vision. Lastly, the limitations of this study suggest that future research should include a larger sample size with more variety of interviewee experience.

Implications

The interviews conducted in this paper added a new layer to the current research. Unlike previous studies that used data to infer the impact of commercial success on directors, this study asked directors and producers specifically and gained direct access to their perspectives. This study can be used in future research that discusses the impact of certain business practices in the filmmaking process on directors and producers. Moreover, the findings of this study can be used to inform critics and audiences about how commercial pressures can affect the artistic elements put in a film. In short, this paper gained insight into how the growth in commercial success in cinema has impacted the artistic value of films.

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Appendix A

The three mutual questions:

What's your definition of commercial success in Canada?

Do you feel that the Canadian film industry is a market in which your films can succeed commercially?

In your relationship with your film partners (director/producer) do you have competing philosophies on what carries value in a film (i.e., artistic vs commercial merit)

Do you feel pressure or a need to conform to popular or critical appeal to achieve success?

To producers only:

Has the growth of the commerciality of cinema as a whole inclined you to devote more time to business practices within the filmmaking process, like marketing, for example?

Do you believe that there is value in critic classification of your film as an independent, which has been demonstrated to lower the chance of it achieving commercial success in the public sphere?

To directors only:

Is the commercial success of your film important to you?

Would you rather achieve recognition from critics over commercial success?

Do you feel like you are sacrificing the artistic merit of your films to achieve success in the public sphere?

Appendix B

Consent to Participate in Interview-Based Study

Title: The Commerce-Art Dichotomy in Cinema:
A Thematic Analysis of Interviews of Filmmakers in the Canadian Film Industry

Researcher

120 Howland Ave, Toronto, ON M5R 3B5
Royal St. George's College

Description:

THE COMMERCE-ART DICHOTOMY IN CANADIAN CINEMA

You are being asked to participate in a 15–20-minute interview where you will answer questions about your experiences in balancing commercial success with art as a filmmaker/producer. The interviews will be conducted either in person or through Google Meet. The meetings will be recorded using the recording feature on google meet. If we are online, I will be sending you an e-mail on the day of the interview where there will be a link to the Google Meet application.

Option #1

_____ Confidentiality Option #2

Risks and benefits:

There are no evident risks in participating in this study. The outcomes are based solely on what you say during the interviews. While there may not be direct benefits to you, your willingness to participate in this study will provide great insight into the effects of commerce on art in the film industry.

Confidentiality:

If you wish to have your name referenced in this study, sign the first and second lines. If you wish to remain anonymous throughout this study, sign the first and third lines.

Right to Withdraw:

By signing this form, you will have the option to withdraw from this study at any time. We will negotiate dates and times for interviews after you sign this consent form.

IRB Approval:

This study has been reviewed and approved by the Royal St. George's College Internal Review Board (IRB).

Statement of Consent:

I have read, understood, and accept all of the information as stated above. I have been given a copy of this form. I have been allowed to ask questions, and those questions have been answered. I consent to participate in this study.

_____ Signature of Participant

_____ Confidentiality

Appendix C

Themes	Codes	Quotes
The value of commercial success in Canada	<p>Commercial success in Canada</p> <p>Funding dynamics in Canada</p>	<p>Commercial success in Canada</p> <p>“We did both commercial and critical success”</p> <p>“A film is a success if it has both critical and commercial success”</p> <p>“Nobody really knows what financial success is”</p> <p>“You have to pitch it...show why it can be a good return on investment [for investors]”</p> <p>“Traditionally, certain films are more profitable than others...horror sells better than comedy in an international community”</p> <p>“If I wanted to just make a commercially successful film, I’m just gonna make a horror movie”</p> <p>“If the ideas are good, you can succeed [in Canada]”</p> <p>“Commercial success in Canada is notoriety”</p> <p>“Getting the film made is a commercial success”</p> <p>“Massive box-office success doesn’t happen in Canada”</p> <p>“The traditional private model doesn’t apply in Canada”</p> <p>Funding dynamics in Canada</p> <p>“A lot of content is subsidized to help compete with the US”</p> <p>“If you make it with all Canadian money, you will have to start paying that money back immediately”</p> <p>“[Canadian] business model is access to subsidies”</p> <p>“You want a happy distributor but you also want to stay true to your vision”</p> <p>“The Canadian system is a very closed shop”</p> <p>“Definitions of what constitutes Canadian content are so narrow”</p>

THE COMMERCE-ART DICHOTOMY IN CANADIAN CINEMA

Themes	Codes	Quotes
Seeking commercial success	<p>Growing as a director and producer</p> <p>The value of cast</p> <p>The importance of marketing</p>	<p>Growing as a director and producer</p> <p>“It was a very artistic project. Very artistic. now 10 years later, I would certainly do things differently.”</p> <p>“Rather than to be completely dark, I would go back to the script, the music, and [change] the way of shooting it, which was very rough”</p> <p>“I’m trying to break the mould of what’s commercial”</p> <p>The value of cast</p> <p>“Cast is a huge determinant of commercial viability</p> <p>The importance of marketing</p> <p>“Audiences are attracted to higher production value”</p> <p>“I want my films to connect with as many people as possible”</p> <p>“Traditional marketing techniques don’t work”</p>

Themes	Codes	Quotes
The importance of critical reception	Importance of critics in advancing careers	<p>Importance of critics in advancing career</p> <p>“Artistic success can be the stepping stone to making future investors more inclined to invest”</p> <p>“Critical recognition has been big for me”</p> <p>“If you know people watched the movie and you know people were moved by it, then that has to be enough.”</p>

THE COMMERCE-ART DICHOTOMY IN CANADIAN CINEMA

Themes	Codes	Quotes
The value of artistic vision	<p>The value of film festivals in promoting art</p> <p>Director self-fulfillment</p>	<p>The value of film festivals in promoting art</p> <p>“Word-of-mouth buzz that comes out of festivals”</p> <p>“There’s something free-flowing about making something you want”</p> <p>“Best to follow your heart”</p> <p>“If I were just in it for making money, I wouldn’t be where I am”</p>

Checkmate: A Correlational Analysis of Chess and Executive Functioning Ability in Adolescents

Hutton Mann Shaw

Abstract: The link between chess and executive functioning [EF] skills has been hypothesized since the 1990s and studied extensively in children and adults. This relationship is yet to be examined in adolescents. This study—through correlational analysis of Tower of London EF performance (measured by overall time taken, time taken on difficult problems, and time taken on easy problems) vs online Chess.com performance (measured by Blitz and Rapid ratings)—looks to examine this relationship and contextualize it with previous studies on differently aged participants. The findings of the study indicate that as a chess player's time score improved on all metrics, their chess rating increased. Given that previous research has found EF skills to be highly correlated with chess ability in children, but very minimally correlated in adults, the results of this study introduce the possibility that adolescence is a transition period where EF skills and chess ability become less connected.

Keywords: chess, executive functioning, chess rating

Introduction

Chess is a strategic game, hypothesized to be linked to skills such as memory, calculation, visuospatial thinking, and intelligence (Sala et al., 2015). Since the late 1900s, the relationship between chess and most of these skills has been studied extensively. In adults, higher IQ has been correlated with increased chess ability, while there has been no correlation between chess and visual or traditional memory (Sala et al., 2015; Waters et al., 2002). In children, chess has been correlated with an increased ability to learn spatial

concepts, increased performance IQ, and increased math test scores (Sala et al., 2015; Frydman & Lynn, 1992; Sigirtmac, 2011). Despite substantial research on other age groups, some skills not yet examined in adolescents are: calculation, planning, working memory, and time management umbrellaed under the term executive functioning [EF] skills.

Chess players are required to foresee moves far in advance. Among masters, players with an Elo (a worldwide scale used to measure the strength of a player) rating of 2000 or over, the best move is typically one that will give them an advantageous posi-

tion or piece count later in the game—sometimes up to 20 moves later. Therefore, it has long been assumed that EF skills must be of the highest calibre. In practice, however, the link is not so obvious. To date, most studies on children have found links to increased EF ability after playing chess. Alternatively, studies on adults have generally found no significant correlation between rating and EF (Nejati & Nejati, 2012; Atherton et al., 2003; Unterrainer et al., 2011). This leaves a grey area for adolescents, where it remains unclear the relationship between chess and EF ability. Thus, the question must be asked: **In persons 14-18 years of age**, is there a correlation between chess rating and EF scores?

This study aims to answer this question through quantitative correlational analysis between EF test scores and online chess ratings. It was conducted using the Tower of London EF test, the same test used by many previous studies on chess and EF skills (Unterrainer et al., 2011). Six correlation coefficients were calculated using the Spearman coefficient, to test for a monotonic relationship. The sample for this study comprised 20 boys and 4 girls, who ranged from 100-2400 in chess Elo rating.

The results of this study will be beneficial to chess players/coaches and educators. Determining if there is a correlation will improve understanding of the cognitive skills linked to increased chess performance. This will give way to optimized on and off-board training methods, as well as more informed selection of students and classes to benefit from the use of chess as an educational development tool.

Literature Review

Previous Studies on Adults

Most commonly, chess has been studied as it relates to general intelligence. One of the first examinations was in 1927 when Djakow et al. (1927) studied 8 grandmasters (Elo of 2500 or over) and compared their intelligence scores on a general intelligence test to that of a similarly aged control group. They found no significant difference between the grandmasters and the control group. More recently, Doll and Mayr (1987) compared a control group's scores on the Berlin Structural Model of Intelligence test to that of chess

masters. Conversely, they found a positive correlation between adults' general intelligence and chess ability.

Regarding more specific strata of intelligence such as spatial intelligence and memory, the results have leaned toward no correlation. Djakow et al. (1927) found no significant increase in visuospatial memory for grandmasters compared with their control group, except on a memory test where material closely resembled chess positions. In Doll and Mayr's (1987) study, there was also no link between increased performance and chess ability. Perhaps the greatest evidence for a lack of correlation between spatial/memory intelligence and adult chess ability is a 2002 study by Waters et al. This study examined a 36-participant pool of chess masters, and their results on a visual memory test as they correlate to chess rating. Using the Spearman-Brown coefficient, no correlation was found, and scores were very similar to that of 550 random US naval recruits. As Waters et al. (2002) point out, "[a lack of correlation between chess ability and visuospatial memory among adults] seems to be a standard finding in the literature" (p.11) (Gobet and Campitelli, 2002; Sala & Gobet, 2016).

Such insights are not exclusive to studies conducted by Gobet (Waters et al., 2002; Gobet & Campitelli, 2002; Sala & Gobet, 2016). A meta-analysis on cognitive ability transfer between chess and other domains finds that most of the skills related to chess seem to be "specific to the game" (Bühren & Frank, 2010, p.158). Additionally, Sala et al. (2015), in their review of recent chess research on adults, and Woodworth and Thorndike's (1901) theory of identical elements suggest that the "transfer of skills [from chess to other domains among adults] is quite rare"

(p.1).

Previous Studies on Children

In children, positive correlations between chess ability and cognitive skill are more apparent. One of the best-known studies on children and chess was conducted by Lynn and Frydman (1992) on 33 young players aged between 8 and 13. This study found a link between increased full-scale IQ and performance IQ (essentially visuospatial ability) among the proficient chess players who participated in the Wechsler Intelligence Scale for Children [WISC] (included subtest for performance IQ). Despite the correlation, it is

unclear whether the results suggest that the acquisition of chess skill requires previous visuospatial ability and intelligence, or whether these cognitive abilities are enhanced by playing and learning chess (Lynn & Frydman, 1992). While correlation does not mean causation, it is more than can be said for most studies which examine adults (Sala et al., 2015; Burgoyne et al., 2016).

Another study by Bilalić et al. (2007) aimed to answer the question of whether chess in children requires intelligence. This study used the same WISC to examine a sample of 57 young players. Rather than just looking at one variable hypothesized to be linked to chess performance, Bilalić et al. (2007) examined practice, years of experience, and intelligence. Contrary to the results of Lynn and Frydman (1992), they found that chess skill was impacted most by practice, and that there was no significant correlation between chess skill and intelligence. Today, the question of whether intelligence is required to acquire chess skill still remains largely unanswered. It has, however, been discovered that chess training alone is not enough to “explain expert performance,” and some other variable, such as intelligence, must be at play (Sala et al., 2017, p.130).

It seems (both from individual case studies and meta-analyses), that chess is more beneficial for children than adults. Contrary to the findings with adults, there is typically a moderate correlation in children, especially in terms of visuospatial intelligence (Gobet & Campitelli, 2002). Moreover, chess can improve concept learning and scholastic achievement, as noted by Sala and Gobet (2016), even if it does not always. Not only does correlation seem more common, but the transfer of chess skills to cognitive skills in other domains seems much more likely among children. A meta-analysis by Burgoyne et al. (2016) finds that specifically in children in the early stages of learning chess, this transfer is common.

This is supported by the findings of Gliga and Fleisner (2013) as well as Sigirtmac (2011), both of which came to conclusions starkly different from the conclusions made about adult samples.

Studies on EF

The first study on adults which discussed the possibility of EF playing a role in chess was in 2003 by

Atherton et al. This study found, using MRIs, that there was limited activation of the frontal lobes when analyzing a chess position, suggesting limited use of EF in adults. Accordingly, more recently, a 2011 study by Unterrainer et al. (on 30-year-olds), which examined the Tower of London test scores between a control group of 30 non-chess players, and an experimental group of 30 advanced chess players, found no significant increase in overall EF abilities (with time restrictions in place). Again, a 2012 study by Nejati and Nejati, found that 30 expert chess players did not outperform a control group on the Wisconsin Card Sorting EF test.

In adults, the research is clear: EF skills are not better in superior chess players.

Paralleling the pattern for IQ, in children, the results have differed. A 2017 study by Grau-Pérez and Moreira examined 14 chess players and 14 non-chess players aged 7-12 on the Tower of London and Wisconsin Card Sorting EF tests. This study found that the experimental group performed better overall on both tests after having systematically studied chess for 1 year. Another study, which looked at the task monitoring and behavioural regulation aspect of EF, also found that a 44-student experimental group showed more improvement in EF (reported by parents) than a 39-student control group (Addarii et al., 2022). The last more relevant study (Oberoi, 2021) on children looked at 39 chess beginners (aged 8-17) from chess academies across the US, to see how their working memory, impulsivity, and decision-making improved after a chess intervention. This intervention included 14 sessions where the beginners were taught basic chess principles and had the effect of significant improvement in both decision-making and working memory. In short, the results of these three studies on children indicate that EF skills, in general, are improved by playing chess. Despite this, they do not answer the question of whether calculation and planning have a relationship with chess ability in those between **14 and 18** years of age. There have been a few other studies which examine EF skill improvement from playing chess in children, but they do not examine calculation and planning and were conducted on hyperspecific sample groups, such as college athletes or students with mathematical learning disabilities (Khosrorad et al., 2014; Dania et al., 2021).

The Gap

To summarize, this study aims to fill a current gap in the chess literature: in students aged 14-18, how does chess rating correlate with calculation and planning ability? As has been discussed, both this age group and this type of EF have never been studied together. In fact, all previous studies that examine planning and calculation ability have looked at those over 25 or those between 7-12. Particularly in chess research, where there is such a divide between the relationship in cognitive skills among adults compared with children, this study is crucial to a fuller understanding of EF, cognitive skills in general, and how they are related to the chess abilities of those on the brink of adulthood.

In addition to exploring a new age category for an unstudied type of EF, this study will examine chess players of all levels, not just novice chess players. Moreover, it will focus on how a wide range of chess ratings are correlated with calculation and planning skills as opposed to solely looking at all chess players vs non-chess players. Ideally, this will provide a better understanding of the entire relationship between the two variables being studied. Furthermore, most of the existing research on EF looks at EF skills and chess from the lens of improving EF skills rather than through the lens of acquiring chess expertise. This study, alternatively, follows a framework similar to the studies which investigated if intelligence is required to master chess. In taking this alternative approach to an EF study, this correlational analysis will help to bridge the gap between chess expertise-focused studies, and more education-focused studies while also contributing to the ongoing discussion of cognitive skill transfer between chess and other domains in adolescents. Last, similar to Unterrainer et al. (2006), this study looks at overall Tower of London performance, performance on difficult problems, and performance on easier problems, rather than solely looking at overall performance.

Method

Finding Participants

This study gathered a sample of 20 boys and 4 girls between the ages of 14 and 18 who are rated in chess. This number was selected based on previous studies which examined chess and cognitive abilities, and the sample sizes that those studies chose (all around 30) (Unterrainer et al., 2011; Grau-Pérez & Moreira, 2017; Waters et al., 2002). For this study, slightly lower seemed reasonable, hence the choice of 24. A larger sample was deemed unfeasible without paying participants or extending the data-gathering period.

The students for this study, similar to all three anchor papers referenced in the previous paragraph, were selected for a desirable characteristic, making this a form of purposeful sampling. The desirable characteristic was chess rating, where efforts were made to analyze a wide range of levels to satisfy the requirements of a correlational analysis. These students were gathered through word of mouth, emails, and social media. Messages were sent to all high school students in three independent boys' schools and three independent girls' schools in Toronto. Possible participants were asked to fill out a form to be contacted with a meeting link.

Collecting the Data

Background Info

Simple background questions (Appendix 1) were asked through a Google Form about each participant's chess experience before completing the test. Although, apart from the chess rating, this information is not required for the crunching of numbers, it is important for the analysis in the discussion section. Participants were informed they could decline to answer questions.

The Tower of London Test

The most important part of this study is executing the test to measure the planning abilities of my participants. To do this, the Tower of London test was used. This test was selected as it has been used in ev-

ery study to date that has examined planning skills and chess. For example, two of the anchor papers referenced above used it (Grau-Pérez & Moreira, 2017; Unterrainer et al., 2011). In the Tower of London test, the participant is given a starting position of objects and is required to convert that starting position to the given ending position. The objects were different coloured disks in three different stacks, where only the top disk could be moved between stacks.

This test was accessed through *Brainturk*, a website that provides the test for free (<https://www.brainturk.com/tol>). The version of the test used was an extension of the original test by Shallice (1982). This version consists of 27 increasingly difficult problems with an increasing number of disks. Unterrainer et al. (2011) employed a version where participants had to complete 48 increasingly difficult problems, but, given the resources available, a slightly less in-depth version was better suited.

On the google meet call, participants were asked to open the test online and to present their screen. The google meet was recorded so that I could keep track of how long it took participants to complete the test. This raw time data was then used to score the test, where the amount of time in seconds to complete the test was the score. This is a twist on part of the Krikorian et al. (1994) model. Essentially, the test was explained to participants who were allowed a few practice problems and then told to complete it as fast as possible. All results were recorded in an Excel spreadsheet.

The Correlational Analysis

After all data was collected, the analysis consisted of a correlational evaluation of the relationship between overall time score and blitz rating; overall time score and rapid rating; mean time score on difficult problems and rapid rating; mean time score on difficult problems and blitz rating; mean time score on easy problems and rapid rating; and mean time score on easy problems and blitz rating. For each, the Spearman rank coefficient (r) was used, the same coefficient used by Waters et al. (2002). This coefficient was selected as it can be used to analyze more than just linear relationships, and is relatively insensitive to outliers, unlike the Pearson coefficient. The expectation was non-linear results, so there was no harm in

using a coefficient that better accounted for unpredictable relationships.

The last step before completing the analysis was converting all chess ratings to the same scale. FIDE ratings, Chess.com, and Lichess ratings were all accepted when collecting data, so a conversion table was used to convert all of them to Chess.com ratings (conversion table used: <https://www.chess.com/article/view/chesscom-rating-comparisons>). This was done as Chess.com was the most commonly reported rating scale.

To execute the analysis, the RANK.AVG and the CORREL functions were used in Microsoft Excel. Excel was then used to graphically represent the results. Finally, two-tailed P-values were determined for all six correlations to measure significance on the 0.05 scale using the T.DIST.2T Excel function. The same following null and alternative hypotheses were formed for all six correlations:

Null hypothesis: There is no correlation between chess rating and Tower of London time score. **Alternative hypothesis:** There is a negative moderate or stronger correlation between chess rating and Tower of London time score.

If the P-value indicated a statistically significant correlation (<0.05), the null hypothesis was rejected and the alternative hypothesis was accepted, and if the P-value indicated a statistically insignificant correlation (>0.05), the null hypothesis could not be rejected.

Findings

The sample size of this study was 24 students, composed of 4 female and 20 male participants. Participants were asked for their Rapid, Blitz, and Bullet chess ratings, however, only Rapid and Blitz ratings were used on account of about 40% of participants not playing Blitz, and, therefore, having a skewed score in that category. The overall mean rapid rating was 940, and the overall mean Blitz rating, matching online rating conversion charts, was slightly lower at 784. There was no significant difference in ratings between ages, so comparison has been omitted. In general, there was no apparent link between chess rating and length of time playing chess, apart from those participants who had been playing for less than 1 month, who generally had lower ratings in both blitz and rapid categories.

There does, however, appear to be a link between increased chess score and recent consistency in playing. The eight highest Rapid-rated participants, all rated over 1000, reported playing at least a few times a week. Alternatively, playing consistently did not necessarily mean a higher chess score, suggesting that it is important to chess rating, but not the sole contributing factor.

After completing the tests, the mean score between participants was determined to be approximately 279 seconds, with the best score being 166 seconds, and the worst score being 502 seconds. The lowest score was achieved by the participant with the 2nd lowest Rapid rating of 558 and the 3rd lowest Blitz rating of 365 among the participants. The highest score was achieved by the participant with the 10th highest Rapid rating of 1000 and the 6th highest Blitz rating of 1050. Furthermore, participants' time scores appeared unaffected by their cumulative time playing chess.

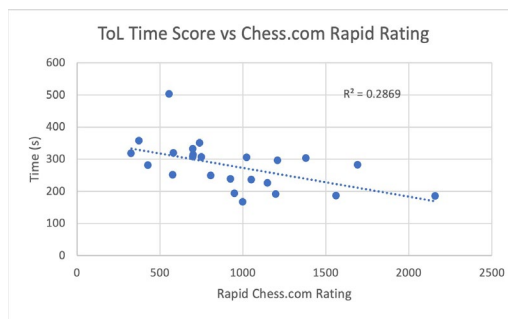


Fig.1

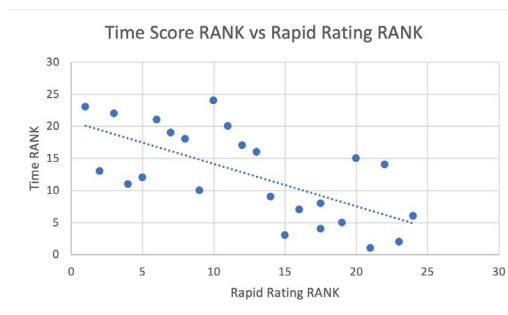


Fig.2

Following the bulk of analysis, the Spearman coefficient was determined to be -0.641 between rapid ratings and overall time scores on the Tower of London Test. This indicated a moderately strong negative correlation between the rapid ratings and overall time scores. This correlation was also deemed significant as the P-value < 0.05 at 0.003125, so the null hypothesis was rejected. Since the R^2 value of the relationship between raw rapid ratings and overall time score was 0.23 (as seen in Fig.1), indicating a low correlation, it can be concluded that the relationship between these two variables is only roughly linear (possibly due to measurement noise), but is moderately monotonic. Essentially, Spearman's coefficient—which is the same as calculating Pearson's coefficient on the ranked data—measures how well the two variables can be related by a monotonic function. Monotonic functions are defined to be either entirely non-increasing or entirely non-decreasing but do not have to be linear. As is seen in Fig.2, the relationship between the ranked data is more linear, and that is why the Spearman correlation is moderately strong, but the Pearson correlation is fairly weak. The negative coefficient indicates that as rating increases, for the most part, time taken decreases. Therefore, those with a higher Rapid rating are more likely to perform better overall on the test and are more likely to have better EF.

As is seen in Fig.3, results for overall time scores vs Blitz ratings were very similar with a Spearman correlation coefficient of -0.604, a slightly less strong correlation, and, therefore, a slightly less monotonic relationship. The P-value of 0.006193 also suggested that this correlation was statistically significant, so the null hypothesis was, again, rejected. The R^2 value of the raw relationship (Fig.3), and visual interpretation of the scatter, also suggest that it is roughly linear, but the ranked data indicates a moderately strong negative correlation. This means that as the Blitz rating increases, a moderate amount of the time, the Tower of London time score will decrease.

CHESS AND EXECUTIVE FUNCTIONING ABILITY IN ADOLESCENTS

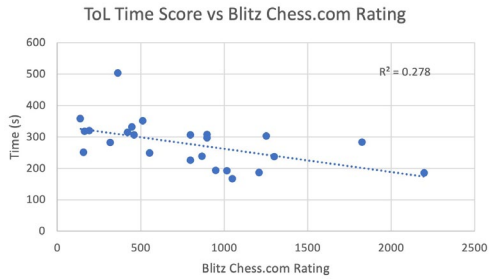


Fig.3

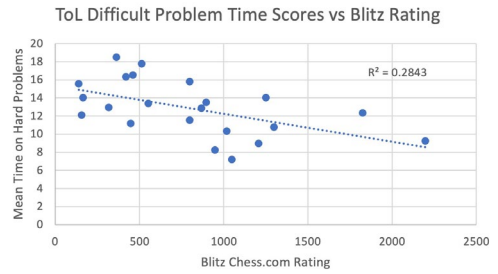


Fig.5

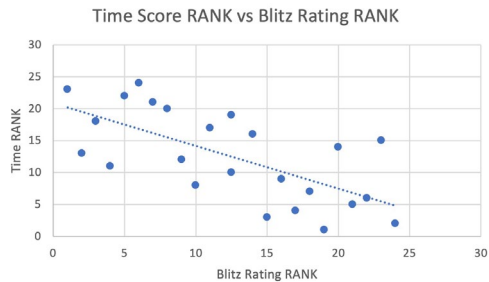


Fig.4

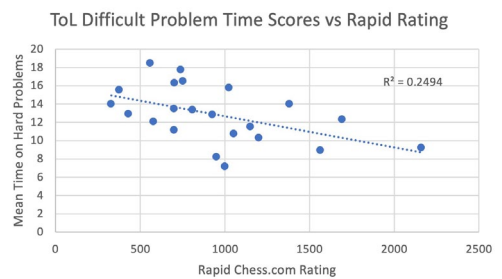


Fig.6

The link between performance on difficult problems and rapid and blitz ratings was less strong, with a coefficient of -0.513 for rapid ratings (Fig.5) and a correlation of -0.561 for blitz ratings (Fig.6). Both of these correlations are moderate negative correlations, meaning that as blitz or rapid rating increases, the time taken to complete the test decreases. Additionally, both of these coefficients were deemed statistically significant with P-values of 0.0146 and 0.0066, respectively. The null hypothesis for both coefficients was rejected and the alternative hypothesis was accepted.

The correlation between performance on easier problems and rapid and blitz rating was stronger than on more challenging problems. For rapid and blitz rating, the coefficients were -0.653 (Fig.7) and -0.556 (Fig.8), respectively. Once again, both of these coefficients were deemed statistically significant with P-values of 0.000987 and 0.00717, respectively. The correlation between rapid rating and Tower of London time score is, therefore, negative and moderately strong, and the correlation between blitz rating is negative but only moderate. The null hypotheses for both correlations were rejected, and the alternative hypotheses were accepted.

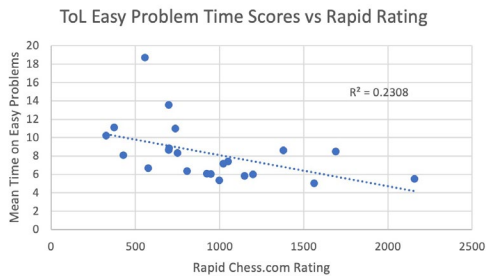


Fig.7

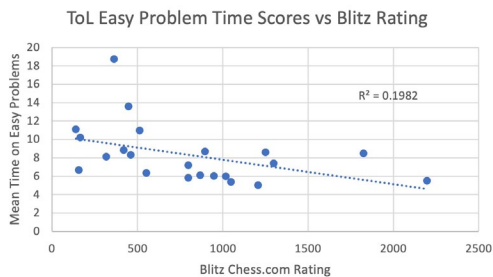


Fig.8

Discussion

The results of this study indicate a moderate--moderately strong correlation between chess rating and all Tower of London time scores in chess players aged 14 to 18. For all six analyses, this correlation was statistically significant, with two-tailed P-values well below the 0.05 benchmark that was used in this study. These P-values are an indication of the high likelihood that the results of my small sample group are a reflection of the overall population. Overall, this suggests a correlation between increased chess ability and increased EF skills. As most studies in the field have noted, however, this does not indicate causation, and so no conclusion can be drawn as to whether EF skills are required to be good at chess, or if chess skills are required to have superior EF skills. Additionally, there were a couple of outliers in all 6 calculations, and the correlations were only moderate, so even if causation

could be concluded, it would not fit all cases.

Given the results of other studies on other groups, the results of this study are expected. All three previously mentioned studies on children found improvements in EF skills in young persons who had played more chess. This includes working memory, decision-making, and planning and calculation skills as measured by the Tower of London test (Addarii et al., 2022; Oberoi, 2021; Grau-Pérez & Moreira, 2017). In adults, however, EF skills have almost no correlation of significance with chess ability, with two almost identical studies on adults finding no correlation between chess rating and planning skills as well as chess rating and visuospatial memory (Unterrainer et al., 2011; Waters et al., 2002). The results of this study, therefore, fill the gap, and demonstrate the possibility that adolescence is a transition period where EF skills and chess ability become less connected; we see that in children it can have a significant effect; in adolescents, it can have a moderate effect; and in adults, it has next to no effect. The implications of this may be that, with age, chess also becomes a less effective tool for improving math skills or spatial concept development, which has largely been shown to help younger children (Sigirtmac, 2011; Sala et al., 2015).

Ultimately, as the background info responses indicate, and Sala et al. (2017) suggested, no one cognitive strength is enough to explain expert chess ability, whether that be intelligence or EF-related skills. This study supports this narrative as EF skills are generally better in higher-rated players, but are not always. Additionally, higher ratings being linked to recent consistency in playing points to practice as a good secondary tell-tale of how advanced a chess player might be. This result partly aligns with the conclusion made by Bilalić et al. (2007) in their study on child chess players, which found that chess skill was most impacted by practice as opposed to years of experience or intelligence. Unfortunately, this study lacks the comparative component between different contributing factors. Nevertheless, it aligns with the idea that multiple factors are impactful. Additionally, the shallow impact of years of experience playing chess on chess rating, likely due to inconsistent playing, supports the findings of Bilalić et al. (2007) that this factor is not a significant determinant. Last, in contrast to the findings of Unterrainer et al. (2011), adolescent chess players proved more dominant on easy problems rather than hard

problems. Unterrainer et al. (2011) found that adult chess players, while not significantly better overall, proved more dominant on harder problems.

In the context of other chess studies with cognitive ability, this study fully supports the idea that the effect of different factors on chess performance changes with age. Apart from practice, it seems that all factors—including intelligence, EF skills, memory skills and so on—are more significant in young players trying to improve at chess. Whether it is preexisting EF skills that entice young players into playing chess, encouraging them to practice more or to improve other cognitive skills, or it is playing chess that actually improves cognitive skills through practice, this study suggests that one or the other, or a balance of the two, is true.

Limitations

The majority of the limitations of this study stem from a lack of time and resources. First, the sample size of this study is only a limited representation of the entire population of 14 to 18-year-olds. Only 24 participants were included in the final analysis, obviously only a fraction of the number of students who play chess and could contribute to the results. Therefore, despite both P-values indicating a very low probability that the null hypothesis is correct (that there is no correlation between chess rating and EF ability), the low sample size decreases the strength of the data. In addition to the smaller sample size, the lack of female representation in this study and in the literature at large is a serious limitation to the generalizability of all results. This study aimed to have equal numbers of females and males, but, unfortunately, one girls' school entirely declined to participate, and, for a variety of reasons, the two others were difficult to communicate with. Second, and probably the most specific to this study, is the inaccuracies in results due to the difference in access to technology between participants. Since the entire study was conducted online, as meeting in person with every participant was not possible, some participants used trackpads and some used mice. It seems unlikely that this would have skewed the data towards a correlation, as it would be no more likely for a higher-rated chess player to have a mouse than a lower-rated

player, but it still limits the accuracy of results. In addition to discontinuities in equipment, the tests were all completed at different times of the day, and on different days of the week, which could have impacted fatigue, and, by extension, performance. The effects of this limitation should be minimal, however, as every person has different times when they are most awake, and participants got to choose the time of their test. It should also be mentioned that, in the broader sense of chess score vs EF skills, it is possible that the correlations would not be significant, especially if the Tower of London measure does not correlate with other EF measures. Finally, Chess.com's rating accuracy may contribute to the limited accuracy of the results of this study. In comparison with official chess ratings, it is much easier to cheat on Chess.com to unfairly advance your rating or to have a rating that doesn't reflect your ability if you do not play enough.

Future Directions

A future continuation of this study should aim for a larger sample group (probably around

50), with a better range of chess ratings and a more diverse spread of gender and demographics. Additionally, it should aim to include more EF questions by possibly running the EF test twice, and should better mitigate the speed differences in technology from participant to participant. This would probably be best achieved by completing the study in person, where all participants use the exact same technology. To investigate the possibility that the broader significance of correlations found in this study was a non-specific effect, future research could also examine how chess scores correlate with other measures such as the Wisconsin Card Sorting Test. Last, in addition to a continuation of this study, another comparative study on factors that contribute to chess mastery in this age group would be very interesting and a great complement to the existing literature. A study like this would give insight unavailable from this study by looking at multiple factors and ranking the magnitudes of their effects, also providing a better estimate of actual cause.

Conclusion

The results of this study indicate that there is a statistically significant, moderate negative correlation between Tower of London scores and Blitz and Rapid Chess.com ratings for those between 14 to 18. The basis that these two variables rise together introduces a variety of implications for education and the chess world. Up until this point, it was known that chess could be an effective scholastic tool in ages 5-12, but unknown how effective it might be in adolescents. This study confirms it to be at least a possible tool, one that should be attempted, in a school setting. Additionally, with the recent spike in interest in online chess in Toronto and beyond, this study provides numerical evidence in support of allowing adolescents to play chess during breaks at school (Keener, 2022). In terms of adolescent competitive chess players, this provides insight into possible tweaks in training methods for improvement in chess ability. Further comparative research is required to determine if EF skill training is superior to other forms, but this study establishes it in the literature.

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Appendix A

Background Questions:

- How long have you been playing chess?
 How often do you play chess?
 Did/do you attend a chess academy/receive chess lessons?
 How old are you?
 What is your gender?
 Do you play chess competitively? If yes, for how long?
 What are your rapid, blitz, and bullet chess ratings? On what scale? (Lichess, Chess.com, etc.)
 Optional: Do you have any learning/cognitive conditions or disabilities?

Appendix B

Number	Rapid	Blitz	Bullet	Total Time	Mean Time Hard	Mean Time Easy
1	328	166		317	14	10.1875
2	1692	1828		282	12.29	8.461538462
3	558	365		502	18.45	18.6875
4	700	450	500	331	11.13	13.54545455
5	1382	1253	1211	302	14	8.571428571
6	808	555		248	13.36	6.3125
7	927	869	986	238	12.82	6.0625
8				5:02		
9				4:54		
10	1052	1301		236	10.73	7.375
11	702	422	272	313	16.3	8.823529412
12	1150	800	800	225	11.5	5.8
13	740	515	682	350	17.75	10.94736842
14	1563	1210	1122	186	8.92	5
15	950	950	950	193	8.21	6
16	1200	1019	961	191	10.29	5.95
17	700	899		307	13.47	8.636363636
18	1025	800		305	15.77	7.142857143
19	579	158	700	250	12.08	6.642857143
20	582	193	1200	319		
21	1210	900	745	296		
22	375	140		357	15.54	11.07142857
23	2160	2200	2400	185	9.2	5.470588235
24	752	463	403	306	16.5	8.294117647
25	430	320	280	281	12.92	8.071428571
26	1000	1050	1200	166	7.17	5.333333333

Appendix C

Consent Info Given to Participants

Description:

You are being asked to participate in a quantitative research study on chess and planning scores. If you agree to participate, you will complete the Tower of London planning test. This test will be conducted on my computer in person, or on your computer over Google Meet, and consists of 27 different questions of varying difficulty. For each question, you will see, on screen, three different stacks with different colours of disks stacked randomly on them. You will be given a starting position for these disks, and the goal/ending position. You will be tasked with converting the starting position to the ending position as fast as possible.

In addition to completing the test, you will be asked the following questions for some background information:

How long have you been playing chess?

How often do you play chess?

Did/do you attend a chess academy/receive chess lessons?

How old are you?

What is your gender?

Do you play chess competitively? If yes, for how long?

What are your rapid, blitz, and bullet chess ratings? On what scale? (Lichess, chess.com, etc.)

Do you have any learning/cognitive conditions or disabilities?

Risks and Benefits:

There are no apparent risks in participating in this study. This study will contribute to the adaption and development of more informed training methods for improving in chess. Additionally, it will benefit students by allowing educators to optimize their use of chess as a learning tool.

Confidentiality:

Your name, if given to me, will not be mentioned at any point in the study, nor will it be recorded with the data you provide. You will always be anonymous.

Right to Withdraw or Refuse to Answer:

You may withdraw from this study at any point and have your information and data completely removed from the study. Additionally, you have the right to refuse to answer any questions which you feel uncomfortable answering. It should be noted that, while you

may refuse to participate in parts of the study, your data may be removed entirely if you choose not to participate in a significant portion of it.

The New Blues: Determining Significant Factors in Right-Wing Populist Support Among Young Canadians

Lara Choy

Abstract: The recent popularity of figures such as Pierre Poilievre and events such as the Ottawa “Freedom Convoy” demonstrate the rise of right-wing populism among young Canadian voters. Through a mixed-methods approach with thematic analysis, this study attempted to determine the most significant factors contributing to right-wing populist support in this demographic. The survey of 56 self-identified conservative Canadian university students and Reddit users aged 18–35 found that right-wing populist support was predicated on three factors: economic uncertainty, with unsustainably high cost of living and mismanaged fiscal policies; distrust in government, with negative perceptions of institutions, including the media; and cultural conflict, with backlash against “woke” ideas and “non-traditional” values. The themes point to disillusionment with Canada’s current economic, political, and social environment, and a desire for the alternative messaging often found in right-wing populism. The findings contain significant implications regarding current and upcoming Canadian voter behaviour and the effects of populist worldviews.

Keywords: Canadian youth, political ideology, right-wing populism, thematic analysis, voting behaviour

Context

Conventional wisdom states that young voters lean liberal, and Canada is immune to the wave of right-wing populist political leaders sweeping the globe (Budd, 2021). While there may be a kernel of truth in each assertion, neither one reveals the whole story. The 21st century has seen the rise of “radical right” political parties and leaders that often harness populist strategies to mobilize voters (Rydgren, 2007). Right-wing populism is typically defined as a political worldview that advances conservative political positions—fiscal, social, or both—by advocating for the “common person” and against the “established elite”

(Rydgren, 2007). While right-wing populism is associated with concepts such as economic protectionism, nativism, and anti-globalization, it is far from a united belief system (Spruyt et al., 2016). Instead, it most often provides an outlet for discontented voters’ grievances, with certain demographics correlating to right-wing populist support: those with lower perceived socioeconomic mobility, lower educational attainment, and higher identification with political signifiers as a core facet of identity (Spruyt et al., 2016). However, the specific factors and grievances that motivate right-wing populist beliefs vary greatly depending on voter location and demographics, and thus cannot be grouped into a single “box” (Spruyt et al., 2016). After an overview of recent political and

historical context, this paper will investigate the primary factors motivating right-wing populist belief among young Canadian voters.

Literature Review

Right-Wing Populism in Canada

While Canadians are stereotyped as more politically liberal than their peers in the United States, national research on political ideology indicates that this is only partially correct (Budd, 2021). The factor analysis models of Cochrane (2010) show greater fragmentation in the political beliefs of right-wing Canadian voters compared with a relatively unified ideological environment on the left. Traditional conservative-leaning Canadian political campaigns placed greater emphasis on fiscal beliefs, such as tax reduction and free-market capitalism, in comparison to social and cultural matters (Cochrane, 2010). Budd's explanatory case study of Doug Ford's 2018 successful campaign for premier of Ontario, under the populist slogan "For I People," demonstrates how Canadian populists have often concentrated on working-class "money matters" (2020). This form of populism emphasizes anti-elitist concerns through the language of economics, rather than ethnic or cultural identity (Budd, 2020). In Canada's single-member plurality electoral system, it becomes necessary for any "legitimate" party to attract a diverse electorate. Budd defines this phenomenon as the "populist paradox" and as another explanation as to why Canada is often perceived as immune to the effects of right-wing populism—on the campaign trail, politicians must present "extreme" policy plans in a moderate matter, even if they plan to enact them once in office (Budd, 2021). One notable exception was Maxime Bernier's People's Party of Canada (PPC) in the 2019 federal election, which was also investigated by Budd in a 2021 case study. While certain facets of the Conservative Party united standard right-wing policy positions (i.e., the free market) with populist strategies, the PPC took its more radical cues from anti-immigration and economic nationalist leaders in other countries (Budd, 2021). Thus, their beliefs may be connected, but not homogeneous, further supporting the idea of right-wing populism as a framework or signifier. While right-wing parties in Canada

often emphasize the "common person" in electoral campaigns, the mainstreaming of so-called "radical" populist sentiments is a relatively new development (Budd, 2021). Right-wing populism itself is often not considered a singular ideology (Erl, 2021); instead, it has been proposed to be a "thin" political worldview that can be attached to a range of more substantial "thick" policy positions in order to attract a more diverse electorate (Erl, 2021). This creates a more nuanced understanding of the "right-wing populist" label beyond a convenient grouping of recent Canadian political phenomena.

The 2019 Federal Election & COVID-19 Pandemic in Canada

Many Canadian political commentators agreed that the October 2019 federal election was marked by widespread voter apathy, resulting in a slim minority government for the incumbent Liberals (Waddell, 2022). Voters seemed neutral about Canada's short-term economic outlook, but notably pessimistic about the state of society. In early 2019, 54% of Nanos opinion poll respondents agreed that future generations of Canadians would encounter a "worse standard of living" than Canadians in the present (Nanos, 2020). The one-month-long electoral campaign was "thin" on policy matters and "thick" on more abstract battles, exemplary of Erl's thesis (2021). Events such as stalled negotiations on the U.S.-Mexico-Canada free trade agreement or refugees seeking asylum in Canada fuelled debate about economic anxiety and identity politics both in person and on social media (Nanos, 2020). Walsh's (2022) thematic analysis of migration discourse among Canadian Twitter users during the 2019 election campaign builds upon Nanos' findings. Although some users expressed positive sentiments about refugees as a boon to the country's diversity, the majority of collected tweets linked asylum seekers to claims of a border security crisis and the loss of a collective Canadian identity, with clear attempts to return nativism to the Canadian political landscape, reminiscent of Bernier's sentiments (Walsh, 2022). Although the ideological focus seems to contrast earlier claims about Canadian populism's more economic concerns, the social aspect seems firmly rooted in many Canadian conceptions of populism. The latter category of tweets received greater engagement than more posi-

tive posts, which could speak to negative shifts in the media landscape from which many Canadian voters get their daily news (Walsh, 2022). Moreover, the Canadian news media played a dynamic role in the 2019 federal election campaign, both in what it did and did not report. While Canadian voters' tweets focused on "kitchen-sink" matters such as taxes and healthcare, journalists' relative issue emphasis concerned "ethics" and "foreign affairs," issues that may seem more abstract to the median voter (Waddell, 2022). Thus, the gap between the concerns of "everyday people" and "elites" in the mainstream media reporting the 2019 campaign could exacerbate conditions for resentment and push citizens toward partisan, possibly unreliable sources.

Less than six months after that indifferent federal election, the COVID-19 pandemic would overturn many voters' political priorities or intensify previously held sentiments. While the body of research is evolving, some sources agree that the pandemic emphasized division, often between populist conceptions of the "people" and the "elite." An inductive content analysis of opinion columns in right-wing Canadian newspapers during the early pandemic (March to May 2020) found pervasive criticism of Trudeau's "weak" leadership united the columnists, as well as support for economic protectionism (Van den Brink & Boily, 2022). These sentiments seemed to grow more extreme as it became clear that the pandemic would cause lasting fissures. Another manifestation of far-right grievances, more in line with Bernier than the mainstream Conservative Party, was the national "trucker convoy" on Parliament Hill in early 2022. Initially formed to protest COVID-19 vaccine mandates, the protestors expanded to populist concerns such as working-class economic insecurity and viewed the state in direct opposition to their beliefs (Maclaren, 2022). While it remains to be seen whether recent events will contribute to the mainstreaming of right-wing populist sentiments in Canada, precedent demonstrates how geographic context shapes political grievances.

Novelty of Study: New Blue Wave?

Despite the growing body of research on populism in Canada, few studies have focused on the dimension of youth. While young Canadian voters may be expected to vote for the Liberal or New Democratic Party (NDP), it was younger Conservative Party voters who propelled oft-described populist Pierre Poilievre

to victory in the party's September 2022 leadership race (Routley, 2022). The youth dimension could further fragment right-wing populist sentiments, as numerous studies have found that the political views of young people are often plural and contradictory (Pollock et al., 2015). They tend to be less ideological and more motivated by their geographical context, family backgrounds, and media consumption habits (Pollock et al., 2015). In the age of social media, political rhetoric and messaging have become more important than ever. Following and posting right-wing populist sentiments on social media platforms was often motivated by "emotionalized blame attribution" (Heiss & Mathes, 2017). Polievre's social media presence, often in the form of emotionally charged and issue-specific videos, was considered a major factor in his Conservative leadership victory (Routley, 2022). Conservative student associations are present on most Canadian university campuses, which in right-wing media, are often pitched as the breeding ground for "elitists" and the "culture wars." Through semi-structured interviews with self-identified conservative American university students, Binder and Wood (2013) found that students' expression of right-wing beliefs varied significantly from campus to campus, perhaps taking a more or less populist approach depending on their environment. As demonstrated by earlier studies of right-wing populism, conservative students and young Canadian voters as a whole do not share identical motivations or approaches to promoting conservatism on campus. However, these specific motivations have not been studied in any real detail.

This investigation has led to the research question "what are the most significant factors contributing to right-wing populist political support among Canadians aged 18–35?" For better or for worse, right-wing populism is increasingly relevant in Canadian politics. Doug Ford and Pierre Poilievre may be controversial, but they dominate national news headlines and attract supporters on social media and at the polling station. As Generation Z Canadians (born approximately 1995–2010) become eligible to participate in elections and eventually comprise a plurality of the voting population, a shift toward right-wing populist sentiments and worldviews presents significant, and so far, understudied, implications for Canada's political future (Ibbitson, 2021). Thus, this paper intends to survey young Canadians who identify with right-wing

populist beliefs as a means of gaining insight into current and upcoming Canadian voter behaviour.

Method

One of the key findings from the literature review was the pluralism of populist belief; in other words, support was not solely predicated on singular political issues or figures (Budd, 2021). In order to effectively answer the research question, the research methodology had to consider broader theoretical and worldview-based factors as well as “concrete” matters. A mixed methods approach could collect quantitative measurements and qualitative textual evidence about young Canadian voters’ sentiments while accommodating as many potential factors as possible (Palinkas et al., 2016).

“New Blues” Online Survey

Data collection was facilitated through the use of a Google Form survey, chosen for its user-friendly interface and respondent anonymity. The survey population, Canadian citizens aged 18–35 who identified with right-wing populist sentiments, was targeted through purposive sampling. This method of outreach allowed the researcher to contact specific communities in alignment with the aforementioned demographic, and conduct research efficiently and without

direct contact with the participants, preserving confidentiality (Palinkas et al., 2016). Within the demographic, two primary groups were identified for purposive sampling: post-secondary students, inspired by the findings of Binder and Wood (2013), and Reddit users. Although right-wing populist sentiments are disseminated across a range of social media platforms, Reddit was specifically chosen due to its expansive character limit, which attracts more discussion-based discourse, and “subreddit” structure, which facilitates relevant data collection (Proferes et al., 2021). After a web search of conservative campus groups at major Canadian universities, twenty such groups were emailed a link to the survey. A similar Reddit search was conducted to identify six conservative-leaning subreddits focused on Canadian political issues. Subsequently, participants could fill out the survey using a link provided in a Reddit post.

The first part of the Google Form survey consisted of 15 Likert-scaled statements that evaluated the respondent’s political attitudes and populist worldviews (Table 1). The response options ranged from “5 - I strongly agree” to “1 - I strongly disagree,” though participants could also choose not to respond. Many of the statements were based on the MYPLACE questionnaire, which was used to survey citizens of the European Union about their political participation

Table 1
Open-ended prompts for the second part of the online survey

Prompt
How do you think your political views compare with those of your family, friends, and community?
How have your political views evolved over time and what events or experiences have influenced your perspective?
What specific issues or concerns are most important to you and how do you hope politicians will address them?
How do you evaluate political candidates or parties, and what qualities do you look for in a political leader?
What is your understanding of the term “right-wing populism,” if you are previously familiar, and what political positions or figures might you associate with it?
If there is anything significant you would like to share or comment upon, this is an open space.

(Pollock, Brock & Ellison, 2015). The statements were designed to be as neutral as possible to combat perceptions of partisanship on the part of the researcher and social desirability bias on the part of the respondents (Gittelman et al., 2015).

In the second part of the survey, participants were asked to respond to the following neutrally-worded open-ended prompts:

This section allowed respondents to elaborate on previous responses and add insights into factors and aspects of political worldview not considered by the survey.

Data Analysis & Triangulation

The quantitative results from the five-point Likert-scaled questions in the first part of the survey generated descriptive statistics. A frequency distribution of descriptive statistics, namely mean response and standard deviation, visually represented statements that attracted varying levels of agreement and polarization.

To analyze the open-ended responses in the second part of the survey, a qualitative thematic analysis approach was selected. Braun and Clarke (2012) note that thematic analysis is particularly well-suited for research questions that examine the factors underpinning a specific phenomenon. Moreover, the qualitative approach was partially inspired by the work of Van den Brink and Boily's analysis of common themes among Canadian right-wing opinion columnists' coverage of the COVID-19 pandemic (2021). Their inductive method of textual analysis, based upon broad politically focused questions as opposed to more solidified hypotheses, also made sense in the context of this research study.

To begin, following Braun and Clarke's recommended procedure, all written responses were pooled into a single document. After each response was read and illuminating words or phrases were identified, initial codes were generated. The codes were grouped into broad colour-coded themes. After re-reading and identification of emergent codes on three separate occasions, themes were deleted and revised as necessary. The common themes identified through analysis corresponded to factors, addressing the research question about most significant factors in support for right-wing populism, in the data, as well uncov-

ering as any divergent perspectives or opinions. This iterative multi-step process systematically coded the qualitative data into a set of distinctive and coherent themes that, together, told a story in response to the question, with strong evidence both paraphrased and directly quoted.

After uncovering recurrent themes, the results between the qualitative and quantitative portions of the data analysis were compared to determine how findings might support and contradict each other. This triangulation of mixed methods provided confirmation and cross-validation between two parts of the survey, reducing researcher bias (Olsen, 2004). Pure numerical or pure textual data might exclude critical findings or evidence, while combining the two allowed for deeper insight and a new understanding of the underlying factors in right-wing populist support (Olsen, 2004). The approach was fairly novel in that few other populist research studies have attempted to combine two such different approaches; though, based on model studies, frequency distributions and textual coding are both accepted methods in political science research (Spruyt, Keppens & van Droogenbroeck, 2016; Van den Brink & Boily, 2021).

Ethical Considerations

As political affiliation and beliefs can be a sensitive topic for even politically engaged citizens, respondent confidentiality was a key concern throughout the data collection process. The survey did not collect any form of contact information, though some respondents opted to include their email addresses in order to receive the research results at a later date; this had no bearing on data analysis procedures, which did not consider names or details about the respondents.

Before participating in the survey, potential respondents were required to virtually sign a consent form that outlined the principles of informed consent, voluntary participation, and open communication. The consent form also contained contact information that allowed the researcher to promptly respond to any questions or concerns from potential respondents. Information from the consent form was reiterated throughout emails and Reddit posts. The research design received approval from the Internal Ethics Review Board at the researcher's institution.

Findings

The survey received 56 responses, ten of which completed the scaled questions but not the open responses. This left a total of 56 response sets for quantitative analysis and 46 response sets for qualitative coding.

Table 2 depicts the frequency of scaled responses for each quantitative survey question. Also included are the mean levels of agreement and standard deviation. As not every respondent answered every question, the individual number of responses do not always equal 56.

Table 2

Frequency distribution of responses to Likert-scaled questions (rounded to two decimal places)

Statement	n	Mean	SD	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
Most politicians have ignored the issues that are important to me.	55	4.07	1.12	47.27%	30.91%	9.09%	9.09%	3.64%
The current political elite are out of touch with the concerns of everyday people.	56	4.41	1.05	66.07%	21.43%	3.57%	5.36%	3.57%
“Establishment” politicians should step aside in favour of political “outsiders.”	55	3.31	1.23	23.64%	16.36%	36.36%	14.55%	9.09%
The federal government has mishandled the response to the COVID-19 pandemic.	56	4.23	1.18	60.71%	19.64%	5.36%	10.71%	3.57%
“Political correctness” and “cancel culture” have negatively affected today’s society.	55	4.47	0.89	65.45%	21.82%	9.09%	1.82%	1.82%
The media is not giving a fair representation of political/social issues that matter to me.	55	4.16	1.28	58.18%	21.82%	1.82%	12.73%	5.45%
The current political system is failing to protect Canada’s traditional values and culture.	54	4.15	1.20	51.85%	29.63%	7.41%	3.7%	7.41%
Canada’s current economic, political and social systems are harming the working class.	56	4.34	0.95	55.36%	32.14%	5.36%	5.36%	1.79%
The state should have a limited role in citizen’s lives and promote individualism.	56	3.95	1.17	42.86%	25%	21.43%	5.36%	5.36%
The government should institute further restrictions on immigration.	56	4.14	1	51.79%	21.43%	17.86%	7.14%	1.79%
The government should take a tougher stance on crime and national security.	56	4.18	1.09	50.00%	26.79%	12.5%	5.36%	5.36%
The government should implement protectionist policies to benefit domestic workers.	55	3.62	1.22	29.09%	32.72%	14.55%	18.18%	5.45%
The government should prioritize native-born interests over special interest groups.	56	3.48	1.35	32.14%	23.21%	17.86%	14.29%	12.5%
There is little space for people like me in today’s political environment.	56	3.89	1.27	44.64%	26.79%	8.93%	12.5%	7.14%
The country of Canada feels like it is on the decline.	56	4.34	1.11	60.71%	26.79%	5.36%	0%	7.14%

FACTORS IN RIGHT-WING POPULIST SUPPORT AMONG YOUNG CANADIANS

Table 3

Definitions of themes from open-ended responses

Theme	Definition
Economic Uncertainty	Participants expressed anxiety about the state of Canada's economy on a personal and nation-wide scale, particularly in the wake of the pandemic. Codes included concerns about the cost of living, perceptions of the middle class being "squeezed out," and negative attitudes toward government intervention.
Distrust in Politics	Participants shared their perceptions of political parties and associated institutions as corrupt, untrustworthy, and compliant to the demands of the elite. Codes included skepticism of politicians' motivations, suspicion of media shaping political narratives, and calls for greater transparency.
Cultural Conflict	Participants demonstrated their opposition to socially liberal principles and policy positions. Codes included resentment toward "woke" culture, frustration with "us vs. them" mentalities, and desire for protection of "traditional values."

Table 3 reveals three primary themes found through the qualitative coding process, along with definitions, subthemes, and indicators. Collated from 46 sets of open-ended responses to the aforementioned five questions, the themes are inherently broad.

Discussion

The recurring themes, supported by triangulated quantitative and qualitative evidence, can be considered "factors" motivating young Canadians' support for right-wing populism.

Economic Uncertainty

Under the first umbrella theme, participants expressed concerns about cost of living, perceptions of a squeezed out "middle class," and skepticism about government intervention in the economy. Inflation and the rising cost of everyday expenses emerged as a prominent concern, affecting respondents' access to housing and other necessities. Respondent #7 noted that they "should not have to [cohabitate] with six other people in order to make ends [meet] as a business owner"; similarly, Respondent #16 felt that "the housing shortage is the biggest indicator of an [unsustainable] economy." Such concerns reflected a population of working-class and middle-class individuals concentrated in urban areas. Speaking to a belief that

"everyday" citizens bear a disproportionate economic burden, Respondent #8 wrote that "always the middle class will contribute more than they receive from the government." One topic where opinions notably diverged was immigration, with the statement "the government should prioritize native-born interests over special interest groups" reporting high polarization with a mean agreement of 3.48 and standard deviation of 1.35 (Table 2). This was mostly in the context of economic challenges, as a few responses expressed concern that increased immigration would increase competition for resources and job opportunities. In alignment with the findings of Budd (2020), it seems that right-wing populist supporters in Canada express less uniformly nativist sentiments compared with their international counterparts. Moreover, the textual data within this theme is linked to the widespread belief that the current economic system, or at least, the government's fiscal approach, creates divides between the "haves" and the "have-nots," which are then perpetuated by the political system in a vicious cycle. A few respondents singled out their opposition to the Liberal government's spending during the pandemic, which was perceived as overzealous and inefficient, as well as its more Keynesian economic vision. In line with traditional conservative ideologies, respondents generally expressed support for free markets and minimal government intervention. In the words of Respondent #39, "free economies are the most efficient thing we've created (everyone voting with their dollar in real time) and how a select group of suits believe

they know better astounds me,” illustrating a common sentiment that Canada’s political system contributes to inadequate economic opportunities for everyday citizens. The theme as a whole demonstrates voters’ more day-to-day opinions about how the government is not doing enough or taking the wrong approach to address their concerns, sowing the seeds of mistrust.

Distrust in Politics

In the second theme, participants generally expressed pessimism toward politicians’ character, suspicion of the media shaping political narratives, and calls for increased transparency. In the quantitative section of the survey, the statements “most politicians have ignored the issues that are important to me” and “the current political elite are out of touch with the concerns of everyday people” earned some of the highest levels of agreement, at 77.36% and 87.03%, respectively (Table 2). Later in the survey, many respondents claimed to be disillusioned former left-wing voters who found that mainstream parties were out of touch with everyday voters and were driven to seek alternatives, namely right-wing populist figures such as Poilievre or Bernier. While the Liberal Party and the New Democratic Party were both cast in a negative light, overarching justifications behind respondents’ distrust differed. The former party, which has governed the country since 2015, was perceived to act complacently and perpetuate “constant buzzwords and media hegemony,” according to Respondent #45. Conversely, the more politically progressive NDP was often initially viewed as more representative of the working class, with its occasional left-wing populist approach, but ultimately falling in line with the more centre-left positions of the federal Liberals. Thus, the shift toward conservative parties seemed to be more motivated by rejection of “mainstream” Canadian politics than any particular affinity for their politicians; more right-leaning groups emerged as the “best” alternative among many “bad” options, which seemed to exacerbate cynical feelings around the political process. Respondent #2 claimed that all politicians are “liars” and “crooks” and “[they] would just vote for the [liar or crook] that represents [their] interests,” as opposed to the interests of the “elite.” At the same time, respondents expressed relative neutrality to the statement “establishment’ politicians should step

aside in favour of political ‘outsiders,’” with a mean agreement of 3.31 (Table 2); this could explain why even right-wing populist voters may be more inclined to vote for a “safer” option like Poilievre, still affiliated with the federal opposition Conservative Party, as opposed to a more “niche” figure such as Bernier. Outside of the legislative and executive branches, the news media was frequently criticized as a mouthpiece for the establishment’s political agenda. A quote such as “media in Canada is often not reporting on things that affect [everyday] people” from Respondent #17 suggests that mainstream media outlets such as CBC and CTV are seen as dishonest, or even working to cover up certain “inconvenient truths,” in the words of Respondent #26, to perpetuate the rhetoric of certain parties or politicians. This perceived bias led some respondents to seek out “alternative” media sources, which are frequent disseminators of right-wing populist positions and “emotionalized blame attribution” (Heiss & Mathes, 2017). When asked what they did want to see in a government, respondents commonly cited greater openness and transparency about political matters as important matters. Such sentiments suggest a desire for less perceived corruption, as an antidote to the dishonesty observed in many politicians’ behaviour and policies, as well as more active participation in the political process, which was often perceived by respondents as unreachable to the ordinary citizen. At the same time, respondents did not seem optimistic that this could actually occur, or that their interests would one day be properly represented in the government or media.

Cultural Conflict

The final theme of “cultural conflict” was expressed through frustration with us vs. them mentalities, resentment toward “woke” culture, and desires to protect “traditional” values. The textual data revealed frequent opposition to the perceived division in Canadian political life, in which people felt like they were forced to pick a side in certain contentious issues and stick to it without any space for growth or discourse. Expanding on this, Respondent #35 noted how “social media bubbles” insulate users from other viewpoints and “normalize more extreme positions” in an ideologically polarized environment. Such results connect back to the previous theme, distrust in

traditional media, as well as a tendency to dismiss any views that do not align with one's own. Perhaps right-wing populism seems like an appealing escape from mainstream debates; on the other hand, many other responses expressed open hostility toward liberal policies and supporters. A watershed moment in this "culture war" seemed to be the COVID-19 pandemic, as the perceived rise in "woke" politics and so-called restrictions on civil liberties, such as vaccination and mask mandates, led many respondents to look toward right-wing alternatives. On the whole, "wokeness" and political correctness were viewed as the narrative of the ruling class, used to impose a type of hierarchy on ordinary Canadians; 87.27% of respondents felt that such ideas had a negative effect on modern society, with the highest mean agreement level of any statement at 4.47 (Table 2). Some respondents felt that they had to self-censor themselves or like Respondent #18, "mask their true feelings to work in a white-collar field," for fear of ostracization from liberal colleagues and peers. Conversely, this zeitgeist emboldened certain respondents to become more open about their conservative leanings; for instance, Respondent #39 expressed that their beliefs were considered more right-wing than in reality because they "dare[d] to question the group think," yet felt a responsibility to shield others from "liberal propaganda." Moreover, while 81.48% of respondents agreed with the statement that "the current political system is failing to protect Canada's traditional values and culture," the specific values and cultural elements were not immediately clear, though clearly linked to right-wing support (Table 2). Quotes such as that of Respondent #46, which opposes the adoption of "some globalized homogenized corporate culture," allude to an undercurrent of nativism and the belief that right-wing populism can safeguard Canada against external cultural threats. Overall, these sentiments indicate that right-wing populist support is not strictly a political phenomenon, as there are strong cultural motivators that are perhaps overlooked in current research on populist belief.

Limitations

Despite clear patterns and themes in the data, certain limitations and possible confounding factors in

the research study should be considered before arriving at conclusions.

First, the sample population consisted exclusively of university students and Reddit users, which likely skewed overly educated and active online as compared with the general population. In the case of the latter group, Reddit, particularly conservative-leaning and politically focused subreddits, draws a disproportionately white, male, and middle-class audience, which aligns with the backgrounds mentioned in many open-ended responses (Proferes et al., 2021). Since the questionnaire did not collect voter intention or any demographic information, it is impossible to determine the gender, racial, socioeconomic, geographic, or ideological diversity of respondents. Thus, the findings may not provide an accurate, representative, or generalizable picture of young Canadian voters who identify with right-wing populist beliefs.

Second, there is a subjective understanding of right-wing populism, which again, is a "thin" worldview that can encompass a wide range of specific beliefs and attitudes (Erl, 2021). Participation in the research study, though targeted through purposive sampling, was based on self-identification with right-wing populist viewpoints or figures, rather than a set of criteria. Moreover, it is possible that the politically charged connotations of the term "right-wing populism" deterred potential respondents or fuelled some of the negative sentiments expressed in the responses.

Third, despite attempts to word survey questions neutrally as possible, a few comments on the Reddit posts and free-response space raised concerns about the study's potential bias and affiliation with government operations such as CSIS, Statistics Canada. While these concerns may reflect the potential participants' suspicious outlooks, it was valuable to consider such perspectives within the scope of the research study.

Conclusion

In response to the research question, this study identified three significant factors contributing to right-wing populist support among Canadians aged 18–35: economic uncertainty, distrust in politics, and cultural conflict. These findings are not meant to overgeneralize people's experiences, as right-wing

populist support remains highly specific to one's environment and lived experience. Overall, though, these interconnected themes shed light on a growing sense of pessimism and disillusionment with Canada's existing economic, political, and social contexts. This, in turn, seems to increase young voters' receptiveness to right-wing populist messaging that promises to put ordinary people's interests first.

In the future, as younger voters make up a greater share of the electorate, Canada could see right-wing populist politicians and viewpoints rise to the mainstream. Furthermore, as many young people feel that their concerns are not being properly addressed, this opens the door for decreased, or alternative, political participation. Mixed opinions on certain issues, notably immigration, allude to complex divides within Canadian society, with the suggestion of a growing backlash against liberal or progressive social norms. Altogether, this raises questions about how inclusive and representative Canadian politics really is. Parties and politicians could use these findings to enact certain policies or capitalize off of negative sentiments about the future direction of the country.

Considering the inherent limitations of the project, further research could replicate the research methodology with a larger and more representative sample population. More specifically, the methods could be used to compare young Canadians' right-wing populist attitudes across geographic regions, socioeconomic backgrounds, and cultural groups.

The topic of right-wing populist worldviews among young Canadians opens many relevant pathways for future investigation. As social media, namely platforms such as Twitter and Instagram, remains the primary means of disseminating right-wing populist sentiments to young people, researchers should study the strategies used by such groups, specifically in Canada, to promote their ideologies. Furthermore, the effects of exposure to these messages on individuals' political attitudes is another critical topic. Left-wing populism, on the other side of the political spectrum, often addresses a variety of concerns relevant to Canadian youth; these include economic inequality, social justice, and hostility toward centrist and conservative establishment institutions. While it has not received the same attention as its right-wing counterpart, its integration of "anti-elitism" with more liberal ideologies is apparent in many left-wing party platforms.

Using similar data collection and analysis methods, future research should consider investigating the factors affecting the development of left-wing populist worldviews among young Canadian voters. Further examination into the dynamic between left- and right-wing populist movements in Canada could be key to the body of research on populism and political worldviews. The ways in which these movements take advantage of a politically charged environment, interact on social media, compete for voters, and co-opt each other's messaging could present significant implications for political discourse in the coming years.

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Appendix

Right-Wing Populism Questionnaire

Part A: Scaled Questions

To begin, you have been asked to rate your agreement with the following fifteen statements on a scale from “strongly agree” to “strongly disagree.”

Response Options: “strongly agree” (5), “agree” (4), “neither agree nor disagree” (3), “disagree” (2), “strongly disagree” (1), “don’t know/don’t want to respond”

Most politicians have ignored the issues that are important to me.

The current political elite are out of touch with the concerns of everyday people.

“Establishment” politicians should step aside in favour of political “outsiders.”

The federal government has mishandled the response to the COVID-19 pandemic.

“Political correctness” and “cancel culture” have negatively affected today’s society.

The media is not giving a fair representation of the political and social issues that matter to me.

The current political system is failing to protect Canada’s traditional values and culture.

Canada’s current economic, political and social systems are harming the working class.

The state should have a limited role in citizen’s lives and promote individual responsibility.

The government should institute further restrictions on immigration.

The government should take a tougher stance on crime and national security.

The government should implement protectionist economic policies to benefit domestic industries and workers.

The government should prioritize the interests of the native-born population over those of immigrants, minorities, and special interest groups.

There is little space for people like me in today’s political environment.

The country of Canada feels like it is on the decline.

Part B: Open-Ended Questions

Next, you have been given unlimited space to respond to the following prompts. Your answers should be specific and detailed, but do not need to be in full sentences. If there is anything else you would like to contribute but have not had the opportunity to share, please include it in the final question. Thank you for your participation!

How do you think your political views compare with those of your family, friends, and community?

How have your political views evolved over time and what events or experiences have influenced your perspective?

What specific issues or concerns are most important to you and how do you hope politicians will address them?

How do you evaluate political candidates or parties, and what qualities do you look for in a political leader?

What is your understanding of the term “right-wing populism,” if you are previously familiar, and what political positions or figures might you associate with it?

If there is anything significant you would like to share or comment upon, this is an open space.

The Resilience of Cambodia's Music Through Darkness; An Oral History of The Khmer Rouge Regime and Its Adverse Effects on The Legacy of Cambodia's Golden Era of Music

Justin Kdep

Abstract: In the early 1960's Cambodia was introduced to its "golden era" of music. Unfortunately, Pol Pot and the Khmer Rouge would overthrow Cambodia's Government, ending the reign of Cambodia's golden era, and leading to a 5-year regime filled with brutality, torment, and thousands of mass atrocities. The purpose of this study was to seek a better understanding of how the legacy of Cambodia's golden era has been impacted by the events of the Khmer Rouge regime. In order to preserve the voices of the survivors of the regime, oral history interviews were conducted with ten different survivors of the Khmer Rouge regime. The outcome of this study revealed that music from the golden era was significant to helping those who have endured such tragedy, by providing emotional support. This music has helped many survivors heal from their past traumas while also simultaneously helping to reminisce on their past.

Keywords: Cambodia, culture, golden era, Khmer Rouge, Khmer, music, regime, survivors, genocide

"Please Give Us Voice" by Chanrithy Him¹

When Broken Glass Floats, a nation drowns,
Descending to the abyss.

From mass graves in the once-gentle land,
Their blood seeps into mother earth.

Their suffering spirits whisper to her,
"Why has this happened?"

Their voice resounds in the spirit world,
Shouts through the souls of survivors,
Determined to connect, begging the world:

Please remember us.

Please speak for us.

Please bring us justice.

INTRODUCTION

"When Broken Glass Floats" is a fundamental Cambodian proverb and metaphor which often symbolizes a time when "evil" conquers "good."² This proverb directly coincides with the feelings of many Cambodians after having endured five or more years filled with brutality, torment, and thousands of mass atrocities under the Khmer Rouge regime. On April 17th, 1975, Pol Pot, who led the Khmer Rouge (Red Khmer), more formally known as The Communist Party of Kampuchea (CPK), incited a revolution, which in turn catalyzed a massive amount of fear and confusion amongst the Cambodian population. Unfortunately, Pol Pot and the Khmer Rouge were quickly able to overthrow Cambodia's leader, General Lon Nol who led the Republic of Cambodia (ROC). Just days under Pol Pot's new regime, he declared it "Year Zero" and soon, migrated thousands of Cambodians from the urban areas in Cambodia into the desolate countryside to undertake agricultural work. This was a secret plot initiated by Pol Pot and his party, in order to establish his goals of creating a classless agrarian society.³ Instead, its outcome would leave thousands of families separated⁴, and over two million fatalities caused by starvation, disease, overwork, and execution.⁵ Pol Pot largely disapproved of the urban and western ideologies which swept through Cambodia during the golden era, so any forms of artistic expression, or signs of intellectualism and professionalism were seen as treasonous. This also meant that religious worship and cultural practices were banned in order to remove any influences from Cambodia's past.⁶ In turn, this



*Baksey Cham Krong, Cambodia's first guitar group.
Courtesy of Mol Kamach, Argot Pictures*

led to Pol Pot's decision to ban anything culturally significant to Cambodia's past, and anyone who was seen as disobeying these new orders was easily punishable by death.⁷

Pol Pot's focus on the removal of Cambodian culture is broadly defined by anthropologists as the attitudes and beliefs of a particular social group. However, in this situation culture can more narrowly be defined in relation to the arts, such as music, dance, religion, and literature.⁸ The Khmer Rouge believed that anything holding any cultural value, most often forms of music or dance, was a threat.⁹

In the early 1960s, just a decade before the conquering of Cambodia by the Khmer Rouge, many of the cultural norms and practices in Cambodia began to shift vastly. Fortunately, many Cambodians viewed this as a positive change and often referred

1 Him, C., (2000). *When Broken Glass Floats: Growing Up Under the Khmer Rouge*, A Memoir. W.W. Norton.

2 Him, C., (2000). *When Broken Glass Floats: Growing Up Under the Khmer Rouge*, A Memoir. W.W. Norton.

3 Kambouly, D., Socheat, N., & Suyheang, K. (n.d.). *Historical Overview of the Khmer Rouge*. Documentation Center of Cambodia.

4 Sa, F., Poole, S., & Senghul, H. (2014). *Memory and the Khmer Rouge Tribunal*. Cambodia Law and Policy Journal, 3(1), 1-6.

5 Onion, A., Sullivan, M., & Mullen, M. (2009). *Pol Pot*. History.

6 Mamula, S. (2008). *Starting from Nowhere? Popular Music in Cambodia after the Khmer Rouge*. Asian Music 39(1), 26-41.

7 Linton, R. (1947). *The Cultural Background of Personality*. Appleton-Century Co.

8 Barton, G. (2018). *The Relationship Between Music, Culture, and Society: Meaning in Music: Implications for Classroom Practice*.

9 Delano, D. L., & Knottnerus, J. D. (2018). The Khmer Rouge, Ritual and Control. *Asian Journal of Social Science*, 46(1/2), 79-110.



Sinn Sisamouth record sleeve. Courtesy of CVMA

to this period as the “golden era.” This era of pop culture was heavily characterized by western ideologies and was most distinctively known for its new wave of Cambodian music, which was led by notable musical pioneers such as Sinn Sisamouth, Ros Soreysothea, Pan Ron, and many more. As stated by Alex Benson, “Imported Afro-Cuban records coupled with the instrumentation of Filipino marching bands broadened the palette of instrumentation available to Cambodia.”¹⁰ Many Cambodian musicians took it upon themselves to experiment with new styles of music and this allowed them to create a wide variety of ballads from genres such as rock and roll to genres with slow, romantic, and melancholy melodies, all of which were groundbreaking at the time. Their music eventually took Cambodia by storm with all of their greatest hits being heard playing at events such as parties, weddings, and in pop culture productions such as movies. However, because of Pol Pot’s decision to ban music in particular, many of their creative works disappeared during the regime. During this 5-year period, no one could purchase, play, or

sing popular Khmer songs without the fear of being punished by the Khmer Rouge. Even the discussion of music could be viewed as a betrayal of the party’s new customs. Despite all of these hardships, the effort to revive and continue the legacy of the golden era of Cambodian music has been gradual, but it is a process supported by many who believe that Khmer music from the golden era will continue to live on for future generations, and that it will now serve an even greater purpose than before because of its symbolic meaning for the past, present, and future.

LITERATURE REVIEW

The Effects of Genocide on Cultural Heritage

This literature review examines the goals of war and mass genocide in its efforts to conceal, or in extreme cases, eradicate, any potential influences of culture in societies which have had a strong sense of identity. One important aspect of culture which has had a massive influence in shaping one’s identity, is often displayed through performance arts, such as music. Ray Hudson, part of the *Department of Geography and Wolfson Research Institute*, explores this idea by stating that music can be connected to one’s “well-being” as well as their “identity”. He elaborates further by stating that, “music provides people with ways of understanding and developing their self-identity, of connecting with other people, of maintaining well-being, and experiencing and expressing spirituality” as well as providing “strong memories and associations with a person’s life.”¹¹ By suppressing these cultural themes which are displayed in music, a great population of survivors who have faced mass genocide struggle to uphold the legacy of their cultural heritage, as well as traditions for the current and future generations to come.

Petocz, and his colleagues write in the *International Journal of Cultural and Creative Industries*, which sought to determine the importance of cultural sustainability in terms of music, and its benefits to

10 Benson, A. (2018). *The Rise and Fall of Cambodian Rock and Roll*. Medium

11 Hudson, R. (2006). *Regions and Place: Music, Identity, and Place*. *Progress in Human Geography*, 30(5), 626–634.

cultural heritage. In their findings they indicate that, "Cultural heritage refers to the preservation in some form or other of the non-tangible aspects of society in the past" which includes things such as "musical compositions". It is also mentioned that cultural sustainability should be considered to "maximize its impact on the country's social and economic life."¹² Both Hudson and Petocz seem to believe that music plays a vital role throughout cultures. However, Hudson takes a more personal approach to his belief by discussing music's impact on the affected party, such as the survivors of genocide, rather than the perspective taken by Petocz, and his colleagues, who look at music's impact on society as a whole.

Another researcher by the name of Edward Luck highlights the personal recollections of Raphael Lemkin, a Polish-Jewish lawyer who focuses on the relevancy of cultural heritage, and who also first coined the term "genocide." Luck goes on to narrate Lemkin's first-hand experiences with being at the forefront of genocide. He states, "His personal experience deepened his understanding of the intimate connections between cultural and physical destruction, for the aggressors recognized that the annihilation of a culture or way of life was a more daunting task than mass murder."¹³ Lemkin's experiences encourage a new perspective on genocide; often, associations with this word are paired with the ideas of killings or of mass murder. While this may be true, many of the other implications of genocide, such as cultural and economic destruction, tend to be forgotten. Thus, the findings made by Hudson, Luck, as well as Petocz and his colleagues, all share a common theme, which is that genocide's focus is not only on mass killings of an ethnic group, but it also has a huge role in damaging their identities, cultural traditions, and practices, as well as harming the economic state of a society as a whole.

Legacy of the Khmer Rouge

One notable group of people who were impacted by the extreme beliefs of genocide were the Cambodian people. George Chigas and Dimitri Mosyakov, who are both apart of the "Genocide Studies" program at Yale University, outline the experiences that many Cambodians endured under the CPK. They stated that many groups of people were targeted by the Khmer Rouge such as, "Buddhist monks, ethnic minorities, and educated elites." The party also had a "Four-Year Plan", which read that it would "Continue the struggle to abolish, uproot, and disperse the cultural, literary, and artistic remnants of the imperialists, colonialists, and all of the other oppressor classes."¹⁴ Likewise, Estelle Bockers and their associates explain that "Every Cambodian alive during the regime experienced on average 10 traumatic events, such as starvation, lack of shelter, being close to death, forced labor, torture, or witnessing the death or killing of family members or friends."¹⁵ Similar to the findings presented by Hudson, Petocz, and Luck, both Chigas and Mosyakov, along with Bockers and their colleagues, determined similar tendencies when specifically focusing on the goals and practices of the Khmer Rouge.

For many survivors, the return to "normalcy" after the regime has been a slow and grueling process. Casey Quackenbush, a writer for Time Magazine, presents the findings of David Chandler, who is a Cambodian historian. Chandler claims that most Cambodians who are under their 50s do not have a direct experience of the Khmer rouge regime. This means that the "legacy of the genocide is extremely limited."¹⁶ Kate Hodal, who writes for The Guardian, adds that Cambodia was once home to an "important music scene," led by musical pioneers such as Sinn Sisamouth and Ros Soreysothea. Hodal believes that in a nation where 90% of artists, musicians, dancers, as well as intellectuals had been targeted by the brutalist Khmer Rouge regime, "remembering the past is a vital

12 Petocz, P., Reid, A., & Bennett, D. (2014). *The Music Workforce, Cultural Heritage and Sustainability*. International Journal of Cultural and Creative Industries, 1(2), 4-16.

13 Luck, E. C. (2020). *Cultural genocide and the protection of cultural heritage*. Getty Publications.

14 Chigas, G., & Mosyakov, D. (2022). *Literacy and Education under the Khmer Rouge | Genocide Studies Program*. Yale University.

15 Bockers, E., Stammel, N., & Knaevelsrud, C. (2011). *Reconciliation in Cambodia: thirty years after the terror of the Khmer Rouge regime*, 21(2), 71-83.

16 Quackenbush, C. (2019). *40 Years After the Fall of the Khmer Rouge, Cambodia Still Grapples with Pol Pot's Brutal Legacy*. Time Magazine.

aspect of safeguarding the future.”¹⁷ Although there has been a huge loss of musicians and dancers who have been an important symbol of Khmer culture, with the help of the very few artists who are still alive today, it has helped many younger Cambodians who have faced a “cultural barrier” within their lives, grasp the idea of their cultural identity and help to pave a legacy for the many future generations of Cambodians to come.

METHODOLOGY

The methodology used in this study aims to answer the question: *In what ways has the Khmer Rouge genocide influenced the cultural legacy of Cambodia's golden era of music in the present day, for survivors of the regime?* It is important to understand that the question already implies “In what ways has the Khmer Rouge genocide influenced” rather than “has.” This is because past research has already addressed the fact that the genocide has already inflicted harm on Cambodia's society in a number of ways, and this study aims to discover the significant effects from the event which took place. It is hypothesized that the methods used by the Khmer Rouge to eradicate Cambodian cultural practices and expressions, erased many of the survivors' memories of music from the golden era and limited its legacy which continues to affect the Cambodian population up until modern day.

Oral History Interviews

The design of this study takes on a qualitative approach for the methodology, which takes into account data that will help to understand people's beliefs, experiences, attitudes, behavior, and interactions.¹⁸ For the purposes of this research, a qualitative approach will best fit the means, because it uses data to account for historically significant events, and the impact it holds in present day, as well as looking into possible effects on the future.¹⁹ The methodology chosen for this study is oral history because it allowed the researcher to

conduct open-ended interviews, in order to help “preserve the voices, memories and perspectives of people in history,” as well as capturing “unique perspectives.”²⁰ The use of this method allowed survivors to share their unique and untold experiences, related to the period of the golden era in Cambodia. In the context of this study, ten individuals, who are all survivors of the Khmer Rouge genocide, and ranged from the ages of 50 to 80 were selected to be interviewed by the researcher. These interviewees were chosen based on their membership in the *United Cambodian Development Association* (UCDA), a non-profit organization based in the Northwestern region of the U.S, whose main focus is working towards the development of the Cambodian community and helping to provide support to the newer generation of Cambodians. Those who agreed to be interviewed received an informed consent form (refer to Appendix A), as well as a list of guided questions, prior to the day of the interview (refer to Appendix B). Each interview lasted about 30-40 minutes, and the list of guided questions was set up in a chronological fashion, meaning that each question was set to follow each survivors' experiences starting from their early childhood life, and then later moving on to their current adult lives. These questions pertained to any first or second-hand experiences of the golden era of Khmer music, as well as any memories about the Khmer Rouge. The researcher was allowed to ask any follow up questions if necessary, and throughout the interview, each interviewee was also allowed to share any photos that were significant to their personal experiences. Any faces of people in the shared photos were blurred out for privacy purposes, as well as if they did not give consent to the researcher.

Thematic Analysis

While analyzing the results of the interviews, a method of thematic analysis was applied to the research. Thematic analysis is often used in qualitative research to determine relationships between shared experiences. As for the purpose of this research, an oral history methodology was used in which survivors

17 Hodal, K. (2012). *Cambodia's art of survival*. The Guardian.

18 Pathak, V., Jena, B., & Kalra, S. (2013). *Qualitative research. Perspectives in clinical research*, 4(3), 192.

19 *Qualitative study design*. (2023). Deakin University.

20 Henson, P., Hobbs, H. (n.d.). *How to Do Oral History*. Smithsonian Institutional Archives.

of the Khmer Rouge regime shared their individual experiences with the researcher. After transcribing and analyzing these different stories told by the interviewees, any overarching themes that appeared more than four times throughout each interview were chosen as fundamental themes within this study. After completing all ten interviews, themes were revised to provide a consistent analysis to the topic of research.

Validity

The use of this methodology has helped to address a gap in the research because previous research has been limited to a small number of studies about the experiences surrounding the golden era of Cambodian culture, such as music. Research on this topic also tends to be generalized after focusing on one specific group. John Pirozzi was the film director for *"Don't Think I've Forgotten: Cambodia's Lost Rock and Roll."* In this film, Pirozzi explores a wide range of information related to the golden era. However, he barely acknowledges survivors who do not have any previ-

ous musical knowledge.²¹ In doing so, the methods used in this study will allow for a broader and unique range of different perspectives. The age range (50-80) in this study helps to eliminate any broad generalizations that have been made about a small population of Cambodian survivors in the past. As well it, allows the researcher to interview younger survivors, who might have had experiences that were second-hand, which should not be dismissed within the field of research because they still provide a greater view on any valuable information that has not yet been discovered about this topic.

Limitations

A plausible number of limitations to this study must be considered before coming to a final conclusion. The most significant of these is that the sample group of this study, (United Cambodian Development Association) consists of mostly male members (70%). This created difficulties with a wide range of representation with the selected interviewees. Furthermore, since the target

Figure 1: Themes and Definition

Themes	Operational Definition(s)	# of occurrences throughout all interviews
Self-healing	The process to help oneself recover from past tragedies. In this case, an experience with using music to help heal from past trauma.	8
Reminiscence	Experiences where an interviewee used music to help reflect on past memories.	6
Perseverance	An experience where the interviewee mentioned a time they pushed through and recovered from a difficult period in their life.	9
Social class	Experiences related to socioeconomic status	8
Conformity	An instance in an interviewee's life, where they felt like they had to conform to societal standards in order to "fit in".	10
Sense of Community	Using music to help connect with others within their community.	7

21 Pirozzi, J. (Director). (2014). *Don't Think I've Forgotten: Cambodia's Lost Rock and Roll* [Film]. Argot Pictures.

age range was 50-80, there was a greater population of younger survivors to interview. This meant less access to older age groups, and with the problems with being inclusive of older age groups there also came a difficult task of combating a language barrier, because most older interviewees only spoke in Khmer, which is the national language of Cambodia. Since the methods of this research only strictly include qualitative interviews, there is a higher probability of improper translation, which could reflect on the results of this study. Finally, these themes were subject to misinterpretation because the creation of the six commonly occurring themes was purely based on the researcher's judgement. However, an effort was made to clarify each event with the interviewee, in detail with the use of follow up questions. In turn, this will help to eliminate any false subjectivity on the part of the researcher.

FINDINGS

When using thematic analysis to help develop common themes which have appeared from the ten different interviewees experiences, a total of 12 themes appeared. However, these themes were only characterized by six commonly reoccurring themes, which are: self-healing, reminiscence, perseverance, cultural expression, conformity, and a sense of community. These themes and their definitions are depicted below.

Discussion

Just years leading up to Pol Pot's reign over Cambodia, the golden era was known to be one of the most important cultural scenes to take place at the time. The influence of music continued to rapidly spread to all areas within Cambodia. Interviewee #1, resided in the western part of Cambodia, known as the Batt-

Figure 2: Song Titles & Artist Names

Corresponding #	Song Title	Why They Chose This Song:
Interviewee #1	"Prot Phnom Sampov" by Sinn Sisamouth	Reminds him of his birth village, Phnom Sampov
Interviewee #2	"Sro Em Phalla" by Sinn Sisamouth, Pen Ron	It helps to lift his spirits
Interviewee #3	"Kompong Thom Chom Rom Chet" by Sinn Sisamouth, Ros Sereysothea	It allows him to revisit his childhood memories
Interviewee #4	"Dai Knong Dai, Pnek Knong Pnek" by Sinn Sisamouth	Reminds him of his wife
Interviewee #5	"Dorng Steung Sonkaeh" By Sinn Sisamouth	Reminds him of the scenery in Cambodia
Interviewee #6	"Yop Dob Pi Kal" by Sinn Sisamouth	His favorite song to listen to
Interviewee #7	"Kon Srek Rok Meh" by Sos Mat	She listens to this song in remembrance of her mother
Interviewee #8	"Romdoul Dorng Steung Songaeh" by Sinn Sisamouth	This song combines both Western and Cambodian influences which she enjoys
Interviewee #9	"Moha Sangkran" by Sinn Sisamouth	A very sentimental song which makes her feel happy
Interviewee #10	"Kouk Kam Procham Kay" by Sinn Sisamouth	A song to commemorate her parents and her husband

ambang Province. He vividly remembers being highly influenced by the music of the famously known artists during the time of the golden era. For instance, he stated, “We called him the king of the golden voice... Mr. Sinn Sisamouth. The male singer who is known to be the ‘Elvis of Cambodia’” Interviewee #10 adds, “I like all of his songs [Sinn Sisamouth], there were about over 10,000 songs he sang, and I love all of them.” Many other survivors shared similar stories related to artists from the golden era. As a matter of fact, almost all of the ten interviewees frequently responded with the names of these notable musicians (refer to Figure 2), which displays how critical of a role that these artists had with their influences on Cambodian culture during that time period. However, unlike Interviewee #1, Interviewee #3 coupled with a few others, have had little to no experience with the golden era of music in their early life. Interviewee #3 states, “I recall just listening briefly to it [Khmer music] and how I liked the sound of the music and the melody... But back then I didn’t know their names [Sinn Sisamouth and Ros Soreysothea].” Many Interviewees had also faced different living conditions and family upbringing prior to the regime. Interviewee #6 exclaims, “My father was a doctor, and my mother was a teacher, so I grew up in what I would consider a middle-class family”. On the other hand, Interviewee #5 stated, “My dad would pretty much trade and resell stuff, alongside being a famer... and my mom was a stay-at-home mom.” This led to the realization that wealth and status was a huge contributing factor on whether an interviewee had exposure and experiences related to the golden era.

Unfortunately, The Khmer Rouge or CPK quickly began to gain more power, and under the control of Pol Pot, every Cambodian was forced to migrate to the countryside. This meant essentially “starting over” to rebuild the entire economy without any urban or western influences. Interviewee #1 pointed out that, “The Khmer Rouge came in, so we had to abandon our village, which meant the schools or the public services, hospital, public markets, banking place, [were] all banned and all abandoned.” Just days after arriving to the countryside, refugee camps were set up, and within these camps thousands of Cambodians



A family at Khao I Dang Refugee Camp. (1985)

often faced unbearable, and unethical living conditions. Interviewee #2 adds to that by stating, “There are times when we have personally gone through days without enough food to eat... Each person doesn’t matter what age you are, was only allowed to eat two meals a day.” In order to survive during the regime, many Cambodians took to conformity in order to “fit in” with society around them and to not face the potential backlash from the Khmer Rouge.²² However, this deeply suppressed many memories that survivors had about their former life, which was something that was observed throughout all the interviews. Interviewee #10 who was a schoolteacher prior to the beginning of the Khmer Rouge regime claims that, “They [Khmer Rouge] kidnapped me and asked me if I was a teacher...I had to lie and say I could not read or write.” In addition to this, Interviewee #7 exclaims

22 Hickey, R., Killean, R., (2021). *Property Loss and Cultural Heritage Restoration in the Aftermath of Genocide: Understanding Harm and Conceptualizing Repair*. International Journal of Transitional Justice, 15(3), 468–489.

"In the morning, at exactly six o'clock, you would hear the whistle blow, which meant you had to get up and be ready for your assignment of the day." The Khmer Rouge had also forbidden any personal possessions because it went against Pol Pot's ideologies. Interviewee #3 explains "If you had watches or gold jewelry they'll take it from you... basically all you had left was plain working clothes." The singers of the golden era were seen to be the easiest scapegoats during this time due to their fame and status, as well as their significant contribution to Cambodian culture. So, considering that one of the goals of the Khmer Rouge was to attempt to eliminate any known literate and educated people, it ultimately allowed these musicians to be one of the first targets of the Khmer Rouge killings. Interviewee #2 recounts the tragic scenarios that one of these artists faced during this time period. He reveals that "They basically exiled her to some sort of small village to work in the rice field" he elaborates further by explaining that "This very famous singer [Ros Soreysothea] died of starvation, and her kids also died of starvation too." Additionally, many interviewees have described not being able to listen to music during this time. Interviewee #3 claims that, "They would not allow any music. And not just that, also [listening to] radio and stuff like that. If they caught you listening to music, they would kill you...I just followed them, whatever they said." Interviewee #6 adds "We are not allowed to listen to the former music. So, a lot of the music was propaganda, all about how wonderful the regime was, and all that kind of stuff."

In present day, many interviewees have reflected on their past experiences during the tragic time of the Khmer Rouge genocide. Based on the wide array of individual experiences which are described by all of the interviewees, it is a telltale sign that the Khmer Rouge has had such a distinct impact on all these survivors of the regime, and their remembrance of their own cultural heritage up to this day. Interviewee #2 stated: "You can't even listen to music during that time. So, it really affected you growing up, you know, like not being able to listen to your favorite song, and always being fearful about getting caught doing something that you know you're not supposed to do." Similarly, Interviewee #9 claims, "I remember that majority of [Khmer]songs used to be sentimental... after the war it all became songs of remembrance or mourning." In contrast, many survivors have also claimed to



A Family Arrives to Philippine Refugee Center. (1987)

use Khmer music as a safe haven and have stated that this particular type of music helped them to reflect on their past memories. Interviewee #3 describes, "When they [the singers] describe something, say like a river, I can imagine seeing myself walking along the same river and everything. So, it takes me back to my childhood memory of what I was doing then." Interviewee #1 also mentioned, "When I listen to a song, I can imagine a lot of things. I reconnect to the place where I grew up, connect to the memories that I have with my relatives, siblings, my family, the happy times, and the sad times." Furthermore, Interviewee #8 states, "Music, art and culture really empowers individuals and gives them their own personal identity." Unlike the original hypothesis of this study which claimed that the Khmer Rouge policies would have erased survivors' memories of music from the golden era, interviews revealed a mix of results. Some interviewees did forget music from this era, while others remembered both songs and artists before the Khmer Rouge and clung on to those memories in order to survive and to reinforce personal, community and national identity.

Conclusion

The findings of this study portray the enduring power of music in the face of atrocity and the resilience of the Cambodian people. After having overcome thousands of obstacles and facing a great amount of trauma and devastation in their lives, many Cambodians continue to deeply hold on to their experiences related to their cultural backgrounds. These interviews help us to understand that the golden era still holds an immense amount of importance to the Cambodian community, and although many of the musical pioneers of the golden era have unfortunately passed during the regime, their influence alongside their legacy, continue to live on within the culture that surrounds Cambodia to this day. Finally, it is important to acknowledge that the golden era and its music now serves an even greater purpose than before, which is by providing emotional support to survivors of the regime. It allows those who have faced plenty of hardships in their life to reminisce on their past, heal from the trauma they have endured, or even use this music to connect with people who have experienced the same as them. Even though some of my findings were consistent to those of past studies, I believe that this study helps to address the past issues of generalization related to the experiences with the golden era. The results that were generated help to further the understanding and importance of music and its existence in these survivors lives and will help to preserve the voices that have once been kept quiet. Further research on this topic should identify what steps Cambodians have taken to start the process of preserving their cultural traditions such as music. Projects such as the Documentation Center of Cambodia²³ and The Royal University of Fine Arts²⁴ have been helping to revitalize and preserve the legacies that many influential music artists and dancers had on the culture of Cambodia.²⁵ In contrast, I also encountered interviewees who has a strong passion for classical Cambodian dance, which was something that was also culturally significant to the golden era. Neang Visal claims, "Cambodian folk dance is a visual

form of storytelling, about religion, nature, weddings and funerals."²⁶ This displays the sheer importance of understanding all aspects of culture whether it be music, dance, religion, or literature. Overall, the exploration of these two areas of interest would also provide great contributions to research on this topic and will bring light to the struggles that many Cambodians are still facing, while also portraying the amount of support and strength the Cambodian people have shown in recent years past the regime, with to trying to lead on the legacy of their past into the future.

23 Etcheson, C. (1995). *Documentation Center of Cambodia*. Yale University.

24 Sihanouk, N. (1917). *The Royal University of Fine Arts*. Ministry of Culture and Fine Arts.

25 Gruspier, K., Pollanen, M. (2017). *Forensic legacy of the Khmer Rouge: The Cambodian genocide*. Academic Forensic Pathology.

26 Hodal, K. (2012). *Cambodia's art of survival*. The Guardian.

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Appendix A: Informed Consent Form

Interview Consent Form

Research Participants name:

Research investigator:

This interview will take (30 mins to 1 hour).

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken for the AP Capstone program require that interviewees explicitly agree to being interviewed and told how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.

Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

- the interview will be recorded, and a transcript will be produced
- you will be sent the transcript and given the opportunity to correct any factual errors
- the transcript of the interview will be analyzed by as research investigator
- access to the interview transcript will be limited to _____ and academic colleagues and researchers with whom they might collaborate as part of the research process
- any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed
- the actual recording will be kept until analysis and transcription of recordings are complete
- any variation of the conditions above will only occur with your further explicit approval

I also understand that my words may be quoted directly. With regards to being quoted, please initial next to any of the statements that you agree with:

_____ I wish to review the notes, transcripts, or other data collected during the research pertaining to my participation.

_____ I agree to be quoted directly.

_____ I agree to be quoted directly if my name is not published and a made-up name (pseudonym) is used.

_____ I agree that the researchers may publish documents that contain quotations by me.

All or part of the content of your interview may be used;

- In academic papers, policy papers or news articles
- In other media that may be produced, such as a spoken presentation

By signing this form, I agree that;

1. I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time;
2. The transcribed interview or extracts from it may be used as described above;
3. I don't expect to receive any benefit or payment for my participation;
4. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;
5. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Printed Name

Participant's Signature

Date

Researcher's Signature

Date

Appendix B: Guided Interview Questions

Question #1	Please State Name, Age, Place of Birth (POB)
Question #2	Can you describe the area in which you grew up?
Question #3	How many members are in your family? (# of siblings)
Question #4	Growing up what was the occupation of your parent(s)?
Question #5	At a young age, do you remember being surrounded by Khmer music of the golden era?
Question #6	If so, are there any specific times that you remember hearing/listening to music?
Question #7	Are there any influential artists (golden era) who you remember the most?
Question #8	Approximately what age were you during the invasion of the Khmer Rouge (KR)?
Question #9	Could you provide a brief background about any significant experiences you experienced during the regime?
Question #10	Do you remember what the (KR) controlled or forbid you against doing?
Question #11	Could you provide any information you may have about what happened to (Khmer) music during this time period?
Question #12	Were there any other challenges you faced during this time?
Question #13	How has your current life been impacted by the events of the Khmer Rouge?
Question #14	Are there any Hobbies/Jobs that you have which are related to your cultural background (Cambodian culture)?
Question #15	In what ways has Khmer music made an impact on your life (Current/Past)?
Question #16	Could you provide a song, both the title and artist that you feel has been the most impactful on your life?
Note: A number of responses to interview questions were anonymized in order to meet ethical research guidelines.	

Searching for Eclipsing Binaries in the GSFC-Eleanor-Lite Database

Andy Teng

Abstract: This paper presents the discovery of 66 new eclipsing binaries using a 2-algorithm data pipeline from sector 3 of the GSFC-eleanor-lite database. This database, which contains eleanor-processed full-frame image light curves, was analyzed with a pipeline consisting of two algorithms: ECLIPSR and BLS. In the paper, I present details on the pipeline and the methods used to verify the existence of the eclipsing binaries. I also provide a catalog of the 66 new eclipsing binaries, including the properties measured by the two algorithms. In comparison with the majority of other papers, this pipeline is faster, consisting of per-light-curve runtimes of approximately one second, while still delivering accurate detections. Finally, this work also identifies a lower eclipsing binary density in the GSFC-eleanor-lite database compared with most short cadence photometry analyses but it simultaneously has a higher percentage of new eclipsing binaries as opposed to reconfirming previously discovered ones.

Keywords: TESS, Eclipsing Binaries

INTRODUCTION

The Transiting Exoplanet Survey Satellite (TESS) is a currently operational NASA Explorer-program spacecraft in its second mission extension and has been in service for a current total of five years (Barclay, 2023).

The satellite’s main instruments are a set of four identical wide field charged-coupled device (CCD) cameras, with each camera having a field of view of $24^\circ \times 24^\circ$ for a total of $24^\circ \times 96^\circ$ of vision. TESS cameras observe continuously in a stream of two-second exposures and are summed over different periods of time for its different cadence types. For TESS’ short cadence photometry, images of selected targets were created in two-minute intervals. This short cadence imagery has already proven to be extremely beneficial for the detection of exoplanets and other selected

deep space object types over the course of its mission (Olmschenk et al., 2021). Additionally, long cadence photometry was taken once every 30 minutes during the primary mission period and stored in Full Frame Images (FFIs) (Barclay, 2017). Later, FFI cadences were reduced to 10 minutes and then 200 seconds for the first and second mission extensions, respectively. FFIs combine the uncorrected pixel data from the entire camera. Thus, these FFIs not only include planetary transits, but also have the potential to store data on eclipsing binaries (Kruse et al., 2019).

Eclipsing binaries (EBs) are a type of binary star system orbiting within the plane of the Earth in which the two stars periodically pass in front of each other, causing a temporary decrease in brightness that can be observed from Earth. It is this decrease in brightness (transits) that all detection methods examine

to determine whether the target is an EB, exoplanet, or another object entirely. In order to apply such detection methods, astronomers measure and plot the amount of received light over time, in what are called light curves. For an EB, the different sizes and luminosities of the two component stars create pronounced odd and even transits which can be analyzed (for an example of such a light curve, see Fig. 3).

Through this analysis, EBs provide valuable insights into the physical properties of stars, such as their masses, radii, and temperatures, which can be difficult to measure directly (Prsa et al., 2022). Astronomers can determine the size, shape, and periods of the stars' orbits and thus their masses through Newton's laws of gravitation; additionally, the duration and depth of the eclipses can be used to derive the stars' physical properties such as through the Stefan-Boltzmann law. Eclipsing binaries have been crucial in the development of modern astrophysics, providing a way to test theoretical models of stellar structure and evolution, and enabling astronomers to explore the relationships between stellar parameters. Furthermore, they are important tools for determining the distances to other galaxies by measuring the spectra, which helps to refine our understanding of the scale and structure of the universe. Finally, EBs also serve as an important safeguard against false positives for exoplanet detection, as the light curves of the two objects can appear to be similar due to the transit shape mostly being identical (Prsa et al., 2022). Thus, EBs were chosen as the target to examine FFI data over other transient phenomena for their lack of study within the literature in comparison with their importance.

LITERATURE REVIEW

As the name of the spacecraft would suggest, the analysis of research data from TESS over the past few years has mainly focused on the discovery of exoplanet candidates. Although this paper focuses on eclipsing binaries (EBs), the same issues that plague exoplanet transit candidates affect EB detection because both use transits as an identification method. The primary difference between the two is the different transit depths and durations for odd/even transits in EBs, as mentioned previously. Only one final step of comparing odd and even transits during vetting is necessary to distinguish the two. Thus, it is necessary to examine the methodology that past researchers have used to identify both exoplanets and EBs in order

to adequately understand the current situation for EB detection. To begin, it is necessary to investigate the fundamental principles that underlie such detection methods. Early on in exoplanet discovery, observation depended on Earth-based telescopes performing radial velocity analysis, where the gravitational effect of planets or other gravitational bodies on the parent star induced changes in its rotational velocity which can be viewed from Earth in the form of redshift in its spectrum (Mayor & Queloz, 1995). However, beginning with Kepler (Borucki et al., 2007) and later TESS (Ricker et al., 2014), astronomers could use much more refined photometry from orbital telescopes to identify the physical crossing of a planet in front of a star. Light curves gathered could then be used to find transit candidates.

Although such light curves produced from FFIs are a treasure trove for discoveries, the sheer volume of data is time and power-consuming to process. As such, being able to efficiently extract and process light curves is crucial for a successful algorithm. One common method of doing so was developed by Feinstein et al. (2019), who presented a new process of extracting light curves from FFIs, called *eleanor*. This Python package includes functionality that reduces noise and streamlines light curve analysis, including a point spread function (PSF) and primary component analysis (PCA) to create a corrected flux for each light curve generated. However, for some of the sectors, Feinstein et al. note that artifacts and background stars/planets would taint the data. Thus, it is important to find light curves from the FFIs of non-disrupted sectors and/or from time periods where such artifacts are not present.

In order to perform analysis of these light curves a variety of techniques are used, including the naive but standard box least squares (BLS) algorithm (Kovacs 2002, 2016), a multitude of machine learning approaches (Osborn et al. 2019) (Ofman et al. 2021), and Bayesian probability (Giacalone et al. 2021). Although all of these algorithms have been demonstrated to have their use cases in determining EBs and exoplanets, they each have varying drawbacks that must be considered. In general, machine learning is highly versatile but suffers from long training times and needing large, preclassified data sets to train on. On the other hand, simpler algorithms such as BLS are faster to run but are generally less accurate. BLS

applies a strict-period, box- fitting search that guesses and checks its way through transit durations and depths with a periodogram (Kovacs 2002). In between these two extremes are the statistical approaches, which can range from the simple Z- score checking and autocorrelation function (ACF) of Howard et al. (2022) to the complex, Bayesian modeling of Gialalone et al. (2021). It is important to balance both effectiveness and efficiency: an algorithm must both have high accuracy for a given inputted light curve while also being time-efficient to run.

One such example of an optimized algorithm that stands out from those previously mentioned is by Kruse et al. (2019), who modified the Quasi-automated Transit Search algorithm (QATS) (Carter and Agol 2013) to classify transit data from the K2 mission. QATS is more flexible than the strict periodicity of the BLS algorithm and instead only examines consecutive transits that fall into a time window. Thus, QATS can detect exoplanet candidates and EBs that exhibit transit timing variance (TTV) while being simpler than the more complex approaches by only needing to examine the transits within a few specific windows rather than the entire light curve. After the QATS algorithm was used on the data, human vetting was needed to complete the process of filtering out transit candidates, as is standard in the field. Although the QATS algorithm has strong accuracy and is relatively efficient, it still maintains some drawbacks due to the fact that it was designed specifically for Kepler exoplanets. Additionally, my data pipeline was exclusively coded in Python for the sake of simplicity and time efficiency, and thus it was decided that the C++ coded QATS would not be included.

Due to the varying drawbacks and benefits of each algorithm, it is common to combine them into what are called data pipelines. One recent pipeline, created by Olmschenk et al. (2021), presented a neural network model for identifying planetary transit candidates in TESS FFIs. Their convolutional neural network (CNN) runs on the Keras and Tensorflow machine learning python packages. Data is fed in through several preprocessing stages, including eleanor (Feinstein et al., 2019) as well as QATS (Kruse et al., 2019). Finally, vetting was done with the Discovery and Vetting of Exoplanets (DAVE) (Kostov et al. 2019). The CNN is a 1-dimensional deep neural network with 11-13 layers that can perform fitting on a

light curve in reportedly ~ 5 ms. The CNN, dubbed *ramjet*, was used to determine possible planet transit candidates and then classify them based on the process it learned during its training phase, which consisted of confirmed ExoFOP- TESS-confirmed planets. Even though it was possible for the CNN to identify EB light curves within the FFIs as well, the primary focus of the training set was exoplanets, and thus most outputted EB candidates were rather rejected exoplanets, demonstrating a lack of focus on EBs that was exemplary of most reviewed sources. The overall success rate on their testing data set reached nearly 90% and was generally time-efficient during training compared with implementations of machine learning approaches. However, their data pipeline still required a vast quantity of resources to run and train the CNN which would be impossible for me to replicate, mainly due to time constraints. Clearly, a theme of overly complex algorithms combining to form computationally expensive data pipelines is beginning to emerge.

Indeed, this pattern continues in the few EB-focused papers published. Specifically, the most significant piece of literature published on TESS EBs, written by Prsa et al. (2022), examined short cadence light curves with a 3-algorithm data pipeline followed-up by vetting with DAVE and modeling. They examined approximately 200,000 targets selected from several preexisting public catalogs and databases and subsequently generated a list of 4,584 EBs from TESS sectors 1-26 to be added to an initial catalog. This catalog was later expanded by 370 new candidates identified from short cadence light curves by Howard et al. using another 3-stage pipeline with vetting. In order to create statistical thresholds to differentiate EBs that pass through the algorithm, they manually classified several thousand light curves, ultimately arriving at a multi-pass subtractive smoothing method and creating several heuristic thresholds. On the initial pass, a maximum power of greater than 1,500 for the periodogram was determined, which would signify the presence of an EB within that light curve. The pipelines of the two previously discussed papers were thorough, but confirm two gaps within EB identification literature. First, the majority of existing data pipelines are too complex or demanding on hardware for budget-limited researchers to implement, with three algorithms or multiple passes being done per

light curve. Second, even within the already limited EB literature, there still exists a focus on short cadence photometry as opposed to FFIs.

To summarize, it is evident that the majority of previously mentioned literature has mainly centered on exoplanet identification, and thus there appears to be a research gap in EB identification (Prsa et al. 2021). Additionally, upon closer examination of the limited number of EB-oriented sources, there is a significant lack of analysis of FFIs, with almost all targeting short cadence light curves for their relative ease of access. With the context of prior data pipelines in place, the following methodology was designed to investigate the efficacy of a novel FFI database, GSFC-eleanor-lite, and suggest possible candidates for new EBs using a new, lightweight data pipeline.

METHODOLOGY

Dataset

The GSFC-eleanor-lite dataset was chosen to take advantage of both the aforementioned eleanor FFIs and access to the most recent data. In the past, the short cadence photometry, which singled out specific targets, was significantly easier to examine for research; at the time of data pipeline creation, the most recent data release was for Sector 3, which coincidentally had the greatest number of light curves of any of the released sectors. As such, it was chosen to provide a diverse range of light curves to select from. However, searching through all 1.9 million light curves would be unfeasible, so a subset of 50,000 light curves was chosen from right ascensions between 97 and 100 degrees. These right ascensions were chosen to limit CCD variance (although this was later realized not to be useful) and for the region's high density of light curves. For this subset of 50,000, the data pipeline was run to demonstrate its faster runtime compared with previous pipelines and the usefulness of the GSFC-eleanor-lite database as a source of EBs and exoplanet candidates. The CSV of the dataset entries was first downloaded from the MAST portal, and then processed down to only nine-digit Tess Input Catalog (TIC) numbers and those with the requisite quality flags using Python, arriving at a final dataset of 47,298 light curves. After that, FITS files of the light curves, stored in the eleanor-lite format, were queried

from the Mikulski Archive for Space Telescopes using the astroquery Python package and was then inputted into the data pipeline itself. The eleanor-lite format discards all non-essential data after processing with *eleanor* itself, enabling easier bulk downloads (Powell et al. 2022).

Overview

The methodology of this paper consists of a secondary data analysis performed with a data pipeline made up of two primary detection algorithms. The two, arranged in order of operation within the data pipeline, are the Eclipse Candidates in Light curves and Inference of Period at a Speedy Rate (ECLIPSR) algorithm (IJspeert et al. 2021) and the box least squares (BLS) algorithm (Kovacs 2016).

First, (paraphrased from IJspeert et al., who created the algorithm) ECLIPSR functions by determining transit locations and then finding periodicity, with the algorithm distinguishing between flat-bottomed, V-shaped, and full eclipses. With these three light curve models, it uses multiple derivatives of the light curve to detect the slopes occurring at the beginning and end of eclipses. By multiplying the first and third derivatives, the signal is amplified while noise is smoothed out. The peaks in the second derivative indicate the start and end points of the eclipse as well as marking the flat bottom of an eclipse. Additionally, the signal to noise ratio (SNR) is measured to remove false peaks that appear as transits, but are in actuality just noise. After the correct peaks are identified as transits, ECLIPSR then starts period-searching. A pre-determined range of periods is then scanned, and the highest goodness-of-fit is used to determine the best period. The range of periods is determined by the minimum and median separation between eclipse candidates, and it is checked whether doubling the period results in distinguishable secondary eclipses (IJspeert et al., 2021). If not, the algorithm checks for eclipses that have the same period but are at a different phase offset. Once the period has been determined, the light curve is assigned a score based on how closely it matches the model; a score of more than 0.36 is considered a proven EB as found by IJspeert et al. This algorithm was chosen for its simplicity and repeatability, with only one transit necessary to fit the model and confirm the existence of an EB.

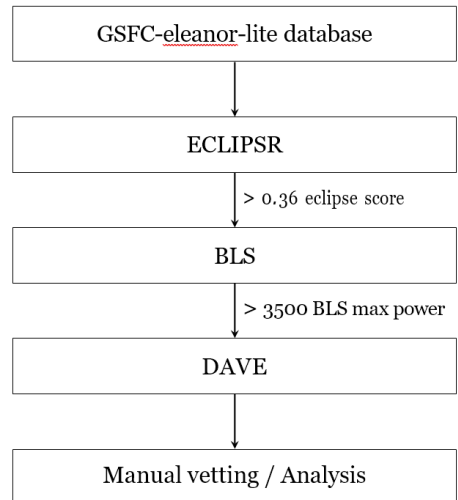
Although the previous algorithm is usually more than sufficient to identify the light curves necessary for later model fitting and triage, it is always beneficial to do a final run through of a relatively simple algorithm for final confirmation. BLS is significantly more time-consuming than ECLIPSR, so it is important to run this algorithm last to reduce the number of false positives that erroneously run through it. One of the main advantages of BLS over other “simple” algorithms is that its transit model consists entirely of background with strict, periodic rectangular transits. Thus, with so few parameters that need to be tuned for each pass, the algorithm remains one of the fastest of the naive approaches (Kovacs 2002). Using BLS, accurate half-periods, periods, and double-periods can be generated to determine the presence of an EB over an exoplanet, and guarantees its detection if it falls within the tested range. For this paper, detached EBs with periods between 0.5 and 27 days were targeted due to this range of periods including the majority of known EBs within TESS data (Prsa et al. 2022).

The data pipeline was run in multiple stages to determine the efficacy of the various constituent algorithms and to ensure that everything is running properly. First, a dry run of the first thousand light curves is run through with only BLS to determine a baseline efficacy of the data pipeline and to determine the time needed to download and process the files. Then, a more thorough run of 10,000 light curves is performed with both BLS and ECLIPSR to better understand the full data pipeline and to characterize its speed. Finally, the final run of the full dataset is performed for characterization of the database itself. With this final run through, the final list of candidates is generated, which is then vetted and compared against the existing Prsa et al. database. After vetting, it is possible to perform modeling or other analysis on the light curves, such as through the Python package ELISa (Cokina 2021), which runs an affine-invariant Markov-chain Monte Carlo simulation to generate stellar parameters; however, that is mostly outside of the scope of this paper.

Candidates that are generated from the final, full run of the data pipeline are subsequently passed through DAVE and subjected to visual examination to remove false positives. DAVE is an industry standard Python program that applies centroid and flux analysis to determine whether inputted candidate light curves are valid. For visual examination, if evident primary and

secondary transits could be confirmed to be periodic, they were classified as confident. If transits were ambiguous due to noise or not being differentiable between primary and secondary transits, then they were subsequently classified as probable. Light curves were determined to be non-EBs when the transit was found to be bad data. This appeared as a drastic angular decrease in flux, oftentimes going below zero in the normalized flux graph as opposed to a less than ten percent decrease in received flux for true transits. Finally, all accepted light curves that passed vetting were added to a file and compared against the existing EB database to test the validity of this data pipeline and to find if any new EB candidates were generated from this process.

The use of two, relatively fast algorithms within this data pipeline, as opposed the norm of three-algorithms within the existing literature, was hypothesized to be more efficient and result in fewer false negatives than past approaches. On the other hand, it would allow more false positives into the final candidates list and the added time needed for manual vetting may significantly impact the efficacy of the pipeline. For the GSFC-eleanor-lite database itself, the non-discriminatory nature of the light sources contained within the FFIs suggested that it would contain a lower, but still substantial EB density than short cadence light curve data. This factor could also artificially inflate the false positive rate beyond what the data pipeline itself would normally output.



RESULTS

During the first dry run of only the BLS algorithm, 1,000 light curves were analyzed, yielding 52 candidates in 2 hours. This result is significantly higher than the 0.5% confident EB rate of Howard et al. However, after close examination of the light curves, it was clear that manual vetting was needed to validate candidates. For the initial run of the data pipeline with only the BLS algorithm, there were a large number of false positives that were not caught by the data quality flags of the database. After manual vetting, only 14 of the original 52 candidates proved to be actual EBs, which is more in line with Howard et al.'s findings.

During the second run through, going through the first 10,000 light curves of the dataset, the original candidates list was revised and added to. This second run consisted of both ECLIPSR and BLS, with extracted periods being matched to ensure that the two algorithms were in agreement. The pipeline generated 273 light curves from the 10,000 processed. It is important to point out that light curves that triggered bad data quality flags or threw errors were immediately rejected and thus future investigation is necessary to determine if they are actual EBs. However, the fact that past researchers flagged it during initial processing makes this concern unlikely. After analyzing the runtime of the various algorithms, it was noted that a large portion of the time processing each light curve was dedicated to downloading the file itself (up to 10 seconds in some cases), and processing of most light curves through both algorithms took only ~ 1 second.

For the final run of the total 47,298 light curves, 1,353 candidates were generated. The previous estimate of ~ 1 second per light curve for the data pipeline was further confirmed, with median times of ~ 0.1 second for ECLIPSR and ~ 0.9 second for BLS. After this final pipeline run, analysis began with visual confirmation of candidate light curves with a custom Python program to manually classify candidates into the following three categories as described in the methodology: non-EBs, probable EBs, and confident EBs. Examples of these three classifications are provided below as reference for manual vetting procedures. From the 1,353 initial candidates after DAVE, further analysis and vetting confined the list to 70 confident and 40 probable EBs, taking approximately one-and-a-quarter hours to complete. The list of candidates

was thoroughly examined to remove false positives. Additionally, EBs that shared the same period were only counted once, as these TICs most likely belonged to the same object. If such TICs were included, there would be 124 final candidates. As such, the pipeline had a success rate of 9.16%.

After comparing with the existing Prsa et al. database, six of the candidates were present.

DISCUSSION

Although the success rate is relatively low (and thus the false positive rate is relatively high) compared with past studies, such as Howard et al. with a 40-50% success rate compared with only approximately 9% for this pipeline, this was the hypothesized outcome, albeit lower than expected. The faster runtime and less stringent conditions of the algorithms reduced the risk of false negatives. However, this benefit was offset by the time required to perform manual vetting, which ended up being significantly more than expected. For future studies, the pipeline may need to be tuned to decrease the false positive rate and to verify whether it is the pipeline, the database, or a combination of both that is causing this result.

For the total dataset, 124 of the 47,298 light curves were identified as probable or confident EB candidates, resulting in an EB pass rate of $\sim 0.26\%$ (0.23% excluding duplicate objects). This relatively low rate is partially explained by the methodology of the original GSFC-eleanor-lite database, which processed all FFI light curves through eleanor with a TESS magnitude of greater than 16, thus increasing the number of included light sources that do not contain useful data. Additionally, the low pass rate is also partially caused by the momentum dump and data downlink periods

Figure 1. Non-EB, transit is bad data

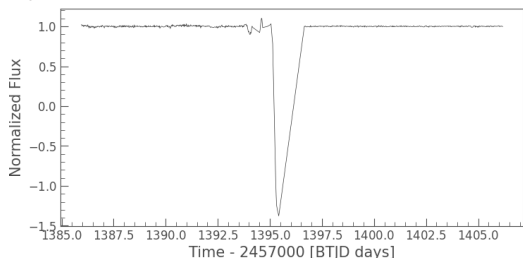


Figure 2. Probable EB, ambiguous odd/even transit, not enough transits, or too noisy

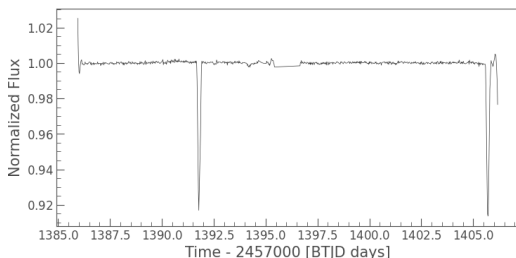
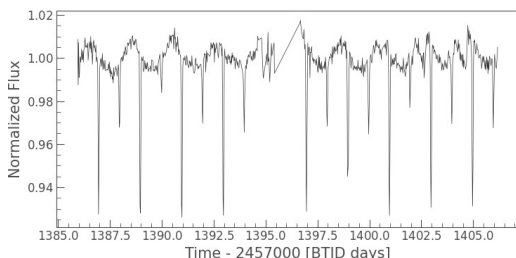


Figure 3. Confident EB, note the obvious primary and secondary transits



at the apogee of each orbit, which creates gaps in the flux that are in some cases interpolated in the data as transits. This apparent transit would usually be caught by ECLIPSR, which is capable of handling noise, but in rare circumstances would take on the exact shape of a transit and thus pass through both algorithms as BLS does not take into account transit shape. Despite the goal of eventually reducing the appearance of false positives in general, manual vetting remains an essential step in ensuring the validity of exoplanet and EB candidates such as by citizen science projects like Planet Hunters (Eisner et al., 2021). Further studies should be conducted to determine the effectiveness of other automated methods in identifying true positives and minimizing false positives as well as reducing the necessity of projects like Planet Hunters.

Prsa et al. and later Howard et al. confirmed an approximate EB density within short cadence light curves of 0.5%. In comparison with this paper’s 0.23%, the density is lower as expected and explained earlier, but the true value of the database comes from the fact that most of the final candidates were not present in the existing catalog, highlighting the importance of FFIs to future EB research. Howard et al.’s follow-up

to Prsa et al. yielded 370 new additions to the catalog out of roughly 2,500 final candidates, approximately 15%. After analyzing the final candidates by checking with the existing catalog, only six of the final 110 were already present, with four being identified within the pipeline’s candidates as confident EBs. Thus, from the list of confident candidates, a total of 66 new known EBs was generated from the data pipeline, roughly half of all candidates and significantly greater than the 15% of Howard et al. (see appendix). When compared with previous short cadence efforts, the density of new EBs is significantly higher for GSFC-eleanor-lite, with a 0.22% (104 out of 47,298) rate compared to a 0.07% rate for Howard et al. (370 new EBs out of approximately 500,000 initial light curves).

Furthermore, there were only seven EBs present within the preexisting catalog not found by the data pipeline. Out of these seven, five were extremely short period EBs outside of the 0.5--27-day period range set for the scope of the data pipeline. After rerunning the pipeline with an updated period range on the five new light curves, they each passed without issue. Another light curve of the seven contained in the catalog but outside the candidates list appeared to be either an error on the part of the original entrant or had a period longer than the length of the sector 3 imaging time as no transits were seen for the entirety of the light curve. The final missed EB was missed likely due to a large data gap in the center. Thus, the new data pipeline performed as expected, with extremely few false negatives and a large number of false positives, which future research would likely seek to rectify. Additionally, the results demonstrate that even with a reduced, 2-algorithm, single-pass pipeline, success rates are not diminished much, if at all. With its low computational requirements and efficiency improvements over past 3-algorithm approaches, the data pipeline has proven itself as an effective tool for EB determination in FFI databases.

Limitations

The primary constraint of this approach is the time required to run the programs, which limits the size of the dataset that the algorithms can be performed on. The program was run on approximately 50,000 light curves of the several million contained within the GSFC-eleanor-lite Sector 3 database. With a lim-

ited dataset and a limited target ascension range, the EB density calculated from this data pipeline may be less generalizable. Future research is necessary to fully characterize the efficacy of GSFC-eleanor-lite without such restrictions and to cut down on the issue of longer manual identification times, but nevertheless, the initial findings do show extreme promise. Furthermore, not an insignificant number of target TICs were identified as the same object, which arises from the nature of the GSFC-eleanor-lite database itself. However, it is possible this was not a major issue as the occurrence of duplicate EBs also likely meant the duplication of non-EBs. Thus, future research could attempt to determine if such occurrences actually present an issue and if so, rectify it. For the database, future papers may be necessary to examine other sectors and a wider range of targets to further determine its effectiveness as a source of EBs, in addition to other astrophysical phenomena. This paper only analyzed a small portion of the database as an initial characterization to determine its potential.

CONCLUSION

This research addresses the existing gap in the literature by examining a new dataset: the GSFC-eleanor-lite database (Powell et al., 2022). The new data pipeline, consisting of ECLIPSR and BLS, has been proven to both be fast and effective for targeted EBs. Furthermore, it was found that the GSFC-eleanor-lite database has a lower EB density than that of the short cadence photometry analyzed by Howard et al. but is an effective source of new EBs as opposed to mostly confirming past data. As such, all research goals initially set forth were accomplished.

Future research can seek to confirm or deny the initial insights provided by this simplified data pipeline as well as further determine if the database is worth mining as a source of EBs. As a result of this research, 66 new EBs were discovered and several intriguing directions for future study were revealed.

Software: Astroquery (Ginsburg et al., 2019), eleanor (Feinstein et al., 2019) IPython (Perez & Granger, 2007), Lightkurve (Lightkurve Collaboration, 2018), NumPy (Oliphant, 2007), Matplotlib (Hunter, 2007), Python

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SEARCHING FOR ECLIPSING BINARIES IN THE GSFC-ELEANOR-LITE DATABASE

APPENDIX

The following is a list of the 66 new confident EB candidates found using the pipeline. “Per” in the following table is short for period, all of which are measured in days. TICs with ECLIPSR periods of -1.0 failed its period-checking component. However, visual examination of their light curves resulted in their approval for the final list. Note that due to the naive nature of BLS, it is necessary to compare both half, normal, and double periods to check with the ECLIPSR period; if at least one matches within 5%, it can be concluded that the candidate is likely an EB.

Table 1.

TIC	ECLIPSR Score	BLS Max Power	ECLIPSR Per	BLS Per	BLS Half-Per	BLS Double-Per
142017247	0.70058	13681.907	3.77246	1.88869	0.944346	3.77739
142018009	0.74375	7363.6759	5.469861	2.736749	1.368375	5.473498
142087248	0.73804	6426.7324	3.206853	1.602473	0.8012367	3.204947
142106257	0.56804	8248.6442	-1.0	2.733216	1.366608	5.466431
142109975	0.41142	9653.9965	0.4671718	0.934629	0.4673145	1.869258
150427902	0.62584	9340.0726	0.5830927	0.5830389	0.2915194	1.166078
150428527	0.63894	22989.483	-1.0	17.21555	8.607774	34.4311
150430915	0.58194	16090.666	0.8496081	0.8498233	0.4249117	1.699647
150431387	0.5101	19722.816	0.7325885	0.7314488	0.3657244	1.462898
150437909	0.38911	217625.5	2.715104	1.35689	0.6784452	2.713781
150441162	0.56088	3629.7138	1.859403	0.9293286	0.4646643	1.858657
150442254	0.55518	141672.76	5.985096	1.489399	0.7446996	2.978799
150443182	0.86263	92283.073	2.599161	2.595406	1.297703	5.190813
150513899	0.67452	36595.109	3.767928	1.885159	0.9425795	3.770318
167246108	0.90129	40164.122	4.688481	2.344523	1.172261	4.689046
167250056	0.47302	67813.404	0.8584951	0.8586572	0.4293286	1.717314
167250519	0.55152	20382.502	1.249065	1.249117	0.6245583	2.498233
167251459	0.95775	566711.81	6.549728	3.273852	1.636926	6.547703
167308162	0.83735	5456.09	9.286412	9.30742	4.65371	18.61484
167308280	0.77423	48414.495	1.099269	0.54947	0.274735	1.09894
167308872	0.74702	36845.166	1.202029	1.199647	0.5998233	2.399293
167309182	0.70976	35595.374	3.993886	3.991166	1.995583	7.982332
167337786	0.84128	19726.025	8.432229	8.416961	4.208481	16.83392
167339237	0.76789	35216.537	4.369485	2.183746	1.091873	4.367491
167366499	0.70699	8735.5248	3.023812	3.021201	1.510601	6.042403
167421087	0.39361	7608.6522	0.557517	0.5583039	0.2791519	1.116608
260541900	0.68296	9532.2242	2.960863	1.480565	0.7402827	2.961131
260606384	0.78845	5391.5507	11.03146	11.01943	5.509717	22.03887
260608080	0.64695	7168.8303	3.424954	1.710247	0.8551237	3.420495
260608425	0.67785	262129.23	0.7632962	0.7632509	0.3816254	1.526502
260608573	0.70088	346398.22	1.388171	1.383392	0.6916961	2.766784
260635551	0.69275	34574.912	1.092206	0.5459364	0.2729682	1.091873
260636186	0.45719	3741.378	1.39404	1.388693	0.6943463	2.777385
260637574	0.67584	6431.9297	1.839197	0.9204947	0.4602473	1.840989
260640388	0.4711	5865.1884	0.4808455	0.9611307	0.4805654	1.922261

SEARCHING FOR ECLIPSING BINARIES IN THE GSFC-ELEANOR-LITE DATABASE

TIC	ECLIPSR Score	BLS Max Power	ECLIPSR Per	BLS Per	BLS Half-Per	BLS Double-Per
260653901	0.63321	16519.756	-1.0	12.63074	6.315371	25.26148
260654689	0.44783	7610.2046	1.281164	1.282686	0.6413428	2.565371
260658047	0.65166	6199.5947	0.9786507	0.9787986	0.4893993	1.957597
278683642	0.81095	28369.501	4.24603	4.238516	2.119258	8.477032
278683864	0.43504	5208.425	-1.0	18.85866	9.429329	37.71731
278683875	0.93839	520786.74	10.28662	18.79329	9.396643	37.58657
278684227	0.64573	17565.285	1.24816	0.6236749	0.3118375	1.24735
278726860	0.8238	4703.1256	9.213695	9.204947	4.602473	18.40989
278730069	0.72438	22200.132	2.486045	1.245583	0.6227915	2.491166
278776988	0.66254	51694.249	1.826993	0.9134276	0.4567138	1.826855
293220838	0.74858	37689.834	1.356033	1.355124	0.6775618	2.710247
293224945	0.82025	25822.334	3.570114	3.570671	1.785336	7.141343
293225157	0.8375	127256.87	5.573882	2.784452	1.392226	5.568905
293268007	0.77315	22873.484	4.061489	2.030035	1.015018	4.060071
293268574	0.75898	45415.106	5.115924	10.14488	5.072438	20.28975
293271277	0.8907	55029.873	4.567738	4.574205	2.287102	9.14841
293273040	0.7717	187060.5	4.960707	4.968198	2.484099	9.936396
293347945	0.48883	135326.7	-1.0	19.64664	9.823322	39.29329
348839218	0.79797	20275.583	2.970327	1.485866	0.7429329	2.971731
348839473	0.68513	5451.424	0.7573335	0.7579505	0.3789753	1.515901
348839494	0.8475	94841.57	3.174446	1.588339	0.7941696	3.176678
348841791	0.54564	23073.018	1.198034	1.19788	0.5989399	2.39576
348843066	0.63717	46696.295	-1.0	19.31802	9.659011	38.63604
372852412	0.73425	10213.969	2.001551	2.0	1.0	4.0
375033166	0.44292	4933.1203	0.4780668	0.9558304	0.4779152	1.911661
375035513	0.93495	864058.88	4.117609	2.056537	1.028269	4.113074
375058760	0.94502	2325567.2	7.137274	7.132509	3.566254	14.26502
514257394	0.64561	7174.3868	3.4246	1.710247	0.8551237	3.420495
737153831	0.93495	864059.02	4.117609	2.056537	1.028269	4.113074
737487643	0.75251	8104.8528	0.7573412	0.7579505	0.3789753	1.515901
737496372	0.65166	6199.5928	0.9786507	0.9787986	0.4893993	1.957597

Why Are Young Canadian Men Avoiding the Humanities?

Arjun Deckha

Abstract: Historically, the humanities have been highly respected. Since the mid-20th century, however, these fields of study have experienced an immense decline in undergraduate enrollment. Scholars have identified this trend as a global humanities ‘crisis’ and highlighted the lack of male participation in the fields may be a root cause. In addition, few to no scholarly studies have analyzed this issue in Canada. Through eleven semi-structured interviews, this qualitative study aimed to highlight the primary reasons why Canadian young men are avoiding humanities undergraduate programs. The findings demonstrate that young men do not study the humanities because they are not exposed enough to the fields, are driven by short-term success, and are heavily influenced by stereotypes and their peers. Future studies should consult educators and school boards to allow a stronger application of this research into the educational system and young men’s lives.

Keywords: Humanities, Young Men, Canada, Stereotypes, Crisis, Lack of Exposure

Introduction

Historically, the humanities were highly regarded fields of study. Defined as fields of social science based on humanistic content, the humanities include a wide range of subjects such as language, linguistics, literature, history, and philosophy (Bennett, 3). Moreover, studies have shown that studying the humanities can increase human prosperity and psychological richness, a term that underscores a strong life shaped by learning experiences (Westgate & Oishi, 2). However, there may be a global humanities ‘crisis’ (Ahlburg & Roberts; Hall, 11). In 1966, upwards of 14% of students studying at US institutions pursued humanities degrees. This percentage halved by 2010 to 7%, a clear indication of the fields’ decline (Ahlburg). This rapid decline, which began in the 1960s, is correlated with the lack of male presence in current-day humanities programs (Ahl-

burg & Roberts). In addition, a study analyzing gender disparities in fields of study at Tel Aviv University described the humanities as “the most feminine” field of study with only 23% of individuals in humanities programs being male (Ayalon, 282). In a Canadian context, although Canadian men made up only 43% (931,220) of students enrolled in postsecondary institutions in Canada in 2021 (Statista), they made up solely 37.9% (259,235) of those who had completed a humanities bachelor’s degree by 2021, demonstrating their lower rate of enrollment in humanities undergraduate majors in comparison with their female counterparts (Statistics Canada). This disparity between the percentages of male and female humanities majors remains unexplored. Although the global decline of the humanities has been discovered by Ahlburg, and the low rates of male enrollment in the fields are observed by Ayalon (282) and Long (3), a gap remains.

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This study aims to highlight the primary reasons why Canadian young men are avoiding the humanities. It will be conducted through a qualitative analysis of semi-structured interviews with Canadian young men currently enrolled in a non-humanities major Canadian undergraduate program. By emulating the thematic analysis research method of Langhorne (305), this study will observe the primary conceptual themes of the responses. The main question being addressed in the eleven, 30-minute interviews with different young men is: "Why did you choose to not study the humanities?" The primary themes and potential rationale as to why young men are avoiding the humanities will be highlighted through the analysis of quotations. Specific keywords in quotations from various interviews that relate to common themes will be established. Ultimately, it is fundamental to understand why young men are not studying the humanities. Not only do the humanities force individuals to acquire humanistic knowledge, but also teach valuable practical skills that humans can apply their whole lives (Jay, 3). The implications of this research may allow us to improve these low male humanities rates and help us determine how we can get young men to reconnect with the humanities.

Literature Review

The Analysis of Social and Intellectual Factors and Their Correlation with College Major Selection

In Päßler & Hell's 2012 study, the correlation between college major choice and vocational interests and cognitive abilities in both men and women is analyzed (479–96). This quantitative study was conducted at various German universities with a total of 2,655 participants (482). Päßler and Hell concluded that while career interests and cognitive abilities were both significant factors in the choice of college major for both men and women, the career was prioritized more (487). Men cognitively had more "math-tilted profiles" and thus, were more likely to select a science/engineering college major that led to a professional scientific career (Päßler and Hell 491). Lastly, Päßler and Hell's data does indicate that only 9.6% of male participants in the study had chosen a humani-

ties major, thus supporting the narrative that young men are often not cognitively strong nor vocationally interested in the humanities (488).

De Gioannis' 2022 logistic regression study analyzes the impact of implicit gender stereotypes on college major selection of Italian students (1093–1112). De Gioannis' study, seemingly one of the few to do so, acknowledges the lack of attention directed at the poor representation of males in the humanities (1094). Although this specific study found the correlation between implicit gender stereotypes and college major selection to be statistically insignificant, it did find a negative relationship between male gender stereotypes and the selection of humanities majors (De Gioannis 1106). In essence, male gender stereotypes do influence our university field of study. In light of this discovery, De Gioannis confirms that enrollment in a humanities major may not align with current male stereotypes.

In Beutel et al.'s 2019 correlational study, the relationship between undergraduate American men's adherence to dominant masculine social norms and their choice of college majors was investigated (374–391). In that quantitative study, the primary masculine social norms that were analyzed were "self-reliance, aggression, achievement, attaining status, restricted emotionality, and avoiding the appearance of femininity or homosexuality" (375). The study found that there was a positive correlation between male conformity to masculine social norms and undergraduate field of study. However, more importantly, male adherence to the masculine emotional norm had a strong negative correlation with fields of study such as the humanities and social sciences, suggesting that male social norms are discouraging men from majoring in these academic fields (374).

From these studies, we can conclude that in general, men choose majors that are stereotypically male and STEM-based.

Correlation Analysis of Academic Environments and Behaviours on College Major Selection

In a 2013 quantitative study by Basit Zafar, coursework and parental approval were the primary factors analyzed in the relationship between the differences in the choice of college major for male and female

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Northwestern University sophomores (545–95). Zafar discovered that females select fields of study more passionately than males with a focus on their “tastes” and interests rather than the pecuniary outcomes, which were males’ primary focus (585). The National Association of Colleges and Employers stated in their April 2014 survey that humanities graduates’ starting salaries were the lowest of all fields of study at USD 36,667. Since men are interested in pursuing majors that lead directly to lucrative careers, they are likely not interested in the humanities, as there is less money to be made in comparison with other fields of study.

Similarly, Morgan et al. studied the impact of occupation plans on college major selection for both men and women in a longitudinal study (Morgan et al. 989–1005). Morgan et al. analyzed four main characteristics of occupational plans including goals, coursework, performance, and career paths (1000). Morgan et al. found that young men took 5% more advanced mathematics and STEM courses than women in high school (995). Moreover, men scored on average considerably better than their female counterparts on SAT math sections in high school and were thus following STEM paths more readily, despite having lower GPAs (Morgan et al. 995). This relationship does, however, indicate that in high school, young males are primarily focusing on STEM-related courses, perhaps a reason why they opt out of humanities majors.

In addition, in a correlational analysis study conducted by Anelli and Peri, *The Effects of High School Peers’ Gender on College Major*, another correlational analysis was done on the gender breakdown of one’s high school peers and their college major preference (553–602). In essence, this study had hoped to analyze whether young men in high schools with a higher percentage of males were more likely to select a ‘predominantly male’ field which included economics, business or engineering, and that women in very female environments were more likely to select a ‘predominantly female’ field which included humanities or health sciences (Anelli & Peri 554). In a longitudinal study of nearly 30,000 individuals, Anelli and Peri discovered that young men, in schools with a higher percentage of male students, generally chose a ‘predominantly male’ field (592). This understanding allows us to understand that being in an environment such as a boys’ school does not promote fields of study such as the humanities.

Lastly, qualitative research has been conducted on factors relating to college major choice. For example, in Mullen’s 2014 study, *Gender, Social Background, And The Choice Of College Major In a Liberal Arts Context*, the connection between gender and social background and the choice of college major is sought through 50 semi-structured interviews at a liberal-arts college (289–312). After these interviews were conducted, Ann Mullen came to the consensus that while privileged women at this institution pursued their intellectual curiosities, men were more wary of doing so, and attempted to avoid paths of study that were considered “feminine” such as the humanities and health sciences despite often finding them interesting (307). Ultimately, this conclusion demonstrates that men are still widely interested in the humanities, but are avoiding it due to its apparent femininity.

In summary, by analyzing the different academic environments described in these studies, we can understand the importance of the coursework that individuals take in high school, their career path focus, the gender of their peers, their social background, and most importantly their gender in choosing their college major. From these studies, we can conclude that in general, males are avoiding the humanities and tend to study in predominantly male fields, that is, STEM fields and fields that have higher wages.

Gap Analysis

There exists little research that focuses solely on the reasons why men are avoiding studying the humanities. While certain studies relate the selection of a college major choice to social factors and academic environments, none are centred solely around the humanities. Also, there remains no scholarly consensus as to why men are avoiding studying the humanities in Canada. Moreover, the majority of the studies analyzed in this literature review focus on both women and men, whilst this study focuses solely on young Canadian undergraduate men. In filling this gap we may be able to seek solutions to improve these low male humanities rates in Canada and help us determine how we can get young men to reconnect with the humanities.

Methodology

Overview

This study aimed to highlight the primary reasons why young men are avoiding the humanities in Canada. It was conducted through a qualitative analysis of eleven, 30-minute semi-structured interviews with young men currently enrolled in a non-humanities major Canadian undergraduate program.

The scholarly work that was generated to achieve my project goal was qualitative research conducted through semi-structured interviews. In these eleven, 30-minute interviews, large and in-depth responses with a considerable amount of information were received. Langhorne (302-317), who also conducted a thematic analysis on the experiences of Southern Ontario high school principals dealing with students' mental health, only interviewed as many as five. However, Mullen's 2014 study, employs both a similar topic and a quantitative analysis sought after 50 semi-structured interviews at a liberal-arts college (289-312). As a result, it was understood that this gap required more than five interviews to fill and thus, it was decided that eleven was reasonable considering the eight-month window to conduct the study.

Sample

The sample size for this study consisted of eleven young men aged 17-25 enrolled at a Canadian university, pursuing a non-humanities degree. To find at least 10 willing individuals who fit this profile, the alumni department at my school, Royal St. George's College was contacted. Through the alumni department at my school, alumni who fit the profile were asked if they were willing to participate in the study or knew another non-RSGC alumni student who fit the profile and would be willing to do so. If they accepted, they would receive an informed consent form that they would have to sign to participate containing background information on the methodology, the risks and benefits of the study, the confidentiality, and their right to withdraw (See Appendix C). This process was successful in initiating the study, although the majority of participants were not sought out in this manner. These eleven interviews were conducted through Zoom.

Finally, responses were anonymized and randomized, and no names were assigned to interviewees when I discussed responses in my findings section. In doing so, personal information was not revealed.

Conducting the Study

Once participants had accepted and signed the consent form (See Appendix C) to participate in the study they were asked six questions over a Zoom call (See Appendix A). Their responses were transcribed verbatim and then analyzed.

While analyzing the interviews, specific keywords within quotations were observed. These quotations were organized into five specific tables based on keywords that reflected common themes (See Appendix B). In doing so, the primary themes and potential rationale as to why young men are avoiding the humanities were highlighted. Following Langhorne's method, these five tables contained at least four quotations from interviews that were deemed as primary conceptual themes (306). These "primary" themes were thus considered significant motives for men's avoidance of humanities disciplines.

Justification

This chosen research method aligns with the research question for numerous reasons. Firstly, this study's research question: "*What are the underlying reasons that young Canadian men currently majoring in a non-humanities field of undergraduate study have decided not to study the humanities?*" challenged a current trend within current Canadian society where few young men are studying humanities majors in university. In doing so, this study sought a theory for this immense disparity, and thus used the grounded theory approach. A grounded theory approach is a form of qualitative research that is based on flexible methodological strategies; the semi-structured interviews that have been conducted will support this approach.

A second reason highlighting this study's methodology's alignment with its research question is that it tried to establish conclusions for the humanities, generally, based on more qualitative content. Had the study been on a topic related to a STEM field of study, a quantitative study may have made more sense contextually, considering that many existing studies in

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STEM are rooted in an analysis of numbers. However, as this study sought out a theory and explored and conducted research on the humanities, a qualitative approach was better suited as it embodied the interpretive turn discussed in the social sciences.

Findings

Throughout the eleven semi-structured interviews that were conducted, five specific themes were identified regarding the lack of male participation in Canadian humanities programs. The first major theme was the lack of understanding of the field of humanities. There are two primary topics which highlight this lack of understanding which include the mislabelling of humanities fields and the admission of a poor understanding of the humanities. Firstly, as mentioned, the humanities are fields of social science based on “humanistic content,” including subjects such as language, linguistics, literature, history, and philosophy (Bennett, 3). However, throughout eleven interviews, when asked question four (see Appendix A): *What is your understanding of the humanities?* an interviewee mislabelled a subject as humanities when answering the question. One indicated that their “Religions of East Asia” course was part of the humanities. Secondly, on three occasions, participants openly expressed their lack of understanding of the humanities as a field of study. For example, one interviewee said, “I would say I have a poor understanding of this concept and struggle.” Others honestly admitted that they didn’t “know a lot about the humanities” largely because they “branched off from the humanities” at a pre-mature stage in their schooling.

A second theme that emerged through these interviews was that men felt that they were more career-oriented and prioritized financial security more than their female counterparts; in doing so, they expressed that they felt a lack of direction on humanities paths. In terms of humanities’ lack of career options, individuals expressed that there were “not many career options I see with a humanities degree.” Moreover, one student expressed that with “business schools or engineering schools” they will have ready access to job opportunities and internships, but with the humanities, everything felt “a little more uncertain.” In addition, an interviewee explained that “people have a

fear of not being able to support themselves with that (humanities) degree.” These ideas are connected with the existing perception that humanities graduates do indeed have lower-paying starting jobs than business and engineering graduates. One interviewee explicitly stated that they avoided the humanities as “there’s this kind of perception where humanities majors don’t lead to high-paying jobs, and I want to make money.” This was an important finding, as it was evidence of what another participant had mentioned that “girls don’t care as much about making a lot of money” and that the young men were more interested in the “financial incentive.” Ultimately, it was very clear that young men were more financially driven through these interviews and, thus, sought out fields like engineering and business which led to a more defined and financially secure career path.

A third theme that emerged throughout the study was the lack of interest in and exposure to humanities subjects. Throughout this study, it was clear that the majority of participants had not developed a strong interest in the humanities for numerous reasons. Whilst money played an important role in the lack of interest, interviewees expressed a variety of reasons, which focused especially on their various depictions of what a humanities major consisted of. While many participants simply stated their lack of interest, one noted that their disinterest was because they felt that the humanities was not “intellectually stimulating.” Moreover, other students indicated that they simply lacked interest in the humanities because they “didn’t find too much creativity” in the humanities. Also, two participants who had admitted a poor understanding of the humanities described that their lack of connection to the humanities was because they had either “branched off from the humanities paths pretty early” or had taken very few humanities courses in high school “So that’s English and History. I don’t know any other humanities courses I would have taken.” From these various interviews, it can then be concluded that due to the lack of exposure to humanities, students did not develop a strong interest.

The fourth primary conceptual theme that emanated from these interviews regarding the lack of male participation in Canadian humanities programs was gender stereotypes. Participants mentioned both male stereotypes and described the common perception of the humanities as a female field of study. In

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terms of male stereotypes, one participant explained that throughout his experiences he noticed that: “science courses were way heavier with boys and same in math courses; the boys seem to prefer math more than girls for whatever reason.” Another male stereotype was described in response to the question “Why do you think fewer young men pursue humanities majors in Canada?” when an interviewee stated that: “using like male stereotypes, those guys are going to be like the providers of the family, right (sic)? So, it’s like it’s important. Money is going to be important for them, right?” By implying that men still felt a responsibility to be a primary provider in a family, this interviewee showcased how this duty may be at the foundation of the male gravitation towards university programs that lead them towards career paths that they perceive to be more lucrative. In addition, the consensus of the humanities as a stereotypically female-dominated field of study was further explored throughout the eleven semi-structured interviews. For example, one participant explained that he thought the perception of the humanities as a feminine field of study was a result of “a cultural thing” where boys are “told from a young age that it’s more of a female-dominated major”, “and then they never look into it.” A second interviewee alluded to a similar theory which he described as “a feedback loop going on, where there are a bunch of women in humanities right now. And because that would be so much of a disjoint, people would see it as more of a women’s program.” These approaches may suggest that young men are branching off from the humanities at a young age as a result of the stigma that may be bestowed upon the field of study.

A final major theme that arose from this thematic analysis was that young men are deterred from studying the humanities because they perceive that it is a simpler degree and that acceptance into a humanities program is less of an achievement than others. Interviewees noted that they felt that “humanities degrees are also perceived to be like really easy.” In addition, one interviewee explicitly stated that a humanities degree is “almost a waste of time” and expressed his uncertainty about the education within the field: “I don’t feel like they’re learning.” Furthermore, one participant expressed that, at his university, individuals enrolled in business and engineering programs “see themselves as superior to [those in] humanities programs.” From this, we can deduce that young men

have a demoralizing view of the humanities as they see little value in the learning process and feel that it is an inferior field of study.

Throughout the interviews, five major conceptual themes emerged regarding the lack of Canadian male participation in humanities fields of study. These themes have emerged through the various unique perspectives of eleven young men who are currently enrolled in non-humanities undergraduate programs. These men indicated that the lack of career options and financial security, the gender stereotypes, their lack of understanding and exposure, and the general menial impression were all significant factors in the absence of men in Canadian undergraduate humanities programs.

Discussion

The five themes discovered through this study regarding the field of the humanities connect to a common theme of ignorance. From these responses, it was evident that individuals did not have strong access to discover the humanities and were therefore either expressing their lack of understanding or interest, had poor misconceptions regarding the field such as simplicity and a lack of career options, or were simply driven by stereotypes and their peers.

The Lack of Understanding of the Humanities Rooted in Poor Exposure and Interest

The first and third themes which emerged through the research regarding a weak understanding of the humanities and a lack of exposure and interest are connected (See Appendix B). These themes are associated with each other as they both involve reflecting on past decisions that participants had made in their lives. Participants demonstrated a substandard understanding of the humanities likely because they had branched off early from its subjects and thus were disinterested in them or had little opportunity to pursue them. Throughout the interviews, it was evident that young men were choosing to pursue a STEM or business-based postsecondary education as they had been introduced to its various aspects and had devel-

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oped an interest in some subject. This finding has also been presented in two existing studies.

Firstly, Päßler & Hell's 2012 study showcased that men, cognitively, had more math-tilted profiles and thus, were more likely to select a science/engineering college major (491). Päßler & Hell concluded that young men are often not cognitively strong in the humanities and thus not vocationally interested in them (488). Similarly, Morgan et al. established a relationship that in high school, young males are primarily focusing on STEM-related courses as they generally scored higher on STEM-based subjects like mathematics, and thus are more likely to diverge from humanities subjects altogether (995). This existing research primarily analyzed the relationship between the academic strength of young men and their chosen career path. It established that young men become disinterested in humanities subjects because their strengths lie elsewhere, most commonly in STEM. As a result, they do not pursue the humanities and can develop only a basic understanding of its field.

Young Men Driven by Short-Term Success

Upon analyzing the various interviews, there were two primary themes where young men were framing their understanding of the humanities based on connections with various individuals. These themes – such as humanities as a field of study that leads to poorer paying career options and an inferior education – are solely based on the participants' perception and are not demonstrably objective (See Appendix B).

Firstly, the emergence of the theme that men feel that humanities lead to financially weaker career options is present in pre-existing research. For example, Zafar's 2013 study found that males focus overtly on pecuniary outcomes and avoided the humanities (585). After investigating other existing studies, the idea that humanities' future career options are poorer was falsified. The NACE stated in their April 2014 survey that the humanities starting salary was the lowest of all fields of study at USD 36,667. In addition, male humanities majors' starting salaries five years post-graduation were below CAD 50,000 in 2020, less than half that of those who had completed petroleum and nuclear engineering degrees, for example (Frenette & Handler). However, a similar 2014 study conducted by Humphreys and Kelly indicated that by ages 55-

60, liberal arts graduates, which include humanities scholars, could earn approximately USD 60,000 annually, \$2000 more than those with other professional degrees (31). This highlights the impatience to young men of their choice of career and undergraduate major.

Secondly, the perception held by young men that humanities programs provide inferior education is another form of ignorance. According to Cohen's 2009 article, the humanities are a field of study that prepares us for personal growth and integration into a democracy rather than just vocational training. In addition, studying the humanities can increase human prosperity and psychological richness (Westgate & Oishi, 2). Rather than teaching humans solely to work a job, the humanities teach us how to live. The participants of this study who exhibited a belief that a humanities education was lesser and/or lacked financially strong career options, solely considered short-term success as high value.

Young Men Driven by Gender Stereotypes

The final concept that may be responsible for the male avoidance of the humanities is gender stereotypes. The male stereotypes consisted of the attraction to scientific and mathematical fields and the responsibility to be a primary provider in a family and thus gravitate towards university programs that lead them towards career paths that they perceive to be more lucrative (See Appendix B). Pre-existing research expresses similar findings. In De Gioannis' 2022 logistic regression study, male stereotypes did affect college major choice; there was a negative correlation between male stereotypes and the male selection of humanities majors (1106). In addition, when in male environments, young men generally chose a 'predominantly male' field (Anelli & Peri, 592). Throughout my research, I also discovered that many of my participants did mention the common stereotype of the humanities as a "female" field of study and how this may have negatively affected their choice to pursue a career in the humanities. This idea is presented in Mullen's 2014 study, *Gender, Social Background, And the Choice Of College Major In a Liberal Arts Context* where she concludes that men attempted to avoid paths of study that were considered "feminine," such as the humanities and health sciences, even if they

found them interesting (307).

Ultimately, young Canadian men are discouraged from engaging in the humanities for numerous reasons. Firstly, as young men score lower on tests in humanities' subjects, they separate themselves from the field prematurely and thus cannot develop a strong understanding or sustained interest. In addition, they are overly influenced by gender stereotypes and short-term pecuniary outcomes with their college major selection and minimize the value that their education can provide them within their life.

To reduce young men's ignorance of Canadian undergraduate humanities programs, high schools should offer a larger variety of humanities courses and cater them more to a male audience through more qualitative approaches. In addition, many individuals choose courses in high schools based on the prerequisites for their desired university program and a high school diploma. Currently, in Ontario, Canada, few humanities credits are needed to graduate, with only three excluding English; they include one in credit Canadian history, French as a second language, and in the performing arts (Ontario Ministry of Education). If universities made high school courses in the humanities a prerequisite for most undergraduate study, the humanities would be able to expand their reach to more individuals, including young men.

Limitations

The sample size of eleven in this study is in accordance with present scholarly work; however, a larger sample may yield stronger conclusions. Although the participants underwent lengthy semi-structured interviews, similar qualitative studies such as Mullen's 2014 Study (293-317) had upwards of 60 participants. In addition, my sample could have been more diverse. Although participants attended universities in many Canadian provinces, they had all completed high school in Ontario, all at private institutions. As a result, parental influence may have been especially strong since parents have invested a lot of money in paying for private education. Seeking out more participants with schooling experiences in various provinces may have provided this study with different insights.

Conclusion

This study helps provide reasoning to understand the lack of male participation in humanities, especially in Canada. Through a qualitative thematic analysis consisting of eleven, 30-minute semi-structured interviews with young men currently enrolled in a non-humanities major Canadian undergraduate program, five conceptual themes were established. These five themes form three firm conclusions which include that individuals did not have a large exposure to discover the humanities and were therefore either expressing their lack of understanding or interest, had poor misconceptions regarding the field such as simplicity and a lack of career options, or were simply driven by stereotypes. Existing research supports these conclusions, especially the impact that gender stereotypes can have on college major choice.

Future studies should consider focusing more on addressing the limitations and finding more definitive solutions. Although a sample size of eleven was large enough to find five significant themes, a more diverse sample size would ensure the discovery of many more reasons for the male decline in Canadian humanities programs. In addition, examining and researching solutions to mitigate this humanities crisis through the consultation of educators and school boards would allow for a stronger application of this research into the educational system and young men's lives.

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Appendix A: Interview Questions

What is the current undergraduate university program that you have chosen?

What were the various influences on your decision to choose this field of study? (This can include parents, peers, etc.)

How did your school environment support you with your applications to university? (I.e., Guidance Counsellor Support; availability of prerequisite courses; career-related events; etc.)

What is your understanding of the humanities?

What are the various reasons that led you to not choose a humanities major?

Why do you think fewer young men pursue humanities majors in Canada?

Appendix B: Thematic Tables

Theme: Poor understanding of the field of humanities and its specific fields	
Keyword/term	Mislabelling
A field/course was mislabeled as a humanity (key words can include: “law”, “music”, “performing art”, “religion/religious studies”)	“I’m not sure if languages are humanities but I think they are because I’m taking a few humanities courses this semester, including religions of East Asia.
Admission of a poor understanding for the humanities (i.e., “don’t know”, “poor understanding”)	Admission of a Lack of Understanding “I would say I have a poor understanding of this concept and struggle.”
(When asked: What is your understanding of the humanities?)	Honestly, I don’t know, again, because as I sort of branched off from the humanities, these paths pretty early, I never looked into them. “No, I don’t know a lot about the humanities to be honest.”

WHY ARE YOUNG CANADIAN MEN AVOIDING THE HUMANITIES?

Theme: Career-Oriented and Financial Security	
Keyword/term	Lack of career options in the humanities
Lack of career options and internships in the humanities	<p>"It's honestly like, I don't really like it, just there's not many career options I see with a humanities degree.</p> <p>"I just didn't, I just didn't see any career options...I just didn't really find anything I was very interested in, in humanities."</p> <p>"So, for places like business schools, or engineering schools a lot more there's a bit more of an idea of like, okay, I'll have these job opportunities and I'll get to take these internships I get to do these and they'll know what's going to happen after, but if you go into humanities -- if you decide to stay humanities -- it might be a little more uncertain."</p> <p>"I think it has something to do with people not knowing what you can do with a degree in humanities and not knowing what you can do also like I feel a lot of people have fear of not being able to support themselves with that degree."</p> <p>"So, when people see University as a means to get a job so it's always like it's a lot more focused on what degree do I get to work where originally they're meant to simply further your education and your interest so I think that big shift is a big reason for the decline we're seeing humanities, I guess."</p>
Money and Financial	<p>Money and Financial Security</p> <p>"Those guys are going to be like the providers of the family, right? So, it's like it's important. Money is going to be important for them, right?"</p> <p>"But I also think there's this kind of perception where humanities majors don't lead to high paying jobs, and I want to make money so I was just never like leaning in that direction."</p> <p>"But I think people are looking for that security a lot more now financially, as opposed to taking courses in the humanities that might interest them or might lead to other career paths that they haven't discovered yet."</p> <p>"I feel like my guess would be a financial incentive. I feel like from the humanities girls that I've talked to, they don't care as much about making a lot of money."</p> <p>"And just like the nature of men and women, women may pursue what is interesting to them. More so than men and men may pursue what they deem to be the best path to earning more."</p>

WHY ARE YOUNG CANADIAN MEN AVOIDING THE HUMANITIES?

Theme: Lack of Exposure and General Interest	
Keyword/term	Lack of Exposure
Lack of Exposure	<p>“So that’s English and History. I don’t know any other humanities courses I would have taken.”</p>
General Lack of Interest	<p>“I’m not sure on the specifics of what the degrees really entail, or sort of their pathways or prerequisites because again, like I, I decided pretty early that I want to think of sciences and math. So, my understanding of them is pretty shallow.”</p>
	General Lack of Interest
	<p>“I just didn’t find the humanities like that intellectually stimulating.”</p>
	<p>“And I think things like business or hard sciences or engineering, definitely draw out that competitiveness a little bit better than the humanities would be my perspective.”</p>
	<p>“But I never saw myself doing that sort of career, I don’t really want to do that sort of stuff.”</p>
	<p>“There’s never really an interest for me to go into something that included a lot of writing and a lot of reading where I found that, for me, it was more kind of speaking and connecting with people on a more personal level.”</p>
	<p>Well, I guess the reason is I didn’t find too much creativity in humanities, I guess. Or at least my experience of it, what I do like history and things like that is mostly just kind of reciting facts and things like that and like dates.”</p>

WHY ARE YOUNG CANADIAN MEN AVOIDING THE HUMANITIES?

Theme: Gender Stereotypes

Keyword/term	Stigma/ Female Dominant
<p>Stigma/ Female Dominant</p> <p>Male Stereotypes</p>	<p>“I think it might be a cultural thing. My inclination is that there might be a bit of a stigma around humanities, where, because it’s more dominant, and more female dominated. Guys will just see that as like, oh, maybe it’s not the right thing for me. And then they never look into it. And so, they’re kind of told from a young age that it’s more of a female dominated major.”</p> <p>“I think there’s probably a self-fulfilling prophecy or like a feedback loop going on, where there are a bunch of women in humanities right now. And because that would be so much of a disjoint, people would see it as more of a women’s program, and then it would kind of go and if you don’t see it as a women’s program, only good women are gonna go there. And then it kind of keeps on spiraling.”</p> <p>Male Stereotypes</p> <p>“So if it’s, if it’s using that idea, like it’s the idea that using like male stereotypes, those guys are going to be like the providers of the family, right? So, it’s like it’s important. Money is going to be important for them, right? So, if I were to give an honest answer, I would say that’s probably why.”</p> <p>“Like science courses were way more heavy with boys and same and in math courses the boys seem to prefer math [more than] girls for whatever reason.”</p>

WHY ARE YOUNG CANADIAN MEN AVOIDING THE HUMANITIES?

Theme: Humanities As An Inferior Program	
Keyword/term	Easy field of study
Easy field of study	<p>“Um, I wouldn’t really say I think I’ve sort of expressed everything I would say, just humanities degrees are also perceived to be like really easy.”</p>
Lack of an achievement	<p>“And at some point, it’s almost a waste of time, a little bit like I guarantee like they can get like good marks and stuff, but I don’t feel like they’re learning like I don’t maybe they are.”</p> <p>“They don’t have midterms; they just have to write essays like it’s perceived to be like a really easy degree.”</p> <p>Lack of an achievement</p> <p>“To a lot of people, like a business program or an engineering program, or like a medical school. Like a lot of people in those programs see themselves as superior to humanities programs, especially for example, like queens here.”</p>
(University Name Has Been Anonymized)	

Appendix C: Consent Form

Royal St. George's - Research Ethics Review
Application Form

Consent to Participate in Interview-Based Study

Title: What are the reasons that young Canadian men currently majoring in a non-humanities field of undergraduate study have decided not to study the humanities?

Researcher

Arjun Deckha
120 Howland Ave, Toronto, ON M5R 3B5
Royal St. George's College
647-554-9537
adeckha@rsgc.on.ca

Description:

Interviewees will be interviewed for approximately 30 minutes, where they will be asked numerous questions on the study. Prior to the interview, there will be an extensive process where I will have to communicate with them via email. Interviewees will be sent a list of possible times to ensure that they can adequately participate. From this point onwards, they will be sent a zoom invitation. Interviews will occur between Monday, January 16th, 2023 and Monday February 13th, 2023.

Risks and Benefits:

Subjects may become emotionally uncomfortable as they will be asked questions based on the choices they made upon selecting their undergraduate field of study; this could be a sensitive subject.

Subjects may or may not find this experience fulfilling depending on how they value reflecting on these past choices.

Confidentiality:

For this study all names of individuals will be anonymized throughout the study to protect their identities and to ensure ethical practices.

Right to Withdraw:

In signing this form, you acknowledge that you will be able to withdraw from participating in this study at any time.

ERB Approval:

This study has been reviewed and approved by the Royal St. George's College Ethics Review Board (ERB).

Statement of Consent:

I have read, understood, and accept all of the information as stated above. I have been given a copy of this

form. I have been allowed to ask questions, and those questions have been answered. I consent to participate in this study.

Signature of Participant:

Adapted from Emily Lott, Chestatee High School, Gainesville, GA, and the University of Toronto Office of Research Ethics

Empowering Champions: An Explanatory Mixed Methods Study on Ontario Adolescent Female Field Hockey Players' Adherence to Gender Norms in Athletics

Darcie Brohman

Abstract: Despite recognizing that sports are inherently masculine, divergent findings exist regarding the effect of athletics culture on female athletes' adherence to gender norms. This explanatory sequential mixed-methods study aims to gain a deeper understanding of how field hockey, a feminized sport in Ontario, influences athletes' conformity to gender norms. Data was collected from 42 field hockey players and 55 non-athletes utilizing a survey adaptation of the Bem Sex-Role Inventory and semi-structured interviews. The study found a minimal discrepancy between athletes' and non-athletes' conformity to gender norms, which is attributed to the contemporary implementation of femininity in athletics and the feminization of field hockey. As a result, athletes experienced empowerment yet reported judgment from stakeholders and body image issues. Therefore, mitigating solutions are proposed, including altering the perception of field hockey to be androgynous to increase the perceived athletic validity of the sport, appointing female coaches, and training male coaches.

Keywords: field hockey, adherence to traditional gender norms, female empowerment, body image issues, athletics culture

Introduction

Since the origin of competitive sport, athletics culture has promoted adherence to traditionally masculine traits, attitudes, and behaviours, having significant repercussions on female athletes who simultaneously are pressured by society to adhere to contrasting traditionally feminine gender norms (Koca et al., 2005; Stick, 2021). However, as female empowerment initiatives gain additional traction in the 21st century, the adverse implications of gender norms in all realms of life, including athletics, receive significant attention

(Stick, 2021). In an effort to gain a deeper understanding of how specifically these consequences influence female athletes and how they may be mitigated, numerous studies have explored the effect that sporting culture has had on competitive female athletes' adherence to gender norms (Koca et al., 2005; Bastug & Kuru, 2011; Steinfeldt et al., 2011). However, results have remained contradictory, arguably due to a lack of specifying the sports athletes participate in, as various sports have been identified as having divergent gender norms influenced by cultural and historical factors (Plaza et al., 2016). As a result, it is integral to investigate competitive female adolescent athletes'

adherence to gender norms in a team sport with specific gender association, such as field hockey in Ontario, which has culturally been feminized (Plaza et al., 2016).

It is hypothesized that despite field hockey in Ontario being culturally feminine, female athletes will reject these restrictive feminine roles, as they may not be reflective of their identity. Instead, it is anticipated that the athletes will conform to masculine gender norms, which are praised in competitive sports (Stick, 2021). As a result, it is anticipated that though rejecting orthodox femininity will provide athletes with a sense of empowerment, consequences from these competing pressures will have adverse implications for participants (Chalabaev et al., 2013; Eime et al., 2016).

Notably, for the purpose of this study, females will refer solely to cis-gendered women, as non-cis-gendered females may experience additional pressures as members of the LGBTQ2S+ community that cannot be rightfully addressed in the time constraints of this study.

Literature Review

This literature review will explore gender as a construct in athletics in contemporary Western society, female athletes' various degrees of adherence to gender stereotypes promoted in athletics, and adverse indications and implications of traditional gender roles in athletics to contextualize this study with documented research.

The Promotion of Gender Norms in Athletics

Arguably, gender norms evident in athletics are derived from detrimental ideologies, such as biological determinism, originating as early as 384 BCE and modernly defined as the philosophy that boys are physically and physiologically superior to girls (UNESCO, 2012). Moreover, philosophies such as biological determinism have significantly influenced the traits traditionally assigned to gender, particularly with the majority of qualities perceived as impactful being associated with masculinity, such as leadership abilities (UNESCO, 2012). Furthermore, these ideolo-

gies are only exacerbated by guardians and peers, negatively impacting impressionable adolescents, as judgments from peers are recognized as one of the most significant barriers undermining female participation in athletics (Brown & Stone, 2016; Lunde & Gattario, 2017). Notably, female athletes may react adversely to these judgments as they inherently go against orthodox feminine traits or are misleading. These judgments are manifested from stereotypes and cultural norms designed to restrict female athletes. For instance, female athletes are often perceived as sexually undesirable or queer, and hassled for their muscular physicality (Slater & Tiggemann, 2010; Yungblut et al., 2012). Similar limitations may be reflected in society as women adhere to socially acceptable gender norms, believing they will gain a sense of belonging (Yungblut et al., 2012; Brown & Stone, 2016). Contrarily, Schmalz and Kerstetter found that not all female athletes feel pressure to conform to these binaries when engaged in sports that are perceived as androgynous (typically requiring less aggression) (Schmalz & Kerstetter, 2006). In contrast, Plaza emphasized in her 2016 study that the criteria assigning a sport to a specific gender are not the gender-identified qualities of the sport, but rather its culture and history (Plaza et al., 2016). Evidently, athletics are continuously associated with gender, a perspective which ignites a harmful assessment of the participants.

Adherence to Gender Norms Promoted in Athletics

Female athletes continue to grapple with either maintaining femininity to adhere to societal expectations or adopting traditionally masculine traits to be perceived as successful in athletics (Koca et al., 2005; Yungblut et al., 2012; Stick, 2021). This dilemma is only amplified as Western society falsely reiterates that masculinity and femininity are opposing binaries that cannot exist cohesively through modern practices of heteronormativity in everyday language, gendered products, and the segregation of men and women on sports teams. The implications of these ideologies and practices in Western society are evident in Whitehead and Biddle's 2008 study, which found that the majority of non-athlete female adolescents in the United Kingdom believed that a girl could not be both sporty and feminine (Whitehead & Biddle, 2008). To further

explore female athletes' adherence to gender roles in athletics, Koca's 2005 study quantitatively measured adolescents' femininity, masculinity, and androgyny levels utilizing the accredited Bem Sex-Role Inventory (BSRI). This study utilized an adolescent participant pool of 463 men and women from Turkey - a geographical region Koca claims has similar Western gender norms to North America - including elite individual and team-sport athletes and non-athletes as a control. The results found that female athletes self-reported higher scores of masculinity and lower scores of femininity (22%) than their non-athlete counterparts (40%), revealing that female university athletes do not adhere to traditionally female gender roles to the same extent as non-athletes (Koca et al., 2005). However, recognizably, Whitehead & Biddle and Koca's studies are slightly dated and as a result, more contemporary findings may fluctuate as social norms have progressed. Nonetheless, Koca's findings align with the theory that sports may be a powerful tool to empower young women to reject traditional gender roles while challenging issues of gender inequality (Bailey et al., 2005). Oppositely, Steinfeldt's 2011 study found that female athletes and non-athletes reported the same level of conformity to feminine roles, with female athletes only reporting higher levels of conformity to traditional masculine norms (Steinfeldt et al., 2011). Steinfeldt examined the difference in conformity to feminine and masculine norms commonly endorsed in Western culture among 143 female athletes (team sport and individual sport) and non-athletes in the Midwestern United States by utilizing CFNI-45, a self-reporting test with 45 gendered terms. Despite contradicting the hypothesis, Steinfeldt stated that similar levels of conformity to gender roles between both female athletes and non-athletes might be derived from an emerging value of traditional female traits in team athletic culture, such as supportiveness and collaboration, potentially having a positive effect as female athletes' experience a new-found value of femininity in sport (Steinfeldt et al., 2011). However, female athletes in Steinfeldt's study, consistent with Koca's study, still presented higher conformity towards male gender roles. These results may be attributed to traditionally masculine traits being embedded as values in sports culture, making an increased adherence to masculinity a commonality of the studies.

The Internalization and Indications of Gender Norms in Athletics

Athletes' adherence to gender norms may be subconscious and, in some cases, anticipated and recognizable through implications such as body image issues and lack of participation. This claim is supported by stereotype threat theory (1995), defined as the potential effect a stereotype can have on someone subconsciously, even if the individual consciously rejects the stereotype (Chalabaev et al., 2013). This theory is supported by Bastug and Kuru, who advocated that analyzing females' body image is integral in determining athletes' adherence to gender roles in athletics, as negative perceptions of the body are often derived from gendered ideologies found in athletics (Bastug & Kuru, 2011). Arguably, this is particularly applicable to adolescent females who, on average, are judged on their appearance more than their male counterparts and who, in turn, may fear developing traditionally masculine physical traits from sports, such as muscularity (Lunde & Gattario, 2017). In contrast, in Bastug and Kuru's 2011 study, it was found that, despite female athletes having more traditionally masculine features than non-athletes, they had more self-confidence in their physical appearance (Bastug & Kuru, 2011). Bastug and Kuru suggest this may be attributed to an empowerment to diverge from traditional gender norms sourced from athletics (Bastug & Kuru, 2011). Moreover, withdrawal from athletics is also identified as an indication of the internalization of stereotypes for young female athletes, as attrition rates for female athletes in North America dramatically increase as girls become older (Chalabaev et al., 2013; Eime et al., 2016). Bailey provides a reason for these rising rates, finding that attrition in female sports peaks around age 12, in alignment with the period when gendered ideology interacts with socialization influences (Bailey et al., 2005). However, the long-term implications of withdrawal versus continued participation are not nearly as evident until approximately two years later, during adolescence (Bailey et al., 2005). In support of this correlation, it is noted that female athletes' exposure to gender stereotypes was found to relatively accurately predict their succeeding attrition rates (Boiché et al., 2014). Indications such as declining participation in athletics and body image issues support the notion that gender roles are fostered in sport-

ing culture. These implications potentially perpetuate severe societal consequences such as acts of sexism formed from harmful ideologies, eating disorders developed from body image issues, and health concerns derived from low participation rates (Chalabaev et al., 2013; Eime et al., 2016).

Gap Analysis

There has been extensive research on adolescent female athletes' level of adherence to gender norms present in athletics in the United States and Europe throughout the early 2000s. However, there are minimal studies examining other regions conducted in the last five years, failing to explore differing cultural perceptions of gender in a modern context in which societal values have progressed. Notably, the majority of documented research claims that athletics promote some degree of gender norms. However, there have been contrasting outcomes (Koca et al., 2005; Bastug & Kuru, 2011; Steinfeldt et al., 2011). Additionally, studies acknowledge sports as being socially assigned a gender based on cultural components and qualities; however, these studies neglect to examine gender adherence in specific sports or explicitly distinguish cohorts of team sports from individual sports (Schmalz & Kerstetter, 2006; Plaza et al., 2016). Therefore, it is plausible that the qualities of a sport may be a factor altering these outcomes. Thus, by focusing on one specific team sport and the identified gender, it may develop a more solidified comprehension of factors contributing to female athletes' response, or level of conformity, to gender norms in athletics. This research paper intends to explore this gap by analyzing adolescent female athletes' adherence to gender roles, specifically in field hockey in contemporary Ontario, Canada.

Methodology

Overview of Chosen Design

This study utilized an explanatory sequential mixed-methods design defined as a two-phase data collection of both quantitative (close-ended data) and subsequent qualitative data (open-ended data) (Creswell & Creswell, 2018). Edmonds and Kennedy em-

phasize the significance of the sequential aspect of the approach as the aim of the design is for the qualitative data collection to provide a subsequent interpretation and clarification of the precedent quantitative results (Edmonds & Kennedy, 2017). Therefore, it is integral to form a connection between the two consecutive phases by developing the questions for the qualitative phase based on unanswered questions or emerging themes evident in an analysis of initial quantitative data. This distinct mixed-method design indicates the procedure to be utilized in the study. However, this design remains under the larger umbrella of mixed-methods designs, originating in the early 1900s to late 1980s (Creswell & Creswell, 2018).

Justification of Design

Mixed methods are frequently chosen due to the design's ability to capitalize on the strengths and minimize the limitations of each approach, contributing to a greater understanding (Creswell & Creswell, 2018). The limitations of only utilizing quantitative designs are demonstrated in Koca's 2005 study and Steinfeldt's 2011 work. Arguably, these studies are the closest to this research as the authors specifically measure competitive female athletes' adherence to gender norms (Koca et al., 2005; Steinfeldt et al., 2011). As a result of the researchers neglecting qualitative methods, the justification for contradicting results, as seen in Koca's work, or unexpected results demonstrated in Steinfeldt's study, must be inferred by researchers to draw a reasonable conclusion. However, this inference presents bias as the authors' preconceived notions may influence these presumed justifications, which have minimal collected data to support these claims. Consequently, an explanatory sequential mixed method design is utilized in this research to explain precedent quantitative data. This is due to the design's primary intent to establish a connection between the quantitative and qualitative data sets by having aspects of the qualitative collection adapted based on emerging themes from initial quantitative results (Edmonds & Kennedy, 2017). Recognizably, this design is effective for fields relatively new to qualitative approaches, which is applicable to this research given the lack of qualitative data collection in precedent studies (Creswell & Creswell, 2018).

Data Collection

In accordance with the explanatory sequential mixed methods design, quantitative data collection began in early December 2022 with an online survey. Succeeding this initial data collection, qualitative interviews commenced in late December 2022. There were two cohorts of participants; each was projected to have 65 to 100 members. All participants were cis-gendered female-identifying adolescents residing in Ontario between the ages of 14 to 18. Participants in cohort A either currently play field hockey for a competitive outside-of-school club, Field Hockey Ontario or Canada and identified field hockey as their primary sport (the sport they invest the most amount of time in). In contrast, members of cohort B had not participated in competitive sports outside of school within the last two years and had never played field hockey. Participants in cohort A were recruited through emails from the organization Field Hockey Ontario. Oppositely, participants in cohort B were a convenience sample recruited through emails sent within an independent secondary school in the greater Toronto area. In addition to an invitation for participation, recruitment messages included access to the online survey and a participant-informed consent form. Participants in both cohorts completed the six-to-eight-minute online survey, which was an adaptation of the Bem Sex-Role Inventory (BSRI), originally developed in 1975 to measure participants' adherence to 40 traditional gendered traits on a seven-point scale (Bem, 1974). Notably, despite the Bem Sex-Role Inventory being slightly outdated, adaptations are consistently utilized in accredited contemporary research, further establishing its relevance. Following the survey, data was analyzed to discover emerging themes that were then utilized to develop relevant interview questions for qualitative data collection. Interviews were 30 minutes long or less and were completed by four participants from cohort A who expressed interest. Participants were asked about their experience with gender roles in field hockey and the implications they believe their experiences have had on their adherence to gendered stereotypes. Participants from cohort B were not interviewed due to time constraints of the study and prioritization for members of cohort A to be interviewed. The answers provided by participants in

interviews were analyzed and interpreted to further understand the effects of athletics culture in influencing competitive female field hockey players' adherence to gender norms.

Ethical Note

Potential foreseeable risks included participants reporting inappropriate or discriminatory behaviour from stakeholders as they were asked to expand upon their experience with stereotypes in athletics culture. If participants were to have shared incidents of misconduct, they would have been encouraged to report these to Safe Sports Canada, which would have provided them with mental health support and resources to file a formal complaint.

Additionally, participants were asked to share their experiences and adherence to gender norms. It is recognized that these could have been uncomfortable conversations, especially for those who identify as members of the LGBTQ2S+ community. Therefore, participants were reminded that if at any time they felt uncomfortable, they had the right to withdraw from the study without penalty of loss of benefits in which they are otherwise entitled. Moreover, participants were made aware through the consent form and verbally that all provided information would remain confidential. Notably, this research was approved by my institution's Internal Ethics Review Board.

Findings

Introduction

This study was conducted to gain a deeper understanding of how field hockey, a feminized sport in Ontario, influences athletes' conformity to conventional gender norms. The following data was gathered from 42 adolescent female field hockey players (Cohort A, referred to as athletes) and 55 female non-athletes (Cohort B) between the ages of 14 to 18 years old residing in Ontario. The quantitative data was collected via an online survey adaptation of the BSRI, a self-reported test which measures participants' conformity to 40 traditionally feminine and masculine gender traits on a seven-point scale. Following the quantita-

tive survey, four athletes participated in interviews for the qualitative data collection. The four participants interviewed were either 17 or 18 years old, had been playing field hockey for an average of seven years, and currently playing field hockey competitively at either the U18 national or collegiate level. Interviews were approximately 30 minutes and posed questions about participants' experience with gender norms in field hockey, what they perceived to be contributing factors to gender norms, and their experience with subconscious indications of gender norms, such as body image issues.

Quantitative Data

Succeeding the survey, a numerical scheme was devised, assigning each level of the scale on the BSRI to an appropriate value between zero and six for

analytical purposes. Finally, a mean calculation was performed for each trait to compare the two broader cohorts of non-athletes and athletes. (Figure 1)

When the overall mean was converted into a percentage, the adherence to traditionally feminine traits was 68% for non-athletes and approximately 63% for athletes, and adherence for masculine traits was 60% for non-athletes and 67% for athletes. Recognizably, a minority of traits in the masculine cohort had more prominent differences, including "athletic" (-45.68) and competitive (-22.45). Despite these small margins, it is recognized that overall, athletes self-reported adhering to masculine traits more than non-athletes did 80% of the time, and non-athletes self-reported adhering to feminine traits more than athletes did 80% of the time. (Figure 2)

Figure 1

Athletes and Non-Athletes Mean Adherence to Traditional Gender Traits

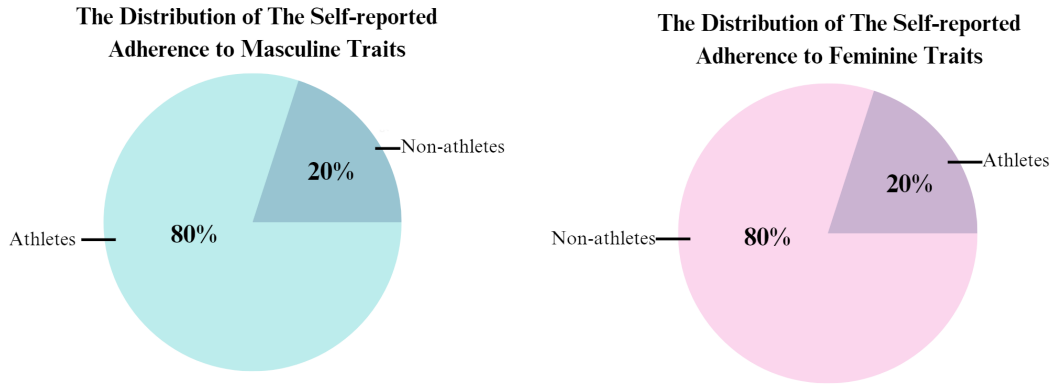
Traits Identified as Traditionally Feminine

Non-Athletes	Mean score	Athletes	Mean score	% Difference
Childlike	3.31	Childlike	2.60	11.90
Tender	3.85	Tender	3.14	11.86
Soft Spoken	3.38	Soft Spoken	2.69	11.52
Does Not Use Harsh Language	3.02	Does Not Use Harsh Language	2.36	11.02
Gentle	4.27	Gentle	3.64	10.50
Affectionate	4.55	Affectionate	3.93	10.28
Sensitive	4.31	Sensitive	3.93	6.34
Flatterable	3.84	Flatterable	3.50	5.61
Shy	2.87	Shy	2.62	4.23
Gullible	3.31	Gullible	3.10	3.56
Empathetic	4.98	Empathetic	4.81	2.87
Warm	4.15	Warm	4.05	1.63
Compassionate	4.98	Compassionate	4.90	1.28
Understanding	4.93	Understanding	4.86	1.17
Sympathetic	4.96	Sympathetic	4.90	0.98
Loves Children	4.33	Loves Children	4.31	0.30
Feminine	4.42	Feminine	4.43	-0.17
Submissive	2.95	Submissive	2.98	-0.51
Loyal	5.27	Loyal	5.38	-1.80
Cheerful	4.31	Cheerful	4.50	-3.18

Traits Identified as Traditionally Masculine

Non-Athletes	Mean score	Athletes	Mean score	% Difference
Athletic	2.85	Athletic	5.60	-45.68
Competitive	3.89	Competitive	5.24	-22.45
Aggressive	2.31	Aggressive	2.88	-9.53
Assertive	3.38	Assertive	3.90	-8.72
Forceful	2.29	Forceful	2.79	-8.25
Strong Personality	3.75	Strong Personality	4.21	-7.81
Analytical	3.73	Analytical	4.17	-7.32
Dominant	3.05	Dominant	3.48	-7.03
Leadership Ability	4.27	Leadership Ability	4.67	-6.57
Independent	4.62	Independent	5.00	-6.36
Acts As A Leader	4.00	Acts As A Leader	4.36	-5.95
Ambitious	4.67	Ambitious	5.02	-5.85
Willing To Take Risks	3.85	Willing To Take Risks	4.12	-4.41
Defends Own Opinion	4.24	Defends Own Opinion	4.40	-2.81
Self-sufficient	4.29	Self-sufficient	4.45	-2.69
Self-reliant	4.44	Self-reliant	4.57	-2.25
Willing To Take A Stand	4.15	Willing To Take A Stand	4.07	1.23
Individualistic	3.91	Individualistic	3.62	4.83
Decisive	2.95	Decisive	2.60	5.84
Masculine	2.24	Masculine	1.86	6.32

Figure 2



Qualitative Data

The interviews provide insight into shared experiences amongst athletes regarding female empowerment, the role of various stakeholders in contributing to a team's culture, and body image issues as an implication of gender norms.

Female Empowerment

100% of athletes stated that playing field hockey empowers them (provides them with a new-found sense of power), whether that be through opportunities for success or encouragement to embrace their femininity. (Figure 3)

Figure 3

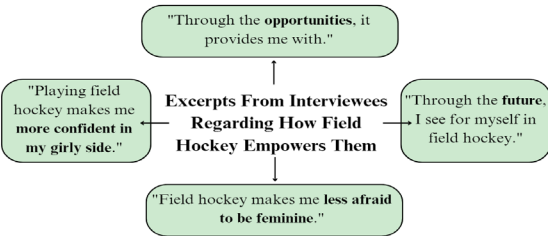
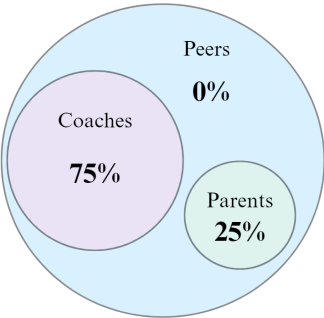


Figure 4

Participant Identified Stakeholders that Contribute to the Promotion of Gender Norms

Participants identified stakeholders that they believe significantly contribute to gender norms in athletics. Reported stakeholders included peers (100%), coaches (75%), and parents (25%). Notably, 100% of athletes reported receiving negative comments from peers specifically that undermined the athletic validity of field hockey within the past year. (Figure 4)



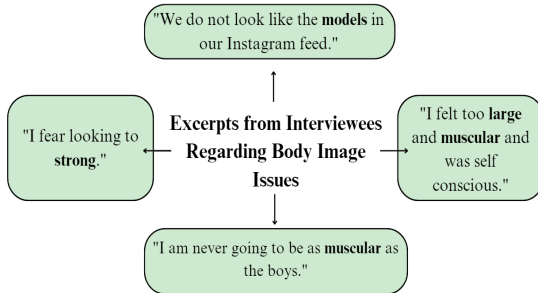
Body Image Issues

100% of athletes affirmed the relevance of body image issues in sport by sharing their adverse firsthand



experiences or the experiences of their teammates. Recognizably, athletes described both experiences regarding pressures to conform to traditionally masculine traits promoted in sport (muscularity, strength, etc.), as well as contrasting pressures to diverge from masculinity and present as more physically feminine due to societal pressures, providing further insight into the competing pressures many female athletes face. (Figure 5)

Figure 5



Limitations

Limitations to these findings include receiving a lower-than-anticipated quantitative sample size. Initially, there was a projected total of 65 to 100 participants for both cohorts. However, eligibility criteria excluded a portion of respondents. For instance, in Cohort B, four out of 44 respondents did not identify as cis-gendered females and, as a result, were not eligible. Similarly, in Cohort A, 20 out of 140 respondents did not identify as cis-gendered females, and another 55 had played a competitive sport outside of school within the last two years, making these responses in-

eligible. Notably, a more substantial sample size may have more accurately reflected the general population.

Discussion

Adherence to Traditional Gender Norms

The quantitative data suggests only a slight discrepancy between non-athletes and athletes' adherence to both masculine and feminine gender norms, with non-athletes having a higher adherence to feminine gender norms (difference of 5%) and athletes conforming more to orthodox masculine traits promoted in athletics (difference of 7%), with the most prominent difference lying in traits commonly associated with athletes in general, such as "competitive" (-22.45) and "athletic" (-45.68). Despite these findings countering the hypothesis, which projected a significant difference in adherence to masculinity and femininity between athletes and non-athletes, ideologies from Plaza's 2016 study provide rationale. Plaza emphasizes that there is a possibility that the gender association of the sport, in this case, femininity for field hockey, may result in those respective gender roles being more prevalent and athletes having a higher adherence to these gender traits (Plaza et al., 2016). Correspondingly, Steinfeldt's 2011 study, similarly found a smaller margin between athletes' and non-athletes' conformation towards feminine gender traits, which Steinfeldt attributed to an increase in valued traditional feminine traits in athletics (Steinfeldt et al., 2011). Oppositely, Koca's 2005 study reported a more substantial difference of 17% (Koca et al., 2005). However, notably, Koca's study is more dated and therefore, contemporary results may differ as societal norms have progressed. Nonetheless, it is vital to recognize that athletes did self-report adhering to masculine traits more than non-athletes did 80% of the time, which aligns with both Koca and Steinfeldt's results that athletes have a higher adherence to traditional male traits than their non-athlete counterparts (Koca et al., 2005; Steinfeldt et al., 2011). Additionally, these findings support the greater ideology that the culture of competitive sports promotes traditionally masculine traits, potentially having an adverse effect on female athletes (Koca et al., 2005; Stick, 2021).

Female Empowerment

Prior to the study, it was hypothesized that female athletes would reject traditional feminine roles, providing them with a sense of empowerment. In contrast, 75% of athletes felt that playing field hockey, which they perceived to be more feminine, was empowering as it encouraged them to embrace their femininity as athletes who often felt restricted to masculinity. For instance, participant three claims, "Field hockey makes me less afraid to be feminine as an athlete," inferring that input from previous stakeholders may have initially deterred her from femininity. Similarly, participant one shares how field hockey assisted her in accepting her femininity, a part of herself which she previously suppressed as an athlete in self-identified masculine sports. Recognizably, this phenomenon provides potential justification for the minimal difference between athletes' and non-athletes' femininity scores. Furthermore, these findings align with Steinfeldt's theory that embedding traditionally feminine traits in sport results in female athletes engaged in the sport experiencing a new-found sense of appreciation for their femininity (Steinfeldt et al., 2011). This is alluded to by participant four, who shares, "Playing a more feminine sport has helped me not to feel pressure to be masculine and instead be myself." Following suit with a gained sense of empowerment, participant two claims that field hockey empowers her through the opportunities it provides her with, including a fully funded post-secondary education. As female athletes reflect on their gained sense of empowerment, they simultaneously bring awareness to the lack of opportunities for male field hockey players in Ontario. Participants continue theorizing that, ironically, a lack of male representation may be an underlying issue that has resulted in the sport being perceived as solely feminine in Ontario and, consequently, gaining an invalid conflation, as precedent studies have argued that society's ideology of sport is inherently masculine (Koca et al., 2005; Stick, 2021). Participant two argues, "Field hockey is only ever seen being played by amateur girls in high school, so people don't take it seriously." Recognizably, peers' perspectives are vital, as precedent studies have agreed that peers' judgments are one of the most significant barriers undermining female participation in athletics (Brown & Stone, 2016; Lunde & Gattario, 2017). Therefore, by providing more op-

portunities for men, shifting the perception of field hockey to be more androgynous, adverse comments made by external stakeholders may diminish. This proposal is supported by Schmalz and Kerstetter, who found that female athletes do not feel the same extent to conform to gender stereotypes when engaged in sports that their peers view as androgynous compared with binary (Schmalz & Kerstetter, 2006). To build a perception of androgyny, participant three suggests developing a policy in Canada similar to Title 9 in the U.S., which "ensures equal funding and opportunities for all genders."

Coaches as Stakeholders

Similarly to peers being recognized as having a significant influence as stakeholders, 75% of the interviewed athletes identified coaches as contributing stakeholders in creating an athletics culture in field hockey which promotes gender roles, with 75% of interviewees identifying the gender of the coach as a contributing factor. Likewise, every interviewee shared that they believed the overwhelming majority of Ontario coaches to be both older and male and of South Asian heritage (a region where men dominate field hockey). The effect of this demographic is alluded to by participant two, who argues, "The older male coaches tend to be more set in their ways when it comes to what it means to be a girl versus a guy." Correspondingly, participant one claimed that her previous male coach frequently spoke about how female field hockey players were biologically inferior to male players, unintentionally decreasing her self-confidence and affirming the relevance of biological determinism (UNESCO, 2012). In contrast, participant three, who recently transitioned to an all-female coaching staff, claimed that female coaching had a mitigating effect on the promotion of gender norms in her team's culture, concluding, "I have noticed a big difference in myself after being coached by women compared to men. My female coaches have gone through the same experiences as me first-hand, which creates this irreplicable connection." As a result of this experience, participant three argues that it would be beneficial to increase the number of female coaches in Ontario or provide male coaches with training to further their understanding of the female athlete experience.

Body Image Issues

In Chalabaev's 2013 study, she advocates that it is integral to examine the potential for stereotype threat theory through subconscious implications of adherence to gender roles in athletics, such as body image issues, particularly when participants do not self-identify as conforming to these roles (Chalabaev et al., 2013). Due to the quantitative results from the self-reporting survey not indicating high levels of conformity, interviewees were asked about potential indications of conformity, particularly body image issues. The interviews revealed that 75% of athletes have experienced body image issues, with the other 25% stating that they have witnessed their teammates struggle with body image issues. These results support precedent studies which caution the development of eating disorders and body image issues as a result of promoted gender stereotypes in female athletics (Chalabaev et al., 2013; Eime et al., 2016). When asked to expand on these body image issues, every interviewee claimed the causation to be a result of co-existing pressures from society and sports, coinciding with the ideology that athletes are coerced into conforming to society's standard of femininity and sports' desired masculinity (Koca et al., 2005; Stick, 2021). Participant one supported this ideology, sharing, "Sports make you have the desire to want to get stronger, but on the other hand, you are told you are going to be too manly, so it never really works."

Future Research

Further research is encouraged to explore proposed mitigating solutions, such as the influence of altering peers' perception of field hockey to be more androgynous, as well as the effect female coaches have on athletes' adherence to gender norms.

Conclusion

This study aimed to develop a more comprehensive understanding of the implications of gender norms on competitive female athletes. Despite participants playing field hockey, a highly feminized sport in Canada, it was anticipated they would reject traditionally feminine roles as they would not align with their true identities. Instead, it was predicted that athletes would

adhere to orthodox masculine traits heavily ingrained in athletics culture. Contrary to the proposition, the quantitative portion of this study revealed that adolescent female field hockey players in Ontario had only a slightly lower adherence to traditionally feminine traits compared with their non-athlete counterparts (5% lower for athletes) and slightly higher conformity to orthodox masculine traits (7%). These mere differences are attributed to a new incorporation of traditionally feminine traits in athletics and the cultural implementation of femininity in Ontario field hockey. As a result, athletes reported feeling empowered as they embraced their femininity as female athletes. However, adverse implications co-existed, including developed body image issues derived from conflicting pressures in sport to be masculine and society to be feminine, negative judgments made by peers undermining the athletic quality of field hockey, and reported incidents of male coaches perpetuating gender norms in athletics culture. A proposed mitigating solution is implementing specified training for male coaches regarding the female athletes experience and giving priority to appointing female coaches. Additionally, it is suggested that mechanisms are implemented, such as equal funding legislation, to provide more opportunities for male field hockey players to increase the sport's perceived androgyny and, therefore, athletic validity of the sport, decreasing the presence of traditional binary gender norms and their adverse implications, allowing athletes to flourish.

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Appendix A: Consent Form

Investigation of the Influence of Athletics Culture on Adherence to Gender Norms in Competitive Female Adolescent Field hockey players in Ontario

Researcher: -----

Date:

November 19th, 2022

Introduction:

I am inviting you to participate in my research study. I am an AP Capstone Research student from ----- . My research uses an explanatory sequential mixed method design to explore the influence athletics culture has on competitive female adolescent field hockey players' adherence to gender norms in Ontario. The data collection is projected to begin on December 1st, and participation should be completed by January 12th.

The study will investigate adherence to gender stereotypes in competitive female adolescent field hockey players in Ontario. There will be two cohorts of participants, one being competitive adolescent female field hockey players (cohort A) and the other being female adolescent non-athlete as a control (cohort B). Participants in group A will be cis-gendered female identifying adolescents residing in Ontario between the ages of 14 to 18 years old who currently play field hockey either for a competitive outside-of-school club and identify field hockey as their primary sport (the sport they invest the most amount of time), or for Field hockey Ontario, NextGen, or Canada. There will be approximately 65-100 participants in each cohort. Participants in cohort B must be cis-gendered female-identifying adolescents between the ages of 13 to 18 who have not participated in competitive sports outside of school within the last two years and have not played on a field hockey team within school.

Your Participation:

Participants from both cohorts will complete an approximately six-to-eight-minute online survey that is an adaptation of the Bem Sex-Role Inventory (BSRI) developed by Sandra Bem. The BSRI will ask participants to rate themselves in accordance with 40 traditionally gendered traits on a seven-point scale. The survey will measure participants' adherence to traditionally feminine, masculine, and androgynous traits. Following the survey, approximately five participants from cohort A who express interest will be asked to complete an interview estimated to be 30 minutes or

less in duration about their experience with gender roles and stereotypes in field hockey and the implications they believe their experiences have had on their adherence to gendered stereotypes. The answers provided by participants in this interview will be utilized to further understand the effects of athletics culture in influencing competitive female field hockey players' adherence to gender norms and stereotypes.

Your participation is completely anonymous and voluntary. Additionally, you have the right to not answer any questions should you not feel comfortable. With your permission, audio recordings will be taken of the interviews to be used solely as a memory aid. You have the right to withdraw from the study, at any time, without penalty of loss of benefits in which you are otherwise entitled.

Confidentiality, Publication of Results, and Access to Research Information:

Any information provided by participants will remain anonymous. If participants are to be referenced their confidentiality will be protected under an alias. Personal information, including identity and collected data will only be disclosed to ----- (research supervisor) and ----- (researcher). However, in the unlikely event of legal reporting requirements, personal information and collected data will be released to legal authorities. Otherwise, all personal information and collected data, including survey responses and audio recordings, will be kept in a password-protected file, and will be deleted three months after participation. This research is intended to be published in scholarly publications and shared through a public presentation. If this research is published, the entire paper will be sent to participants to access. If new information becomes available, that may affect the participant's willingness to continue participation in the study, the participant or the participant's legal representative will be informed in a timely manner.

Risks and Benefits

There are no direct benefits from participating in this study, other than sharing knowledge and learning more about the influence sporting culture may have on adherence to gender stereotypes and roles for competitive female adolescent field hockey players in Ontario. There are no payments, costs, or reimbursements for participating in this study.

Potential foreseeable risks for this study include interviewed participants reporting inappropriate, harm-

ful, and/or discriminatory behaviour from coaching staff or teammates as they are being asked to expand upon their experiences in athletics culture, specifically the pressures they face regarding gender stereotypes. In the event that a participant shares these incidents of misconduct they will be encouraged to report these to Safe Sports Canada which will provide them with mental health supports and resources to file a formal complaint.

Additionally, participants will be asked to reflect upon which gender traits they adhere to and share their experiences regarding gender stereotypes and norms in field hockey. It is recognized that these may be uncomfortable conversations for participants, especially participants who identify as members of the LGBTQ2S+ community. Therefore, participants are reminded that if at any time they feel uncomfortable they have the right to withdraw from the study without penalty of loss of benefits to which you are otherwise entitled. Moreover, participants are made aware that all information provided by participants will remain anonymous, only being shared with the researcher and research supervisor who will keep this information confidential.

Contact Information

If you have any questions about this study, any time before, during, or after the study, please contact:

Participant Informed Consent Form

I _____ (Please print first and last name) have read and understood all of the information regarding my voluntary participation in ----- research project and choose to consent.

First name: _____

Last name: _____

Participant's Signature: _____

Parent/Guardian's Signature (if the participant is under 18 years old): _____

Appendix B: Recruitment Email

Good afternoon, Field Hockey Ontario,

I am -----, a Team Ontario athlete and AP Capstone Research student from -----. I am researching competitive adolescent female field hockey players' adherence to gender norms evident in athletics culture and was wondering if you would be willing to help me advertise my survey to eligible FHO athletes by sending information regarding my survey to athletes. I am sure that the findings of my survey would be useful to you as an organization in developing your understanding of how you can further empower female field hockey players in Ontario.

Ideally, I am looking for approximately 65-100 participants to complete a short six-to-eight-minute anonymous online survey being sent out by the end of November by a deadline of December 16th, 2022. Additionally, I am looking for roughly five eligible athletes who are interested in completing a 30-minute or less virtual interview in early to mid-January of 2023. To be eligible to participate in the survey and interviews participants must be cis-gendered female-identifying athletes residing in Ontario, who are adolescents between the ages of 14 to 18 years old who currently play field hockey either for a competitive outside-of-school club and identify field hockey as their primary sport (the sport they invest the most amount of time in) or for field hockey Ontario, field hockey NextGen, and/or field hockey Canada.

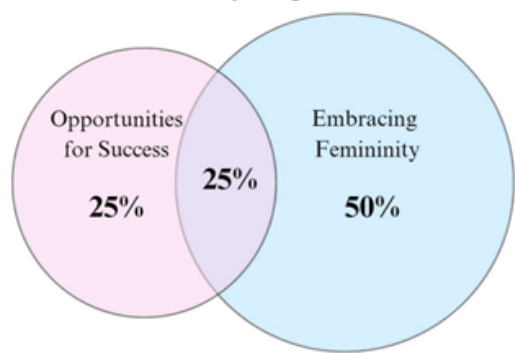
Notably, I have attached my participant informed consent form to provide more information regarding ethics, the role of the participant, and how this collected data will be both protected and utilized in the study.

Please let me know if you are willing or not willing to send an email to athletes regarding participating in this study by November 17th. If you are willing to help me recruit participants via email, I can send you the specific information I am hoping for you to send out, including the link to the survey.

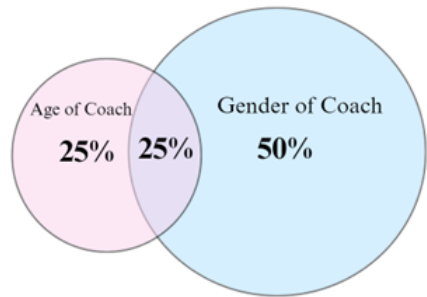
Thank you for your time and please contact me at ----- if you have any additional questions.

Appendix C: Additional Data

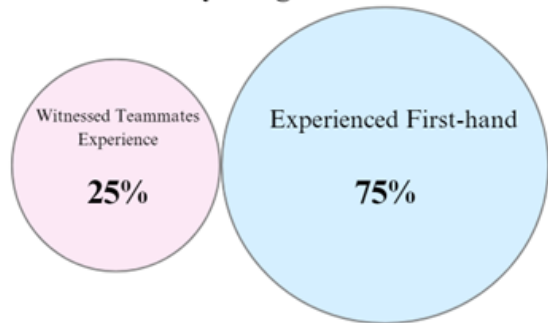
How Field Hockey Empowers Athletes



Participant Identified Factors that Contribute to the Promotion of Gender Norms



How Participants Have Experienced Body Image Issues



Empathy in Kentucky High School Students

Sruthika Shivakumar

Abstract: Empathy rates are declining rapidly, especially in adolescents. Studies show empathy is an important skill used in several fields of work. The lack of empathy led to the research question: Do High School Students of a Highly Rated High School in Kentucky display more Sympathy or Empathy? An online survey with five hypothetical scenarios — each with a different age group — was given to a convenience sample within the school. The responses were coded and analyzed on Atlas.ti, an online qualitative coding software, converting the qualitative data to quantitative data. The results were categorized into one of four categories: Empathy, Sympathy, Mix of Both, or None. The research showed that students showed less empathy to older age groups than younger ones, illustrating Psychological Closeness, where people show more empathy to people with whom they share similarities. The research concluded that high school students in a highly rated high school in Kentucky are more empathetic to individuals they can relate to most.

Keywords: Empathy, adolescents, Sympathy, survey, age groups, Atlas.ti

INTRODUCTION

It is pervasive to feel pity for anything, be it a person, an animal, or even a toy that is being crushed under a chair leg. There are two ways to show pity to another person: Sympathy and Empathy. Empathy rates are rapidly decreasing in the United States today, especially with the recent COVID-19 pandemic (United Way NCA, 2022). To measure empathy burnout, the United Way of the National Capital Area surveyed 1,022 Americans across various demographics and from all 50 states to obtain the results that empathy levels have gone down by 10% on average compared with two years ago for

the whole American population. Within this, Gen Z respondents had an empathy level decrease of 14% from two years ago (United Way NCA, 2022). This statistic is alarming because Gen Z comprises today's adolescents, who will lead the next generation of humans. Therefore, the researcher wanted to measure the amount of empathy in adolescents in their community. However, it is not easy to generalize the psychological patterns of adolescents. Therefore, for accuracy, the researcher chose a small scope and generalized the results to only one school in a Kentucky school district. With the study's gap in location and scope, this research explores whether high school students have more sympathy or empathy in a Jefferson County, Kentucky, school.

LITERATURE REVIEW

ON EMPATHY

Empathy is a complex term to define, and different psychologists have different definitions of empathy. American-Canadian psychologist Paul Bloom defines empathy in his book "Against Empathy" as the ability to "feel what others are feeling and to be able to put yourself in the situation of others" (Bloom, 2018, p. 11). In other words, it is the ability to put yourself in the shoes of others and feel their emotions through their lens. As it may sound, empathy is not an instinct for several people and often must be learned through others or outside experience.

First of all, why is empathy important? Empathy is essential to the social world and is used in several professions, such as teaching and medicine. Emily Wender says in her journal article about teaching methods that empathy is critical in the real world to be a good teacher. She gives several examples of how to use empathy in teaching, such as telling or asking for stories from the listeners. In several places, Wender observes ways that empathetic teaching techniques in the classroom have proven effective. She states that "offering empathic feedback on first-person writing helps [her] show students [she is] aware of and interested in their experiences" (Wender, 2014, p. 37). Showing empathy towards students can help them improve their mental health by letting them know someone is aware and interested in their experiences.

In the medical world, empathy is vital, along with sympathy, because medical personnel must have social interactions with other people constantly. In his analysis of empathy in the medical world, David Jeffrey states that "...the best understood pathway by which empathy improves health outcomes is in the generation of trust between the patient and doctor" (Jeffrey, 2016, p. 450). Empathy can help make these interactions more enjoyable and make people happier. Studies also show that empathy is also shown to significantly raise happiness rates, even when the problem is not solved (Thin, 2014).

ON SYMPATHY

On the other hand, sympathy is a common alternative to empathy. It involves simply expressing pity for

another person and not putting themselves into the shoes of others. Even though sympathy is often downplayed by empathy, it is a reasonably good alternative (Clark, 1987). Clark, a professor at Montclair State College, explains that even though empathy truly is the better option to respond positively to a person in pain, it is often difficult for some people to learn the skill of empathy. In those cases, sympathy is a better alternative to not doing anything (Clark, 1987).

Moreover, experiments show that showing sympathy to a person would decrease their happiness. However, showing empathy to a person would increase their happiness (Thin, 2017), which shows empathy's power over other people's emotions. Both these studies communicate the powerful effects of empathy and their impact on a person's happiness levels. Sympathy also has a powerful effect on happiness levels but is more pessimistic than empathetic responses.

Although almost opposites, sympathy and empathy are very closely related. While both are feelings of pity, "[e]mpathy is our ability to understand how someone feels[,] while sympathy is our relief in not having the same problems" (Rjr, 2022). Empathy is the ability to relate to how someone is feeling and being able to communicate with them while putting themselves into their situation, while sympathy is when the person feels grateful that they do not have the same problems and feels a sense of pity that the other person must go through this type of experience. Sympathy is the more common response to a person in pain, while empathy is the type of response that creates a more positive impact on the person's happiness levels. Therefore, even though sympathy is an excellent type of response, it is preferred that people respond with empathy.

ON EXISTING RESPONSE THEORIES

There are existing theories on how people react to a person in pain or who needs help. One type of response is called the bystander effect. According to James Hudson and Amy Brockman of the Georgia Institute of Technology, the bystander effect is when "individuals are less likely to offer assistance in an emergency when other witnesses are around" (Hudson, 2004, p. 168). This effect comes into play when a person is in a large crowd or a public area. This type of response was studied after the murder of Catherine Susan Genovese, who was brutally killed despite sev-

eral people knowing she was being chased.

The murder case tells the story of Catherine Susan Genovese, a lesbian bartender living with her girlfriend in New York. She was being chased by her killer, Winston Moseley, and was later stabbed and killed in a nearby parking lot. Upon further investigation, the police found out that she cried out for help to at least 38 people in a nearby apartment, none of whom offered to help Genovese. All of them assumed that someone else would call the cops or offer help to Genovese, and this reaction coined the psychological effect known as the bystander effect (Ruhl, 2023).

This idea is most likely to play in this type of environment because people think that since there are more witnesses to a situation, there are more people to potentially help the person, which can cause diffusion of responsibility (Bickman, 1971). The concept of diffusion of responsibility happens when several people witness an event. Everyone subconsciously assumes that everyone is responsible for taking action on that specific event and that someone else will eventually take action. This subconscious thought process transpires in everyone's brains, resulting in almost nobody taking the necessary action. The diffusion of responsibility is often paired with the bystander effect because it causes the diffusion of responsibility, which results in almost no one wanting to help the person in need since people assume that someone else will do it when, in reality, no one will.

Another type of response is called psychological closeness. According to an article called "Pity," psychological closeness is when a person feels pity for someone to whom they can most closely relate. As defined by the article, psychological closeness "depends on the relationship you have with a person..., proximity..., and similarity in background" (Pity, 2022). In other words, people can relate better to people with whom they share certain similarities. For example, a musician's broken hand may not evoke as much pity from a non-musician as a musician since there is a similarity in the background. The differences between the amount of empathy or sympathy shown and the person needing assistance can also be confounding, influencing how much empathy or sympathy a person shows another person.

ON ADOLESCENT BRAIN DEVELOPMENT AND SCOPE

The adolescent brain is complicated to analyze. Sarah-Jayne Blakemore conducted a study using neuroimaging techniques and discovered that the adolescent brain starts to grow new gray matter, which produces different hormones in the brain. It grows at different rates, causing different types of outputs for each adolescent (Blakemore, 2006). This study shows that the adolescent brain is highly unpredictable, and it is nearly impossible to create a theory that applies to all adolescents simultaneously. Sudha Chhikara's results from her experimental study with school-age students also display the vast differences adolescents can have between their ages through her studies on adolescent brains ages 12-18. She stated in her research that the study resulted in vastly different results for each age, with almost entirely different statistics for each age number, further showing that an adolescent's mind is difficult to generalize (Chhikara, 1996). There are vast differences between each adolescent's brain, so the scope must be small enough to generalize to a group of adolescents with a common similarity. Taking smaller samples of adolescents and analyzing them separately as distinctive groups would reduce the chance that the research makes false assumptions about the entire population of adolescents or make the research insignificant. With a smaller sample size with a certain similarity, the research can apply to a specific subdivision of adolescents, making the research more accurate to that subpopulation.

THE GAP

Several studies on empathy show how much happier people tend to become when others are empathetic rather than sympathetic. They also show how teenagers' brains are incredibly unpredictable on a large scale, and trends can only be traced when studied with a small scope. However, there has been no research on whether these adolescents tend to show more sympathy or empathy toward other people. There are no studies on the correlation between empathy and sympathy in Jefferson County, Kentucky. There is one research experiment conducted related to empathy, done by the Christian Science Monitor, called "Does Empathy Training Boost Math Scores?" It is a research study where several high

school students were given empathy training and asked to take a math test after the training to see whether empathy affected their math scores. The experiment lasted for six years, proving that empathy training “showed an 11 to 17 percent increase in students’ academic performance and had better problem solving and conflict resolution skills[,]” increasing the need for empathy training in the school setting (The Christian Science Monitor, 2016). The fact that this is the only research study done in this location makes room for a gap in the body of knowledge. The researcher chose to research only adolescents of a highly rated high school in Kentucky since it is the researcher’s school and, therefore, the most feasible scope for study for the researcher.

Another pair of researchers, Ruth Feldman and Jonathan Levy, conducted an experimental research study called “Can teenagers feel the pain of others? peeking into the teenage brain to find empathy.” They have a similar research question to the selected one, which is why this study is necessary to explain. This experiment’s research question is, “Can teenagers show empathy towards others?” The experiment used a machine called a MEG machine, which tracks brain activity when a student shows empathy to another person of either the same or different race as themselves. The conclusion of this study showed that students of Arab and Jewish descent tended to show more empathy towards people of the same race as themselves (Feldman, 2017).

That experiment had three significant differences from the researcher’s study. The first major difference is the scope of the research. Feldman’s study experimented with Jewish and Arab people specifically, whereas this research is not racially classified. However, the scope of this research study is set to high school students in a highly-rated high school in Jefferson County, Kentucky. The scope is not restricted by race but is restricted by the school. This restriction may produce different types of reactions compared with the experimental research conducted by Feldman.

The second significant difference is the methodology. The study uses the MEG machine, which analyzes brain function and classifies whether it is empathy. This research uses mixed methods, posing hypothetical scenarios to high school students through an online survey. The main advantage of using mixed methods is that the students will present more accurate results than if the MEG machine had inaccuracies that might

have affected the results. A qualitative method of collecting data is potentially authentic because it comes directly from the students. The third and last significant difference is the results themselves. The results of Feldman’s study showed whether the participants showed more empathy regarding their cultural background. In contrast, this research will show whether the high school students showed more sympathy or empathy without concern about their cultural or racial background. The scope has been restricted to one school for increased feasibility.

With the gaps in both location and scope of research, there is a defined gap in the book of knowledge, bringing up the research question, do students of a highly rated high school in Kentucky display more sympathy or empathy towards other people? This research would help contribute to this gap, making this research significant for inquiry.

METHODS

METHOD DESIGN STATEMENT

A qualitative content analysis method will present hypothetical scenarios to several high school students in a highly rated high school and analyze whether these students show more empathy or sympathy towards people of different age groups. The Institutional Review Board (IRB) approved the method for ethical research techniques. The researcher used a qualitative open-response survey modeled similarly to the Association of American Medical Colleges (AAMC) Situational Judgement Test.

ALIGNMENT JUSTIFICATION

The AAMC Situational Judgement Test is designed to accept medical students into residency. Used in several parts of the United States, it is designed with hypothetical scenarios with four multiple-choice options to analyze the effectiveness of the student’s methods and the student’s character in general in the real world. The AAMC Situational Judgement test questions simulate the common difficulties medical students encounter in medical school. An article written by Dr. Sahil Mehta summarizes several scholarly articles on the topic of the AAMC Situational Judgement Test. It states that it ac-

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curately represents the efficiency of the accepted medical students and adds value to the admission process (Mehta, 2023). The test is a multiple-choice format with four actions that the students would rank from most effective to least effective.

Following this method, the researcher selected this test to model their research because it provides a practical and feasible way to analyze a person's personality and methods. The researcher created hypothetical scenarios specifically to provoke a sense of pity in the student. However, the researcher changed the multiple-choice response to an open response to allow for greater freedom in responses and for the students to state their true intentions instead of confining the several possibilities into four multiple-choice answers. The instructions given to the students are provided in Appendix 1, and the five questions asked are provided in Appendix 2 in the same order as they were asked.

SAMPLING METHODS

Since schools are unlikely to release students' demographic data to the researcher, the researcher decided to take a convenience sample and spread

the survey through text messaging to the researcher's existing contacts, giving out flyers, and posting it on schoolwide Google Classroom pages.

The survey was created on Google Forms and used five open-ended hypothetical scenarios, which consisted of practical scenarios with a person needing help or in pain. The hypothetical scenarios assign age and role to the participants, along with a detailed scenario to allow the students to picture the scenario. After the assignment, they are given a description of the environment they are in and the current situation of the other imaginary people. Then a situation description with one person from a specific age group needs help.

The different age groups were toddlers, high school students, adult coworkers, older adults, and newborns, respectively. The age groups were selected based on the differentiation established by the U.S. Department of Health and Human Services. The age groups were crucial in analyzing the results since they showed significant trends and specific psychological effects. The trends are explained in detail in the discussion section of this paper.

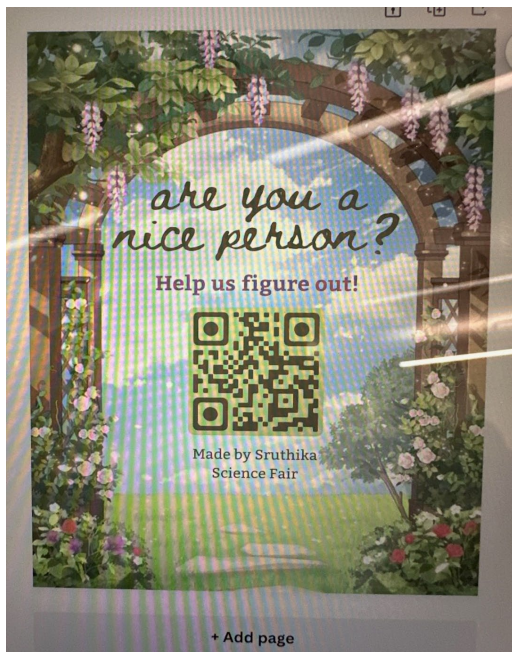
The participant was then asked to describe what they would do in such a situation in the position they were given in that scenario. Using the response given, the researcher determined whether they showed sympathy, empathy, or neither and used the online coding software to code the data and create graphic visualizations, which were used to create the bar graphs that are used in Figures 1-6 in the data and results section.

DATA COLLECTION METHODS

Responses were recorded in the "Responses" section of the Google Form. Once there were no more incoming responses for more than a week, the responses were exported to a spreadsheet. From there, the responses were formatted and uploaded to Atlas.ti, coded, and analyzed by the researcher into four categories: Empathy, Sympathy, a Mix of Both, or None. There were two rounds of coding and analysis, and the online software provided visualizations of the data.

DATA ANALYSIS METHODS

Since this research is a non-experimental mixed-methods project without a control variable, a regular



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t-test statistical analysis cannot be conducted because it requires a control variable to show statistical significance. Therefore, the researcher had to find a different way to calculate statistical significance. The ANOVA is an alternative analysis method that can be used on qualitative data. The more widely used t-test analyzes and compares the means between the control and experimental groups. The ANOVA, also called the f-test, measures the variances between the data groups if there is no control group (Kim, 2017). A one-way f-test was used since the research needed to measure the overall types of responses of the high school students, and there was only one sample of students. The ANOVA results are provided in the Data and Results section.

DATA AND RESULTS

Thirty-three responses were collected in the survey and exported to an Excel spreadsheet to view all the data at once. From the Excel spreadsheet, they were transferred into a Word document where the raw data was formatted and labeled by question number and student number. The responses were then transferred directly into Atlas.ti for coding and analysis. On Atlas.ti, the qualitative responses from the Google Form were converted into quantitative, numerical data. The below bar graphs were generated by Atlas.ti using the question numbers and the codes given to each response. The questions in the survey are provided in order in Appendix 2.

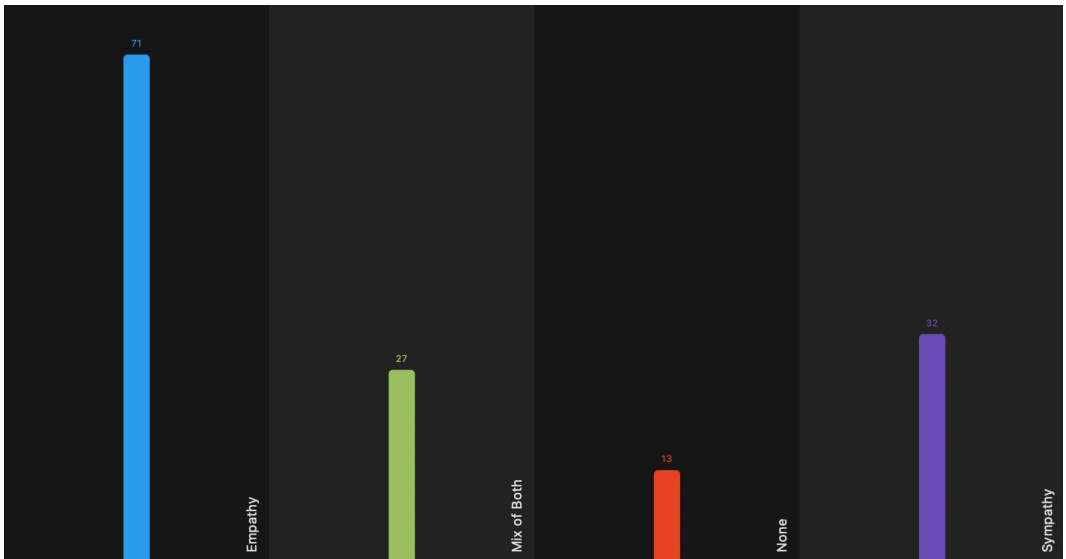


Figure 1:
Overall coded data derived from the survey responses.

Note. This figure shows the trend shown across all five questions. There were 143 total responses. The blue bar represents empathetic responses, the purple bar represents sympathetic responses, the green bar represents responses that were a mix of both, and the red bar represents responses that displayed neither sympathy nor empathy.

The above chart shows the overall data across all five questions, with 71 empathetic responses, 32 sympathetic responses, 27 responses with a mix of both, and 13 responses that do not show either. As shown, most respondents responded with empathy to each scenario. Below are all the charts with the individual amounts of empathy and sympathy for each question.

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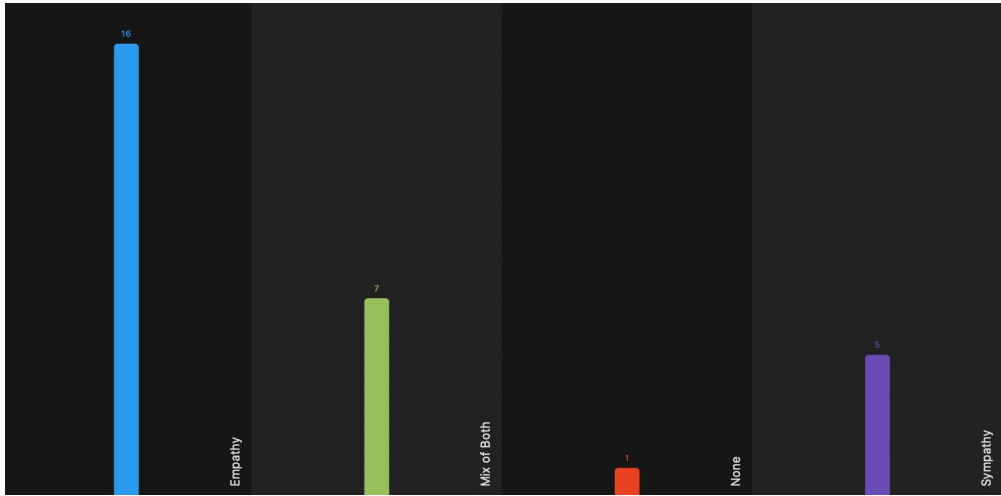


Figure 2:
Question 1 responses - bar graph

Note. This figure displays the bar graph for Question 1. There were 29 responses. All responses can be found in Appendix 3.

In question one, 16 students showed empathy, 5 showed sympathy, 7 showed a mix of both, and 1 showed none. There was a clear majority of empathetic responses.

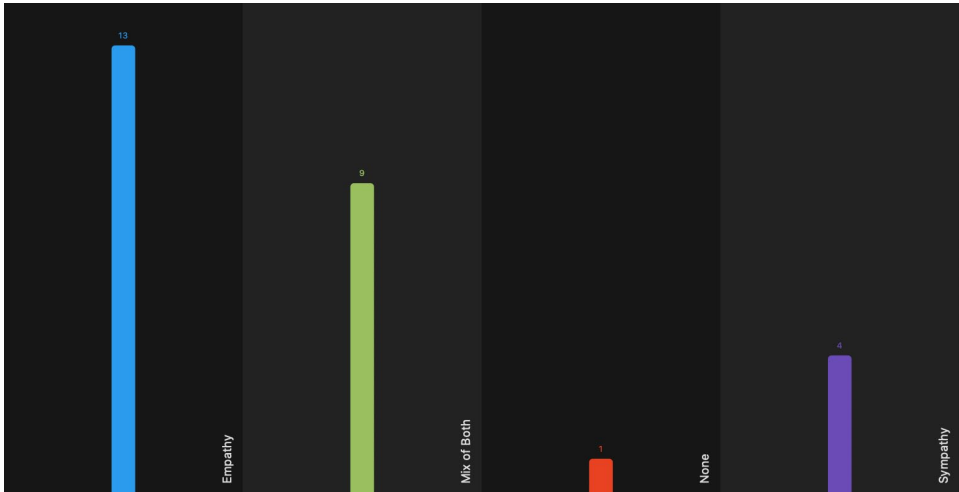


Figure 3:
Question 2 responses - bar graph

Note. This figure displays the bar graph for Question 2. There were 27 responses. All responses can be found in Appendix 3.

In question two, 13 students showed empathy, 4 showed sympathy, 9 showed a mix of both, and 1 showed none. There is a clear majority of empathetic responses.

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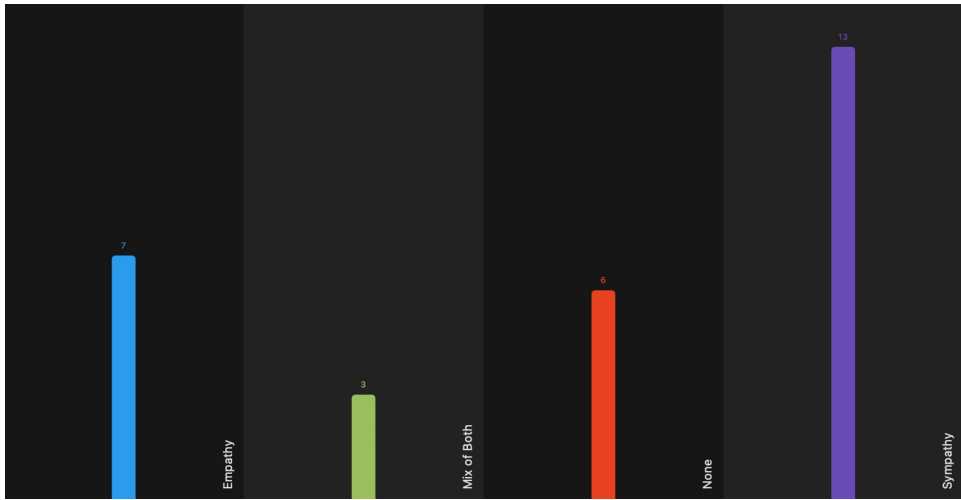


Figure 4:
Question 3 responses - bar graph

Note. This figure displays the bar graph for Question 3. There were 29 responses. All responses can be found in Appendix 3.

In question three, 7 showed empathy, 13 showed sympathy, 3 showed a mix of both, and 6 showed none. There is a clear majority of sympathetic responses.

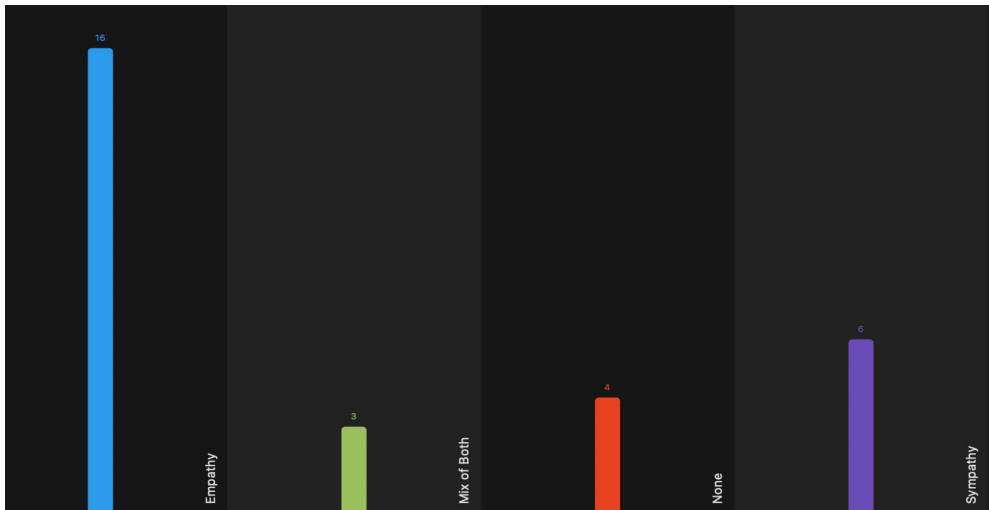


Figure 5:
Question 4 responses - bar graph

Note. This figure displays the bar graph for Question 4. There were 29 responses. All responses can be found in Appendix 3.

In question four, 16 students showed empathy, 6 showed sympathy, 3 showed a mix of both, and 4 showed none. There was a clear majority of empathetic responses.

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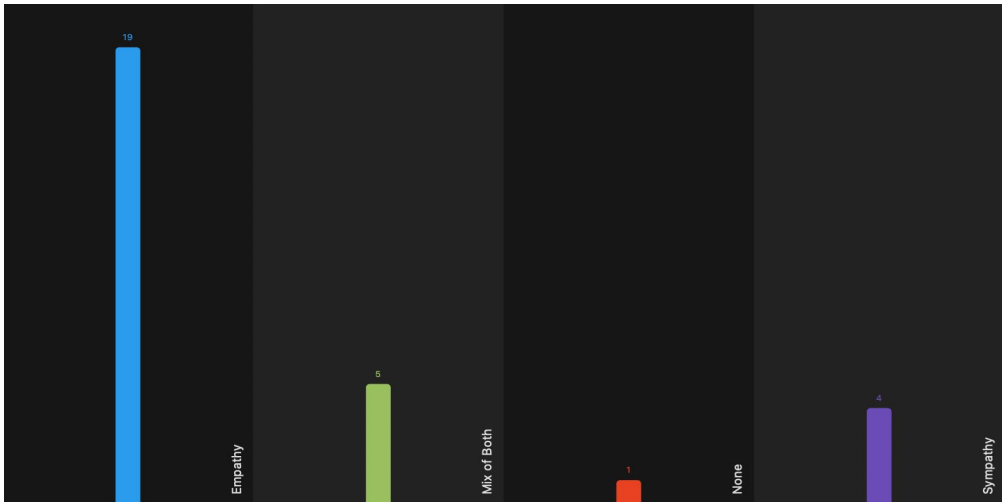


Figure 6:
Question 5 responses - bar graph

Note. This figure displays the bar graph for Question 5. There were 29 responses. All responses can be found in Appendix 3.

In question five, 19 students showed empathy, 4 showed sympathy, 5 showed a mix of both, and 1 showed none. There was a clear majority of empathetic responses.

Figures 7 and 8 show the output of the statistical analysis done on XLMiner Analysis ToolPak, a widely used statistical analysis tool used on Google Sheets to conduct several types of statistical analysis, including the ANOVA test (Zach, 2023). The researcher used XLMiner Analysis ToolPak to generate the above results from the ANOVA test (Figure 8). The p-value is shown in the second-to-last column in Figure 8. As

shown, the p-value of the collected data is less than the standard alpha level of 0.05, making the collected data statistically significant.

Along with the empathetic and sympathetic data, the researcher also analyzed the type of language used in each question's responses. The researcher found that certain age groups elicited more empathy than others. For example, Student 27's response to ques-

SUMMARY				
Groups	Count	Sum	Average	Variance
Empathy	5	71	14.2	20.7
Sympathy	5	32	6.4	14.3
Mix of Both	5	27	5.4	6.8
None	5	13	2.6	5.3

Figure 7:
Statistical analysis - Mean and Variance of groups

Note. This figure displays the Mean and Variance of the different categorical variables from the coding analysis. An average of 14 students showed empathy for all age groups.

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ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	370.15	3	123.3833333	10.47841472	0.0004679304081	3.238871522
Within Groups	188.4	16	11.775			
Total	558.55	19				

Figure 8:
Statistical analysis - p-value and Degrees of Freedom

tion 2 (Appendix 3) was two sentences long and was highly empathetic to the high school student who was the person in need. However, Student 27's response to question 3 (Appendix 3) was much shorter and barely even showed sympathy to the adult coworker. These two responses by the same student show a difference in the levels of empathy toward each age group, which poses an interesting pattern described in further detail in the Discussion section of this paper.

DISCUSSION

The research aimed to determine whether high school students at a highly rated school show more sympathy or empathy towards people of other ages. A survey with five hypothetical scenarios was distributed to students through schoolwide Google Classroom pages. The survey was voluntary, so it was up to the student whether they wanted to complete it. The directions on the survey asked the students to state in as much detail as possible the steps they would take in that given situation. The questions state where the student will be, who is around them, what age they are to assume they are, and which person in particular needs help. Thirty-two responses were collected and analyzed by the researcher. For each question, each response was categorized into one of four categories: Empathy, Sympathy, Mix of Both, or None. The results showed that empathy was the dominant reaction in students when showing pity. However, among the questions, specific trends were noteworthy. Students tended to show more empathy to people younger than or the same age as them, whereas the empathy rates decreased if the person was older or a stranger. The research concluded that while students mostly show empathy, these levels may be lower if the other person is older or a stranger. Therefore, students from a

highly rated high school in Kentucky tend to show more empathy towards people to whom they can most closely relate.

THE ANALYSIS

There may be different scientific reasons for some of the results shown. One reason the students may have reacted with less empathy for the stranger was a psychological effect called the bystander effect. As previously stated in the literature review, the bystander effect is when "individuals are less likely to offer assistance in an emergency when other witnesses are around." (Hudson) Studies show that when many people are around, one person is less likely to help someone in need because they think someone in the crowd would do it for them instead. It becomes a distribution of responsibility. Additionally, experimental research done by Maria Plötner shows that children exhibit the bystander effect, like adults (Plötner, 2015). In this research project, in the question about the stranger, they were given the assumption that they were in a public place with several people around them.

Along with the bystander effect, the students also displayed diffusion of responsibility. To reiterate, the diffusion of responsibility is when a person believes that several people witnessed something and at least one person in the crowd would act. It is usually associated with the bystander effect since the bystander effect causes the diffusion of responsibility. Some students responded that someone else would help the woman since they were in a crowd, which is a clear sign of the diffusion of responsibility. For example, Student 19 clearly stated that other people could help her, so they said they would refuse to help her (Appendix 3). Several other students also responded that they would not help the stranger be-

cause they thought someone else would help, exhibiting the bystander effect.

A scientific reason these students tended to have much more empathetic responses towards the high school student, specifically compared to the other age groups, is because of a factor called “psychological closeness.” As previously mentioned, psychological closeness is when a person feels pity for another person when both share a common factor, such as a musician feeling pity when another musician hurts their fingers.

Similarly, in this research, the high school students could relate to the imaginary student more since there is a similarity in their backgrounds: high school. The students could think back to their experiences as high school students. The high empathy levels and the average response length for that specific question can be the reason for this. The second question had the most extended responses on average, which shows that the respondents had more to say for a person their age and likely felt a subconscious closeness to the imaginary student.

THE CONCLUSIONS

There were different levels of empathy between each presented age group. Upon analysis, the research results showed that the high school students of a highly rated high school in Kentucky showed empathy to people to whom they can relate the most, displaying psychological closeness and signs of the bystander effect.

THE IMPLICATIONS

The main implication of this research is extensive empathy training. A meta-analysis by Emily Teding van Berkhout, a researcher at the Department of the House of Representatives in Australia, states that “... empathy training programs tend to be effective in increasing empathy levels” (Teding van Berkhout, 2016). Based on the conclusions of this research, empathy training would increase the student’s empathy levels. It would increase empathy towards all age groups, not only the ages they have come across thus far, increasing overall empathy levels in adolescents attending this school in Kentucky.

THE LIMITATIONS AND FUTURE DIRECTIONS

The research comprised a survey with under 100 participants, with only five questions. The low number of questions may have led to certain inaccuracies in the research. With only five age groups with only one question per age group, the current research may need to be more representative of all the types of responses that students may give. The student may assist a particular age group more in a different situation than the one mentioned in this survey. Future research on this topic may use more hypothetical scenarios and have more participants complete the study to get more accurate results. With more scenarios, there can be a broader range of age groups and possibilities to analyze further which types of scenarios the students tend to show empathy or sympathy. The number of participants may also pose selection bias, since most participants were part of a convenience sample. Additionally, the results apply to this school only since this school is known for selecting the highest achieving students in the county. Therefore, results may be different in other schools that are rated lower. More participants can cover a more comprehensive range of students’ perspectives and potentially make the research more accurate by having a larger sample size and lesser selection bias.

The new understanding also poses certain limitations. The generated knowledge cannot necessarily be applied to the adolescent population since the scope is only set to one school in Kentucky and may apply only to those students who study there. Moreover, the new understanding may only prove effective in some circumstances. As mentioned, there may be scenarios where students would show more empathy than others, not covered by the small number of scenarios. The students may react with more empathy in one type of situation than another within a single age group. Minor changes to the scope of the study and adding more scenarios for future studies may increase the range for generalization. They may also be more accurate to that specific group.

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Appendix 1: Instructions from Researcher

Please read of the hypothetical scenarios carefully and respond with how you would react to these situations. Please respond with actions that you would perform in real life. If you would do nothing in reality, please respond with honesty. The responses can be as detailed as you like. However, the researcher would like the responses to at least be detailed enough to know what actions you are performing. These will not affect the way other students perceive you as a person. Everything types here will stay between you and the researcher. Have fun!

Instructions from researcher: I will present five scenarios to you now. For each scenario, I would like you to say truthfully what you would do in this situation. Assume that there are people around you, but no one can help solve the problem or take over the problem themselves. Your name will not be recorded, and your responses will not be given to any other unauthorized person. This questionnaire will not judge your character. Please answer as truthfully and as practically as possible. You are always permitted to leave during the survey or refuse to answer specific questions. I will now present the scenarios.

Appendix 2: Questionnaire

Question 1: Imagine you are a kindergarten teacher, and one of your students comes crying to you about how they made a mistake on one of their drawings, how they wanted it to be the best drawing ever, and how they messed up. How would you handle this child, and what would you tell them to console them? Assume the child is crying and is not acting violently.

Question 2: A friend who isn't doing well in school calls you one day and starts ranting about how they feel they aren't doing enough and that they will fail all classes. How would you respond to this friend to console them and convince them that they are doing great? Assume this friend is not one of your best friends but is not too distant.

Question 3: A coworker of yours comes to you and

tells you how they had a terrible day and got a parking ticket for no reason. What would you say to this coworker? Assume you both know each other.

Question 4: Imagine you are walking home from work, and you stop by a grocery store. You see an old lady on the road trying to ask someone for a phone to call their son. What would you do in this situation? Assume that there are people around you. Did you say anything to her?

Question 5: You are now 30 years old, and your friend just had a baby. You go over to visit them, and your friend tells you their baby has not eaten since the morning. She leaves to get something for you, and she leaves the baby in your arms. As soon as your friend leaves, the baby starts to cry out of hunger. What would you do to help the child?

Appendix 3: Responses

Question 1:

Student 1: U can't make a mistake while drawing. Beauty is in the eye of the beholder. Don't worry kid it's about if you are satisfied with it and if u love what u made.

Student 2: I would tell that it's alright to make mistakes and that they can try again. I would give them a new piece of paper so that they can start over. I would also talk in a gentle manner, so as to not upset them any further.

Student 3: I would tell the child that everyone makes mistakes and it is natural and that nothing is impossible to solve. I would console the child to stop crying and tell them to start over their drawing.

Student 4: I would console the child by telling them that mistakes are common in life and you have to learn from them and then hand them a new piece of paper to start the drawing over again.

Student 5: Tell them that mistakes and imperfections is what makes it unique and even more beautiful.

Student 6: I would probably tell them that it's okay and that every artist goes through art that isn't perfect and offer another opportunity where the child could feel better about their art. I would explain how in their eyes it may look bad but in my eyes it looks really good.

Student 7: I would sit down with them and ask them what they did wrong, and what they wanted to do instead. I will

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tell them that I love their idea of what they wanted the piece to be, but that it still turned out to be an awesome drawing even with the mistakes, because mistakes don't make something good or bad. They are "happy accidents" and happy accidents often end up being super cool!

Student 8: I would first try to console the child trying to explain that mistakes are inevitable but practice makes perfect and I will show them how to use that mistake to make their drawing better.

Student 9: I would tell the child that every piece of art is beautiful, and there are no mistakes, only happy accidents.

Student 10: Probably that it's okay to make mistakes and perfection makes life boring. Even picking up a brush/pencil is progress to become more confident in your craft.

Student 11: I'll tell them everything is okay and that life is a learning process. That mistakes make people better it's always good to keep trying don't give up.

Student 12: I would calmly let them know and reassure them that everything will be okay, and let them know that their work is still good, and there is always time to create more art. also for the main point of it's okay to make a mistake, and with their imagination, they could challenge themselves to try to fix the mistake to their liking, hence creating more art.

Student 13: Give the child to its mother and tell it to stop.

Student 14: I would tell them that perfection is not capable and mistakes are apart of artistry and that I love their drawing still

Student 15: I tell them that their drawing is already good and that perfection isn't real.

Student 16: I would try and calm them down, then explain how all artists mess up on their work, and sometimes the mistakes make the art piece better

Student 17: I would probably try to help them fix the mistake they made or help them re-paint it, if I didn't have time to do it I think I would tell them I really liked the painting and ask if they could draw/paint me something.

Student 18: I would try to calm the child down and once the child calms down, I would probably try to find a way to fix the mistake or cover it up some how by tells the child it looks like something so they can paint over it or add more to it. If I can't, then I would tell them it's ok to make mistakes and that it will be a great drawing anyways or I would get them a new paper and tell them that they can make a new even greater drawing. I would also ask them why that drawing was so great and ask them to recreate that feeling again.

Student 19: I would comfort the child and tell them they could make a new drawing or making their original drawing

different.

Student 20: I would do my best to comfort them, reassuring them that they could erase the mistake, or start again. Additionally, I would reassure them that everyone makes mistakes, and that even great artists like Picasso had to re-start or erase things.

Student 21: I would tell the child that everyone makes mistakes and that they can still keep trying to produce the best drawing ever. I would encourage them to keep trying and not give up on their goal.

Student 22: Tell them it's okay and show them how they could fix it once they calm down.

Student 23: i would tell them even though they feel they messed up that their art work was still very beautiful . i would as them if they want a new paper to start over and try to comfort them as best as i could.

Student 24: I would console them, tell them their drawing looks good, and give them another piece of paper to try again.

Student 25: I would first calm them down by telling them that everything is ok and that there are solutions to this problem. I would offer them help on fixing the picture to make it the way that the child wants it, or offer them a few more pieces of paper and materials so they can try again.

Student 26: I would hug them and tell them it's okay and the mistake is unintentionally beautiful. I would tell them that they can learn from their mistakes and they can use this knowledge to even improve their art in the future. I would also draw something purposely worst than what they drew on a different piece of paper hopefully to make them laugh and feel happy.

Student 27: I would start by telling them that not everything has to be perfect all the time, and it's more important that they tried. I would also tell them that every drawing is just practice for the next one, so they should try and learn from their mistake and focus more on making something that they are proud of next time, rather than striving for perfection.

Student 28: I would console the child with such statements as 'Don't worry, just learn from your mistakes and you can make it perfect the second time'

Student 29: I would asked them to explain why and what they messed up and then try to reason with them and find a way they can fix it.

Question 2:

Student 1: I will listen to their rant and say don't worry I've done worse and I survived, u will too.

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People tend to feel better other people have gone through the same senecio and they turned out okay.

Student 2: I would respond saying that sometimes we have our ups and downs, and that they shouldn't take this as them being a failure. Instead, I would tell them to think about what they can do to fix this. Why do they feel they are not doing enough? If they have an answer to that, we can work on a solution. If not, I'd recommend they talk to their teacher or counselor to see what they can do to do better in school.

Student 3: I would tell them that school is very hard and they are going to do great and that they just have to try a little hard.

Student 4: I would console my friend by reassuring them that grades aren't everything in the world and theres more to do than just study, however you have to find a balance between both of them and if my friend is struggling to do that I would just continue listening to the rant and not do anything. Sure you may feel bad right now but things only get worse if you give up so hopefully things get better.

Student 5: I would console and assure that they aren't alone and that i'm stressed as well so they'll feel less alone

Student 6: I would console and assure that they aren't alone and that i'm stressed as well so they'll feel less alone

Student 7: I would tell them that as long as they are trying their best, they're doing enough. As for failing classes, it depends on the situation the person is actually in with grades. If they are truly on a track to fail their classes, I will remind them that grades are ultimately just another number. If they aren't on the track to fail and are just panicking, I will remind them that they are a great student and have always passed their classes in the past so they can do it now.

Student 8: I would remind them of all their past achievements and show that they are capable and have the potential to step back up and do good in their classes in even the short amount of time and tell them that I am willing to help them do so.

Student 9: I would tell them to stop comparing themselves. And that they're always better than someone.

Student 10: I'm also failing all my classes. It's chill. We should start a commune in the woods!

Student 11: Convince them to spend more time in school and not to stress about it too much that it can ruin your mental health

Student 12: i wouldn't know how to respond other than to say it's gonna be alright. maybe ask them questions specifically to what they are frustrated with, to let them speak it off their chest.

Student 13: I would tell then that they are smart and that grades do not define you

Student 14: I would tell the friend that the grading period isn't over till it's over

Student 15: I don't do that, I tell them that my grades are also failing (I'm not lying) and that in the grand scheme of things, it'll be okay because we all choose to live another day anyway, and that tomorrow can bring new things.

Student 16: I would start off with a rant of my own, about how the standardized testing and nomination of such sets kids up to fail and feel like a failure, then offer to help them

Student 17: I think I would just ask them if I could help them with any assignments, or if I could help them with anything.

Student 18: I am would listen to them and try to encourage them to find ways to improve their study methods and habits while complimenting them on what they are currently doing.

Student 19: I would tell them that they have achieved and accomplish a lot that they don't give themselves enough credit for and it's hard to feel like you are doing well when there are constant assignments needing to be done. I would tell them they work really hard and aren't going to fail but if they feel like they need to do more we could study together or they could try making to do lists and focusing more time on work.

Student 20: I would gather some more information about why they feel this way, and how they are doing, and do my best to reassure them that it's just a high school class, there's always next year/semester. I would also try to offer them comfort in the fact that I have my own feelings of not doing enough, and that they aren't alone.

Student 21: I would remind them of how many things they already have to manage and how the transition to high school is difficult but that they have managed to handle it, which is impressive in itself. I would tell them that they are always good enough despite what the people around them are doing. I would also encourage them to talk to their teacher and seek help if they have legitimate evidence that they are struggling in the class.

Student 22: Tell them to list what classes they have and why they feel like they aren't doing great. Tell them about any extra credit they could do to bring it up. If it's too late to do that, tell them that colleges won't just care about grades and bring up what they excel at

Student 23: firstly i would ask if they need help with anything work / school wise. then i would ask what type of grades they have and see what all i could do to help.

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Student 24: I would listen to them vent and be sympathetic. If they are open to advice I would give them advice. However I wouldn't directly try to convince them that they are wrong

Student 25: I would tell them that everything is going to be ok, and that their grade doesn't reflect their effort. I would tell them that a lot of the material they are learning is difficult, and not fully mastering the material doesn't mean that you are an awful student.

Student 26: I would tell them to not give up and that these feelings are temporary. Just to be sure that they won't take their own life, I would tell them that I love them (in a friend way ofc) and they can't solve a temporary problem with a permanent solution. I would tell them they got this and tell them similar situations of mine since tbh, I feel like I'm not good enough everyday lol and give them advice and self care tips. Since they're not one of my best friends, I would try to spend time with them more because obv we're not that close but clearly they need support since they choose to rant to someone who is not close to them/a best friend to them. If I meet them in person, I would give them a big hug since hugs make me calm and hopefully they will feel less sad.

Student 27: I would try and remind them of things that I know they are good at to try and soothe their fears of not doing enough. In addition, I would tell them that it will be okay and that their reaction just shows that they care about doing well, indicating that they have the motivation to get their grades up.

Student 28: LMAO this is me, i'm the ranting friend

Student 29: I would ask them to tell me why they are feeling this way and give them ways they can fix this, if they are doing okay I would reassure them of that.

Question 3:

Student 1: Ask if they have dashcam footage or something and take it to the police. They can't do that. Sue them

Student 2: I would tell them that I'm sorry they had such a horrible day and I hope that the next day will be better.

Student 3: I would tell them that it's going to be okay and if there are bad days then there are good days to which will come very soon.

Student 4: I would tell the coworker that they could've been more responsible with where they park there car however after that I would try and comfort them to the best of my ability and tell them that they can take it easy at work and try and cover for them as much as I can

Student 5: I would ask them what i could do to make their day better

Student 6: I would probably reassure them and possibly help them pay it. I don't think I would offer to pay it fully but I would help a bit and offer them a space where they can rant or let things off their chest from the day. If it's a coworker I would also tell them to just take the job a little more easier than usual

Student 7: I would say that I am sorry they got a parking ticket and had a terrible day. Some days are just like that but that's ok because bad days make good days feel even better when they come around.

Student 8: I would say that there was probably a specific reason for why that happened and if they really think it's unfair then could probably go take a picture of the scenario and report it but I would say that's unnecessary.

Student 9: Try and park better. Or that daily inconveniences happen

Student 10: Man, that sucks. Public transport should be the norm. There are too many cars and we can't afford to make a concrete world to get enough parking.

Student 11: That's it's okay you can go to court and fight it if you didn't deserve a parking ticket and to not overthink it that life will be okay.

Student 12: ask them what happened that day in order to gain more info about their current situation

Student 13: That's so stupid im so sorry

Student 14: The police are so stupid in this area and why do traffic cops have nothing better to do

Student 15: I tell them that that sucks and that they should do one thing that makes them happy for that day.

Student 16: Just let them rant, sometimes that's the best thing

Student 17: I think I would let them rant to me about anything and tell them I hope they have a better day tomorrow.

Student 18: I would listen and try to give advice if I can by comforting them first and telling them they'll have a better day tomorrow. The coworker might be offended if I try to explain why they got a ticket so I won't. I will mostly listen and comfort.

Student 19: I tell them that i am sorry and that must be very annoying to deal with.

Student 20: I would tell them that that really sucks, and ask if there had been anything else that made that day terrible. If there had, I would do my best to console them. If it had just been the parking ticket, then I would try to remind them that it's just one thing that's sucked, and there have been plenty of good things that day.

Student 21: I would ask what happened during their day and show them I understand how they feel about their day.

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I would then assure them everyone has bad days, but this is just another one they have to get through, and they will hopefully have a better day tomorrow.

Student 22: I'd not talk about it much, instead saying "that sucks"

Student 23: i would ask what the parking ticket said and if it was a valid reason for them to have it then i would explain to them why they have it and how they were in the wrong.

Student 24: I would say something along the lines of "wow that sucks"

Student 25: I would tell them that tomorrow will be a better day for them, and I would give solutions to the parking ticket problem, as in helping them pay it off if they are low on money, etc.

Student 26: I would tell them multiple stories of my dad getting a parking tickets in the past lol to reassure them since my dad is fine still to this day. I would tell them that everything is going to be fine, don't stress out but also tell them to be careful of signs and park in spaces that you're sure is parking ticket free.

Student 27: I would say "that sucks" and then ask them for more details.

Student 28: I'd say 'that sucks, wanna talk about it or do you just want some coffee?'

Student 29: I would tell them that I am sorry that their day is going that way

Question 4:

Student 1: The others would be shopping or something. I would let her use my phone.

Student 2: If I'm not in a rush, I'd approach her and ask her if I could help her with anything. If she asks to use my phone, I'd give it to her but I'd stay close by since that is my phone afterall. If I am in a rush, I'd feel bad but I'd continue on with my day.

Student 3: I would give the lady my phone and try to help her in any way possible.

Student 4: I would keep on walking, she'll probably find someone to hand her a phone. I wouldn't say anything to her and just hope that someone does give her a phone.

Student 5: I would give them my phone to call their son

Student 6: I probably wouldn't approach her first. I typically feel too anxious to do those things so I would probably see if she approached me. If she approaches me I would give her my phone to borrow but if she doesn't there's a chance I might not let them borrow the phone incase it's something dangerous.

Student 7: I would ask her if she can access a public phone

booth. If so, I would give her enough change to call her son. If not, then I would give her directions to the nearest phone booth and public transportation stop as well as change to call her son.

Student 8: I would happily give her my phone and stay with her until she gets her problem if any resolved and I would do my best to help her out.

Student 9: I say I'll dial the number and let her talk on speaker

Student 10: I'd offer my phone.

Student 11: I'll tell her to use my phone people are always in need for some help and you never know when you'll be in need.

Student 12: i would let her borrow my phone to call her kid

Student 13: I would give her my phone or ask her to tell you the number.

Student 14: I'd hold the phone and she can tell me the number and I'd put the phone on speaker so that she can hear

Student 15: I would direct her to somewhere public with a phone.

Student 16: Give her my work phone, that has insurance, and let her call her son

Student 17: If I'm not busy I would try to lend the woman my phone, if I am in a rush, I would just ignore it.

Student 18: I would try to help her find like a public phone nearby because I can't fully trust that this person will not steal my phone. If I can't, I'll ask her for the number and call him my self, if he answers, I'll put the phone on speaker and hold the phone.

Student 19: I probably wouldn't say anything to her because it's hard to trust strangers and there would be other people around and i would assume someone else would help.

Student 20: I would ask for her son's phone number, and try to call the son for her. If he picks up then I'd letter her use my phone. If he doesn't I'd apologize, ask if I can do anything else, then move on with my day.

Student 21: I would allow her to borrow my phone to call her son.

Student 22: I would go up to her and ask her if I could help her. I would take her into the grocery store and ask someone if I could place a call, input her sons number and then pay for it if need be.

Student 23: i would take her into the grocery store so that she could use the stores phone just in case her son calls her back and so she has somewhere to be with other people

Student 24: I would probably not help her especially if it is getting dark outside just in case it was a ploy to steal my phone.

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Student 25: I would probably continue walking because, even though I would want to help the lady, I wouldn't know her intentions of having my personal device in her possession. For all I know, she may try to steal my phone.

Student 26: I would ask her what's her son number and call him first. Then after he picks up, I would hand the old lady with my phone. I would ask her what's she doing since I'm worried about her safety (I keep on hearing news about old people with alzheimer's getting lost). If she's lost, I would gladly take her to her destination and maybe show her pictures of my cats since cats pictures can lead to good conversations and my grandma loves cats too and she's always happy to see cats.

Student 27: I would probably leave her alone, since there were other people around who could have helped her.

Student 28: I'd help her out by holding my phone out to her and telling her to put in the phone number, but I would remain highly cautious through out the encounter.

Student 29: I would offer to give my phone and ask if she needs any extra help

Question 5:

Student 1: Go to my friend and ask her to feed the child. Cause I don't know how to. Also I don't even think I would hold the baby because I'm actually scared of them until they can walk. But before that nawwwwww.

Student 2: Assuming that I am aware that this a cry of hunger specifically, I'd try to find something to feed the baby. I'd be suspicious of the fact, however, that the baby only started crying after the friend left. I'd keep a close eye on the mother-child duo afterwards just in case.

Student 3: I would try to distract the child with a toy, or by singing or by showing it something.

Student 4: Hand the baby back to the parent

Student 5: i would wait for the mother because i don't want to give the baby food it might cause harm

Student 6: I would probably try to see if they drink formula or if there's something they could chew on to simulate their feeding but if not I would try to find the mom to see if it's an opportunity to possibly feed her. I would try to comfort the baby the best I could without making it look like I'm trying to be the mother figure

Student 7: I would call the mother back in and say that I think the child is hungry and needs food. It is technically the mothers decision as to whether the child needs food at the moment but if it is obviously hungry then I would keep trying to urge the mother to give it food.

Student 8: I would probably have more experience about

this when I'm 30 but as of now what I can think of is I will console the baby by trying to find any food that he or she can eat and if not, I will put on rhymes or get their favorite toy or walk them around.

Student 9: Give the baby food

Student 10: If I have food, feed them and help the mother if they're unable to help their child. Teach them to forage and grow food if they can't afford it. Get them in contact with my comrades and etc. Make her a revolutionary by midnight. Raise the kid in a commune and then they can choose whether or not they want to help save the world, cuz like no pressure!

Student 11: I'll rush to get a baby bottle to feed the child or call the mother for advice or what to do wether not being experienced or not. I'll rock it back and forth but look for in the need of help to call the baby.

Student 12: i would try to find something the baby can eat or get the baby some baby food at least. and tell my friend they need to feed their kid.

Student 13: Call the mom and ask where formula is

Student 14: Call the mom and ask where the formula is???

Student 15: Text the mom and ask if I should give the baby anything.

Student 16: Make a batch of fake milk, and try and feed the baby

Student 17: I would try to look for something the baby could eat, or I would call their mother to come back.

Student 18: It depends if I was really close to the friend or only semi close. If I was only semi close, I would express concern when she came back and try to find the baby something to eat in the meantime and tell one of the closer friends or if it's that bad, call relatives or spouse if available. I would not call CPS because it would traumatize the child way more later on. If it was a really close friend, I would walk to her kitchen and look through everything to find the baby something to eat and tell her that she needs to get it together and tell her to ask her doctor to make a feeding schedule or something and tell her spouse.

Student 19: I would wait for my friend to come back and tell her the baby needs to eat. but before she comes back i would rock the baby and make shh noises to try to calm them down.

Student 20: I would gently rock the baby, and start moving to the friend, and ask them what we need to do to feed the baby. I do not know how to handle babies.

Student 21: I would try to get food for the baby as soon as possible.

Student 22: Call the mother or the other parent and ask

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them what I should do. I would give it some water, but, as I don't know any of the child's medical needs, I wouldn't feed it anything else.

Student 23: i would make a bottle and try my best to feed the baby.

Student 24: I would give my friend a suggestion to feed it

Student 25: I would ask the mother if there was any milk or formula for the baby since it is showing clear signs of hunger. If neither of those resources were available for some reason, I would offer help to the mother and baby by offering to get some food and resources so the baby could be nourished.

Student 26: I legit don't know how to take care of a crying baby. I would probably swing my arms with the baby since I see that a lot in the tv shows. I would tell the baby it's okay, wait a little longer and say random words like googogaga. I would not feed the baby without my friend's permission since I do not want to cause any mistakes. I would wait for the friend to return and tell her what's going on and apologize to her for making the baby cry and request her to feed the baby since I don't how to feed babies either.

Student 27: I would try and console the baby and then call my friend to ask if she wants me to feed the baby.

Student 28: Probably try to put the child to sleep, or play COCOMELON

Student 29: I would give them food because there is no reason not to

Election Theory: Alternative Voting Methods in the Pennsylvania 2022 Senate Election

Justine Sullivan

Abstract: The single-ballot plurality voting system has remained the standard in the United States dating back to the 18th century. However, the nature of plurality rule has recently been contested by alternatives. While scholars have considered the impact non-plurality voting systems could have on election outcomes, a gap in knowledge remains pertaining to how these systems will affect partisan vote distribution in multi-party elections. This study utilizes a survey approach modeled after the ballots used in Pennsylvania's 2022 Senate election in order to determine how voter support for each candidate may change as a result of non-plurality voting methods being used. The findings of this research suggest that although it is subjective to each system, alternative voting in general tends to increase voter support for third-party candidates in comparison to plurality, with anti-plurality voting in particular displaying a significant decrease in third-party support in skewed elections. Additionally, ranked-choice voting was found to be the most popular form of voting among participants, indicating a general sense of dissatisfaction with the standard plurality system. These findings suggest that the implementation of non-plurality voting methods may be used to better represent voter preferences and decrease polarization in U.S. elections.

Keywords: Alternative voting · Plurality · Third party · Pennsylvania · Voting methods

Introduction

In recent years, American elections have consistently yielded extreme political outcomes. In 1971-72, Capitol Hill seated over 160 moderate Democrats and Republicans; however, in 2022, only about two dozen held moderate Democratic or Republican viewpoints (Desilver 2022). This is the mere consequence of a rapid surge in polarization among American voters. Scholars have found that increased levels of political polarization in election outcomes correspond with that of voters, pertaining both to their personal ideology (Dimock and Wike 2021) as well as their antipathy toward opposing party members (Nadeem 2022). Although the widening divide between liberal and conservative ideals is often attributed to voters' contemporary political environments, the source lies not

within the people but rather in the rigid structure of the nation's electoral system.

In 1963, French sociologist Maurice Duverger formulated a law proposing that "the plurality rule for selecting the winner of elections favors the two-party system" (Riker 1982, 753). The lack of plausible candidate options is arguably the greatest flaw of the United States' standard plurality system. The "wasted vote" concept is commonly associated with this system: regardless if voters' political preferences are more closely aligned with a third-party candidate, by plurality rule, only two major-party candidates have the ability to gain enough electoral support to win an election (Riker 1982, 761; Rosenstone, Behr, and Lazarus 1984; Bassi 2008). Alternatives to the standard plurality system are increasing in popularity, with 261 nationwide jurisdictions, most on a local scale, having reportedly adopted some form of a non-plurality voting system

(Desilver et al. 2021). However, the impact these voting methods could have on the success of third-party candidates has, thus far, only been hypothesized.

Key Definitions

Some key terminology that will be heavily used throughout the paper include:

Two-party system - a political system in which two major parties consistently dominate votes given by the electorate.

Major party - party that holds enough electoral strength to win control of a large government body. In the United States, the Democratic Party and the Republican Party are major parties.

Third party - also known as a minor party, a party that rarely holds enough electoral strength to win control of a large government body. In the United States, some examples of third parties include the Green Party, the Libertarian Party, the Keystone Party of Pennsylvania, the Constitution Party, the Working-Class Party, and, in some cases, the Independent Party.

Literature Review

Third Parties

It is pertinent to mention the emphasis Duverger's Law places on partisan disparities within plurality elections. The "winner-takes-all" structure impedes minor party representation due to a predisposed deprivation of financial resources and a lack of recognition among voters. Minor party candidates have a disincentive to run in elections or carry out their platforms because of the inevitable dissipation of resources spent on a battle that can never be won (Verma 2021, 230). Plurality voting only prolongs this paradox and incites the deficiencies of the two-party system. However, it is not the inherent act of voting third party that leads to unfavorable election outcomes. Rather, minor party candidates simply cannot accumulate enough votes to win under a voting system structured around a two-party system (Collet 1996, 432-33). Research has shown that this is not a choice made by the people but rather an entrapment caused by the system. While 62% of American adults agree with the statement that "parties do such a poor job representing the American people that a third party is needed" (Jones

2021), third parties generally only capture around 5% of voter support (Atske 2020). This suggests that although there is a desire for a two-party system reform to gain traction, plurality defects will continue to limit political representation in government.

Polarization and the Plurality System

Literature has demonstrated a recognition of the mass partisan divides within the American electoral system. Studies have found that a majority of Americans feel pressured to uphold a particular political opinion in their daily lives (Carlson and Settle 2016) and vote for "extremist" candidates in both local and federal elections (Smidt 2017), despite such a large portion of the population reportedly holding moderate viewpoints. Election outcomes are, by standard, reflective of one's surrounding political climate. Thus, political polarization limits single-ballot plurality voting systems to the success of solely major-party candidates, a claim supported by political scientist Daniel Bochsler's (2017) study on the strategic effects of plurality voting (Bochsler 2017). Despite the lack of accommodation in plurality-structured elections, minor-party candidates have the capability to adversely influence their outcomes. Between 1992 and 2019, 49 Senate elections within 27 different states resulted in a winner with less than majority (50%) support (Harrow and Shi 2019). This results in extreme voter dissatisfaction from at least one side of the political coin, only widening the partisan divide.

Pennsylvania in particular is vastly divided due to political differences between rural and urban regions of the state. A poll conducted by the Rose Institute of State and Local Government Pennsylvania found that 4 out of 5 Pennsylvanian respondents planned on voting consistently within their party (Sinclair and Miller 2022). By the end of the race, the margin of victory between Democratic candidate John Fetterman and Republican candidate Dr. Mehmet Oz was a mere 4.92%; however, only 2.42% of voters chose to vote third party ("Pennsylvania Elections: Summary Results" 2022).

Alternative Voting Methods

The researcher believes that alternative voting methods should be taken into consideration as a potential solution for complications with the current two-party

system. Firstly, it is essential to note that votes from the same electorate can yield different results depending on the method used (Riker 1982). When there are only two viable candidates, a plurality-based election functions well. However, when three or more valid candidates run for a single position in office, there are a plethora of non-plurality voting methods that could be used to rationally determine a winner (Brams and Fishburn 1978, 831-32). A substantial number of experiments with alternative voting methods have resulted in outcomes contradictory to standard plurality results (Saari 1999, 313-55; Grofman and Feld 2004, 641-59; Igersheim et al. 2022), indicating that partisan votes may vary as a result of a reformed electoral structure.

Ranked-choice Voting

Ranked-choice voting (RCV), arguably the most popular form of alternative voting, has been put into practice in multiple municipalities throughout the United States. One must note that this particular method has proven to operate well on a local level within the nation. One coalition of researchers from Cornell Tech and MIT found that larger STV (single transferable voting) districts hold a more diverse set of winners from each major party and act similarly with minor-party candidates. When ranking based on partisan score, members of the same party across multiple single-member districts can easily collaborate to select and improve the winning chances of a particular candidate (Garg et al. 2022). Non-plurality voting structures, such as ranked-voting systems used in New York City, Maine, and California, tend to mediate vote distributions between candidates and ultimately equate interparty chances of success. Voters are not confined to two viable candidate selections; instead, they are given the freedom to arrange a ballot that ultimately epitomizes their political preferences. When examining ranked-choice voting in practice, the impacts on voter satisfaction and partisan tension are substantial. A study from the University of Pennsylvania on political attitudes found a decrease in the winner-loser gap in perceived fairness for ranked-choice systems in comparison to plurality (Fischer, Lee, and Lelkes 2021). This increased perception of fairness can be attributed to the more flexible electoral structure encompassed by RCV. Ranked-choice voting is designed to account for candidates' failure

to obtain a majority of single-selection votes, which, in contrast, the plurality system is unable to achieve (Steinberg 2022). This generally leads to increased voter satisfaction, as the outcomes of RCV elections rely not on the status or partisan identity of a given candidate but rather on the voter's individual preferences and willingness to vote for the candidates they most align with, regardless of predicted success.

Assumptions

This research operates under the assumption that voting data from the same electorate engenders different results as different methods are used (Riker 1982). Additionally, it can be assumed that the outcomes of non-plurality elections may contradict those yielded by plurality-based elections (Saari 1999, 313-55; Igersheim et al. 2022; Grofman and Feld 2004, 641-59). Finally, one must assume that a significant portion of the general public has some degree of an inclination to vote third-party, although the plurality system limits this (Jones 2021; Atske 2020).

Justification

Existing studies on alternative voting systems have analyzed the theoretical impact of non-plurality voting structures on election outcomes, many of which have discovered results contradictory to standard plurality (Saari 1999; Grofman and Feld 2004, 641-59; Igersheim et al. 2022). As noted by Brams and Fishburn (1978) as well as Riker (1982), various voting systems can be used to determine a winner from the same electorate, although results may vary. However, no detailed research has been done on how voter support may shift among candidates (primarily minor-party candidates) in multi-party elections through the use of alternative voting. Studying this concept may provide insight as to how different voting systems operate in practice and keep Americans in touch with the validity of varying political viewpoints.

Research Question

To address these factors, the research question is posed: To what extent would the implementation of

alternative voting methods impact partisan vote distribution in U.S. elections?

Methodology

Purpose

The purpose of this study was to observe the impact of alternative voting methods on partisan vote distribution in standard U.S. elections, particularly the highly polarized 2022 Pennsylvania Senate election. Preliminary research has demonstrated that modern U.S. elections inevitably skew in favor of the two primary political parties; thus, the researcher intended to determine if the structure of plurality voting is what may be partly responsible for a lack of third-party candidate support. The ultimate intent of the researcher in conducting this study was to establish the extent to which major and minor-party candidates would be impacted by alternative voting practices in U.S. elections.

The researcher chose to structure the study around the 2022 Pennsylvania Senate race due to its recency and relevance to the public. The vast majority of Pennsylvania residents in the chosen population were familiar with at least the primary two candidates. Having this prior knowledge would be greatly beneficial to the overall purpose of the survey, as the researcher intended to test participants' predisposed candidate preferences. Additionally, Pennsylvania is often regarded as a "purple" state, meaning that state-wide election results will sometimes swing toward the Republican "red", and sometimes toward the Democratic "blue". Due to this political divide, the real election results were nearly evenly split and arguably inconclusive up until the election. This prior knowledge was used to provide the researcher with a base statistic to refer to throughout the interpretation of the mock election results.

Procedure

Prior to data collection, two research methods were considered. The first was the construction of an in-person experimental study with separate groups and ballots for each electoral system. Experimental approaches are commonly used in political fields when

observing voter behavior, such as in Bassi's (2008) experiment on strategic voting. An experimental study would allow the researcher to understand participants' perceptions of the varying voting methods to a greater degree, as political behavior can be recorded firsthand. Regardless, this method was rejected due to the anticipated apprehension voters may have about revealing their political views, as well as a relative lack of political diversity in the researcher's immediate geographical region.

The researcher ultimately selected the second method – a quantitative approach through the distribution of an online Google Forms survey. This method adopted a traditional ballot structure comparable to the first method but eliminated the need for participants to directly disclose their political identities. It also allowed the researcher to pool a considerably larger, slightly more representative sample. Despite the numerous advantages of conducting a survey, the researcher did discover some limitations. For instance, descriptions of the candidates' political platforms in addition to instructions on how to utilize each voting method were both elements included in the survey; however, the lack of accountability a survey provides could have very well hindered participants' likelihood of ensuring thorough understanding of their task and voting options. Additionally, although the demographic questions did require participants to verify demographic requisites, there was no way to confirm all responses were truthfully eligible.

Participants

The researcher chose to conduct the research with legal adults registered to vote in Pennsylvania. This group was the most appropriate and relevant to the study's purpose when considering levels of involvement in the most recent Senate election. To recruit participants for the survey, the researcher asked friends and family members aged 18 and older to participate and send the link to the survey to any eligible individuals they knew. The researcher also focused on the recruitment of members of the 12th grade class, as many of them are 18. Additionally, the link to the survey was posted on social media accounts, Reddit, and SurveyCircle, as well as distributed by flyers throughout the researcher's high school.

Survey Design

The survey was on Google Forms, with all personal-information collection features turned off to ensure anonymity. Participants were required to be aged 18 or older and give their informed consent before participating. If a participant marked that they were under the age of 18, the site would not allow them to proceed with the survey. After debriefing, they were required to consent once again to having their responses used for the purpose of the study (see Appendix B for complete informed consent and debriefing language). Participants were also asked if they were registered to vote in Pennsylvania. If an individual selected that they were not registered to vote, any following responses would not be considered. The researcher asked only for necessary political background and did not collect any identifiable information. Participants could answer as few or as many questions as they desired and could opt out at any point during the survey. Additionally, all responses were anonymous and kept in a secure Google Drive folder that only the researcher and project director had access to. The research study design was approved by an IRB.

In the first section of the survey, participants were asked three demographic questions regarding their political identity and level of involvement in the past PA Senate election. Participants were first asked to record if they voted in the 2022 Pennsylvania Senate election. If the participant chose “yes”, the survey followed up by inquiring about the candidate they voted for. Participants were also asked to select the political party they most identify with from a list of seven options plus an “other,” write-in permissible category.

In the following section, participants were asked to cast mock votes for the five most popular candidates in the 2022 Pennsylvania Senate election. They did so by using a variety of different voting methods, including plurality voting, ranking, cumulative voting, negative voting, and approval voting. The researcher primarily used the Stanford Encyclopedia of Philosophy’s guide to voting methods to translate instructions on how to cast votes in the mock elections. Additionally, participants were provided with a chart featuring descriptions of the political platforms of each candidate. This feature was included so as to familiarize participants with lesser-known candidates. The researcher pulled unbiased information from candidates’ respective

campaign websites if available, and Wikipedia as a last resort.

For the third section, participants were presented with a mixture of multiple-choice and multiple-selection questions. Here, they were asked to provide further information on their political background and their thoughts on the voting procedures. Participants were also asked to report their likelihood of voting for a third-party candidate in a real U.S. election.

Finally, participants were debriefed and then given the option to enter a raffle for a \$50 gift card of their choice. All contact information was kept confidential. Upon completion, participants were offered a link to share the survey with other people.

Data collection took place from January 5, 2023, to February 6, 2023.

Findings and Analysis

Demographics and Plurality

In total, the Google Form survey received 449 responses. Of the 449 responses, 206 were removed due to a Reddit bot infiltration. These were identified through the recognition of fake email addresses entered into the raffle (consisting of random strands of letters and numbers). Time stamps also revealed that the majority of those with suspicious email addresses were duplicate responses that had come in within seconds or milliseconds of one another. After removing the bot responses, 243 real responses remained. Of those 243 responses, 9 were removed due to the participant marking that they were not registered to vote in Pennsylvania. Another response was removed because the participant did not select “yes” or “no” when asked if they consented to their response data being used. This left 233 responses eligible for use. (Refer to Appendix A for definitions of each voting method.)

Of the 233 eligible participants, 232 reported their political affiliation, with an overwhelming majority indicating that they most identify with the Democratic Party (see Table 1a). Nine participants indicated support for a party other than what was provided and gave a brief description of their political identity (see Table 1b).

As shown in Table 1a, a total of 156 of the 232 participants, or about 67.2%, reported identifying most

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Table 1a

Which party holds the viewpoints you most identify with?

Party	Number of Participants
Democratic	135
Independent	25
Republican	21
Green Party	18
Libertarian	15
None/non-partisan	4
Constitution Party	3
Keystone Party of Pennsylvania	2
Other*	9

Note. n=232

Table 1b

Cont.

“Other” Write-In Responses
Progressive/very leftist
Communist
Working families
Socialist
Democratic Socialist
Social Democrats
Each has its advantages and disadvantages, and complementation is better
Fiscally Republican, but much less homophobic
I always vote Democrat, but my views tend to be more left than the party espouses.

Note. n=9

Table 2

Participants’ Real 2022 PA Senate Election Votes

Fetterman (D)	Oz (R)	Gerhardt (L)	Weiss (G)	Other	TOTAL
189 (85.14%)	25 (11.26%)	3 (1.35%)	4 (1.80%)	1 (0.45%)	222 (100%)
Total: 214 (96.40%)			Total: 8 (3.60%)		222 (100%)

Note. n = 222; D=Democrat, R=Republican, L=Libertarian, G=Green Party

Table 3

Participants’ Mock Plurality Votes

Fetterman (D)	Oz (R)	Gerhardt (L)	Weiss (G)	Wassmer (K)	TOTAL
160 (68.67%)	26 (11.16%)	9 (3.86%)	30 (12.88%)	8 (3.43%)	233 (100%)
Total: 186 (79.83%)			Total: 47 (20.17%)		233 (100%)

Note. n = 233; K=Keystone Party of PA

Table 4: 2-Proportion Z-Test

Real Election Votes vs. Mock Election Votes

		H0: $p_1=p_2$		HA: $p_1>p_2$		
Real Election (p1)	Mock Election (p2)	n1	n2	Significance Level	Z-score	p-value
214 (96.40%)	186 (79.83%)	222	233	0.05	5.419	3.003×10^{-8}

with the viewpoints of one of the two major parties in the United States. This statistic aligns with researcher Jones’s (2021) poll, which found that ~62% of Americans feel as though the two major parties are not representative of the political beliefs of the general public (Jones 2021). Although roughly 1 in every 3 participants reported identifying most with something other than the Democratic or Republican parties, as is known, the victory of a major-party candidate is a near-inevitable outcome.

In Table 3, Fetterman won the mock plurality election, followed by Weiss, Oz, Gerhardt, and finally Wassmer.

The researcher noted that of the 222 participants who did vote in the most recent Pennsylvania Senate election, approximately 96.40% reported having voted for a two-party candidate (Fetterman or Oz). Pew Research’s Sara Atske gave credence to the notion of par-

tisan disparity after reporting that only 5% of registered voters tend to vote third party in plurality-based elections (Atske 2020). The researcher’s findings in Table 2 support Atske’s claim, seeing as less than 4% of participants who voted in the 2022 PA senate election reported having voted for a third-party candidate.

However, when the participants were asked again to cast a single-ballot plurality vote for the candidate of their choice, only 79.83% decided to vote for a two-party candidate. In Table 3, it must be noted that the number of votes for Fetterman vastly exceeded that of any other candidate. However, the 31.33% of plurality votes that were not placed for Fetterman were distributed with moderate proportionality between the remaining four candidates. For instance, Green Party candidate Richard Weiss received four more votes than Republican candidate Dr. Oz, despite Oz belonging to one of the major parties. This result contradicts

Table 5

<i>Candidate Ranking</i>	Fetterman (Democrat)	Oz (Republican)	Gerhardt (Libertarian)	Weiss (Green Party)	Wassmer (Keystone)
1	123	15	8	30	16
2	28	8	30	87	39
3	23	12	37	33	87
4	9	18	103	24	38
5	9	139	14	18	12

Table 6

Anti-Plurality

Candidate	Points
John Fetterman (Democrat)	183
Dr. Mehmet Oz (Republican)	53
Erik Gerhardt (Libertarian)	178
Richard L. Weiss (Green Party)	174
Daniel Wassmer (Keystone Party of PA)	180

Note. 0 points are given to each last-place candidate, and 1 point is given to the rest.

Bassi and Bochsler's respective studies, which determined that only two candidates (Bassi 2008) from the two major parties (Bochsler 2017) would dominate voter support in multi-party elections.

The researcher chose to conduct a 2-proportion z-test on the two percentages, as seen in Table 4. The purpose of conducting this statistical test was to determine whether or not there could be an outside factor contributing to the significant drop in major-party candidate votes. The p-value is less than the alpha level of 0.05; therefore, the null hypothesis can be rejected. There is enough convincing evidence to make the assumption that it was not by random occurrence that there was a nearly 17% drop in major-party votes for the plurality method.

Ranked-Choice Methods

For this section of the survey, participants were asked to use ranked-choice voting to number each of the five candidates from 1 (candidate I [the voter]

would most like to win) to 5 (candidate I would least like to win). The researcher referred to the following data for all voting methods that involved the ranking of the five candidates (see Table 5). Forty-one responses were removed due to participants not ranking all five candidates. This left 192 eligible responses for any voting method that involved ranking.

The average ranking scores for each candidate are as follows: John Fetterman (1.7135), Dr. Mehmet Oz (4.3438), Erik Gerhardt (3.4427), Richard L. Weiss (2.5469), Daniel Wassmer (2.9531). It is worthy to note that a lower average score indicates a more favorable candidate ranking.

The following alternative voting methods will refer to the ranking displayed in Table 5. All of the following mock election results in this section have been calculated using variances of ranked-choice voting.

In Table 6, Fetterman won the anti-plurality election, followed by Wassmer, Gerhardt, Weiss, and finally Oz.

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Figure 1

Borda Count

$$BS(\text{Fetterman}) = 123*4 + 28*3 + 23*2 + 9*1 + 9*0 = 631$$

$$BS(\text{Oz}) = 15*4 + 8*3 + 12*2 + 18*1 + 139*0 = 126$$

$$BS(\text{Gerhardt}) = 8*4 + 30*3 + 37*2 + 103*1 + 14*0 = 299$$

$$BS(\text{Weiss}) = 30*4 + 87*3 + 33*2 + 24*1 + 18*0 = 471$$

$$BS(\text{Wassmer}) = 16*4 + 39*3 + 87*2 + 38*1 + 12*0 = 393$$

Note. 5 candidates: first gets 4 points - second gets 3 - third gets 2 - fourth gets 1 - last gets 0

In Figure 1, Fetterman won the Borda Count election, followed by Weiss, Wassmer, Gerhardt, and finally Oz.

In Figure 2, Fetterman won the Condorcet election. Runner-ups were not calculated.

Figure 2

Condorcet's Method

51:A>D>E>C>B	3:E>A>D>C>B	1:D>A>E>B>C	1:D>C>E>B>A
18:A>E>D>C>B	3:A>E>D>B>C	1:C>E>A>D>B	1:B>C>A>E>D
15:D>A>E>C>B	2:E>B>A>C>D	1:B>A>C>D>E	1:B>D>E>A>C
15:A>D>C>E>B	2:B>D>A>C>E	1:E>B>C>D>A	1:A>D>B>C>E
8:D>E>A>C>B	2:E>C>A>D>B	1:B>D>C>A>E	1:B>C>D>A>E
7:A>D>E>B>C	2:E>D>A>C>B	1:D>C>E>A>B	1:C>A>B>D>E
6:A>C>D>E>B	2:C>B>E>D>A	1:D>C>A>E>B	1:A>C>D>B>E
6:A>E>C>D>B	2:B>C>E>D>A	1:A>E>B>C>D	1:A>C>E>D>B
5:A>C>B>E>D	2:C>D>A>E>B	1:C>E>B>D>A	1:E>C>B>D>A
4:B>C>E>A>D	2:A>D>B>E>C	1:E>A>C>B>D	1:A>C>E>B>D
3:E>A>C>D>B	2:A>D>C>B>E	1:A>E>C>B>D	1:C>B>A>D>E
3:D>A>C>E>B	2:A>B>C>E>D	1:E>D>C>A>B	1:B>C>D>E>A
			1:B>C>A>D>E

Note. A = Fetterman, B = Oz, C = Gerhardt, D = Weiss, E = Wassmer

Figure 3
Hare Method

Gerhardt Eliminated First (8 first-place votes)
Fetterman: 124
Oz: 18
Weiss: 32
Wassmer: 18
Oz and Wassmer Eliminated (18 first-place votes)
Fetterman: 144
Weiss: 48
Weiss Eliminated (48 first-place votes)
Fetterman Wins

Traditionally, for both the Hare method and Coombs' method, a candidate is declared the winner as long as they obtain over 50% of the first-place votes (Pacuit 2019). However, the researcher chose to proceed with both methods in order to find the theoretical order of elimination.

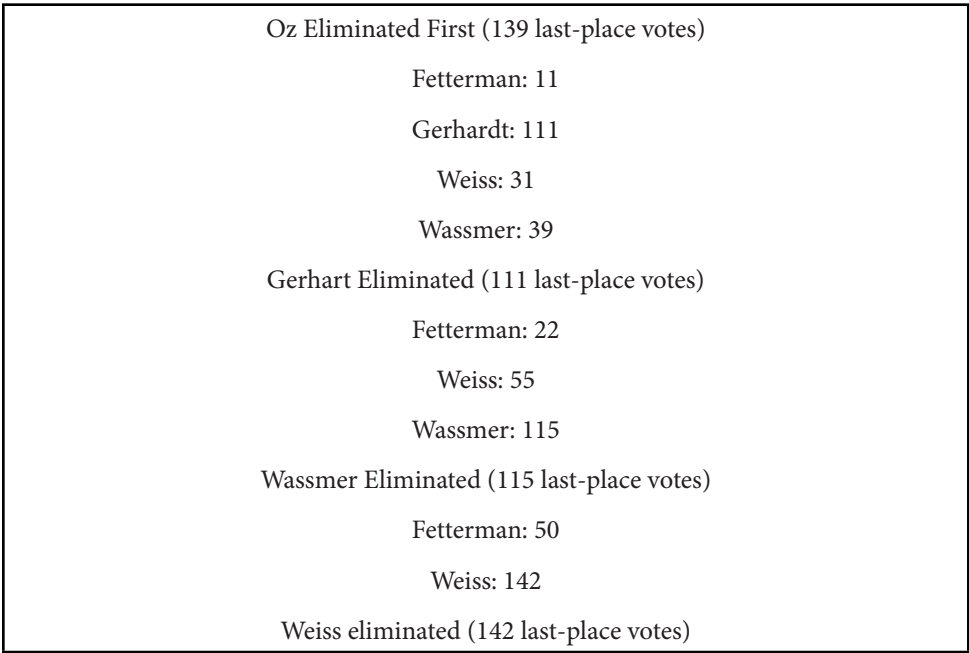
In Figure 3, Fetterman won the Hare election, followed by Weiss, Oz, and Wassmer, and finally Gerhardt.

In Figure 4, Fetterman won the Coombs election, followed by Weiss, Wassmer, Gerhardt, and finally Oz.

Overall, all five methods that operated under RCV resulted in a Fetterman (Democratic Party) victory. One must note that despite the skewed political preferences, Republican candidate Dr. Oz placed third in the mock plurality election. However, Oz was surpassed by third-party candidates in every mock election under the ranking system (excluding the unknown elements of Condorcet's method). Both the Borda Count method and Coombs' method resulted in the same outcome in terms of the arrangement of runners-up (see Figure 1 and Figure 4), further presenting a contradiction to the mock plurality results. Literature supports these findings: both Borda Count and Coombs' method are known to have a mediating effect on electoral outcomes due to their structures,

which favor equitability and compromise regarding voter preferences (Alos-Ferrer and Buckenmaier 2021; Grofman and Feld 2004). Additionally, the anti-plurality method displayed an unexpected distribution of points, as the three runners-up (Wassmer, Gerhardt, and Weiss) were in close proximity both to one another and to Fetterman (see Table 6). This indicates that the event of a third-party candidate winning under the anti-plurality method is highly likely, assuming data is polled from a similar electoral body. Contrary to the prior methods, the partisan vote distribution in the Hare method was most comparable to plurality, with Oz tying for third place. These findings suggest that it is less likely for a third-party candidate to succeed under the Hare method, once again assuming the makeup of a similar electorate.

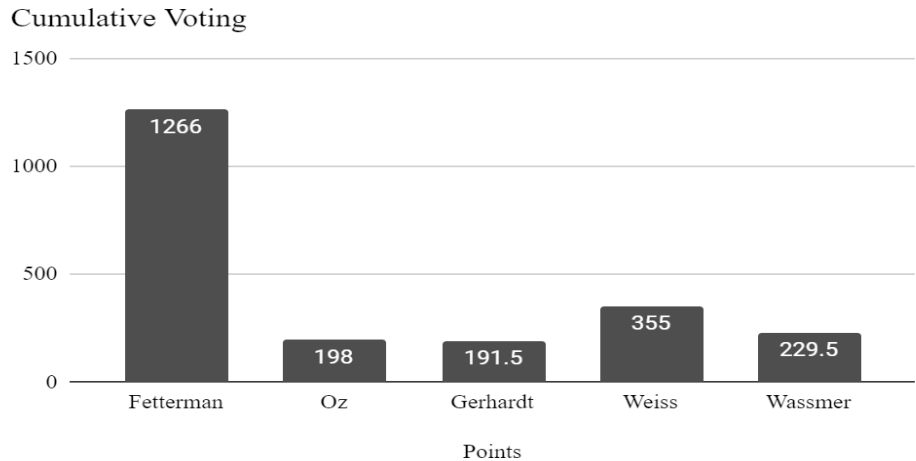
Figure 4
Coombs' Method



Non-Ranking Methods

The following alternative voting methods do NOT refer to the ranking in Table 5.

Figure 5
Cumulative Voting
Note. n=224
9 responses were removed for participants incor-



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Table 7
Negative Voting

Candidate	+1 Point	-1 Point	Total Points
Fetterman (Democrat)	95	14	81
Oz (Republican)	11	87	-76
Gerhardt (Libertarian)	6	4	2
Weiss (Green Party)	9	2	7
Wassmer (Keystone Party of PA)	3	1	2

Note. n=232

rectly adding points, leaving 224 responses to be considered for the cumulative voting method. Participants were asked to distribute ten points among the five candidates, resulting in yet another Fetterman victory.

In Figure 5, Fetterman won the cumulative voting election, followed by Weiss, Wassmer, Oz, and finally Gerhardt.

In Table 7, Fetterman won the negative voting election, followed by Weiss, Gerhardt and Wassmer, and finally Oz.

In Table 8, Fetterman won the approval voting election, followed by Weiss, Wassmer, Gerhardt, and finally Oz.

Overall, Republican candidate Dr. Oz was sur-

passed by third-party candidates in every non-RCV, non-plurality mock election. In the approval voting election, candidates were within the general margin of 30–60 points away from one another, indicating that although there was a clear winner, the margin of approval between candidates of comparable ranking was not exceedingly large. Additionally, all three third-party candidates received more approval votes than Oz, suggesting that voters would rather vote for candidates with more moderate viewpoints than the less favorable major-party alternative. This finding is supported by a study modeled after the 2016 presidential election, which found third-party candidates to perform significantly better in approval voting as compared to plurality (Igersheim et al. 2022). The re-

Table 8
Approval Voting

Candidate	Votes
John Fetterman (Democrat)	198
Dr. Mehmet Oz (Republican)	34
Erik Gerhardt (Libertarian)	63
Richard L. Weiss (Green Party)	143
Daniel Wassmer (Keystone Party of PA)	100

Note. n=233. Voters were to select any candidates they would approve of winning.

ALTERNATIVE VOTING METHODS IN THE PENNSYLVANIA 2022 SENATE ELECTION

Figure 6

Which voting method did you find to be the most fair?

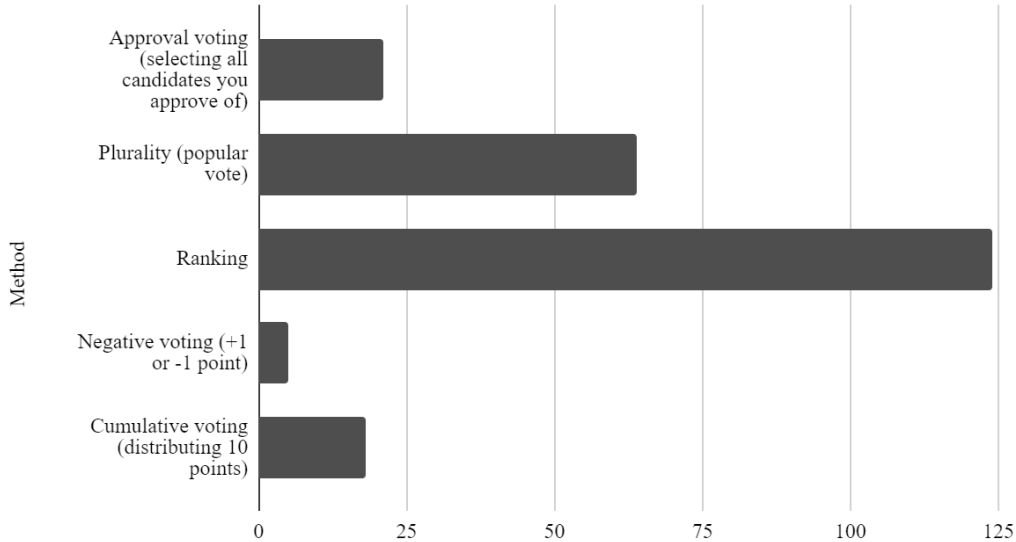
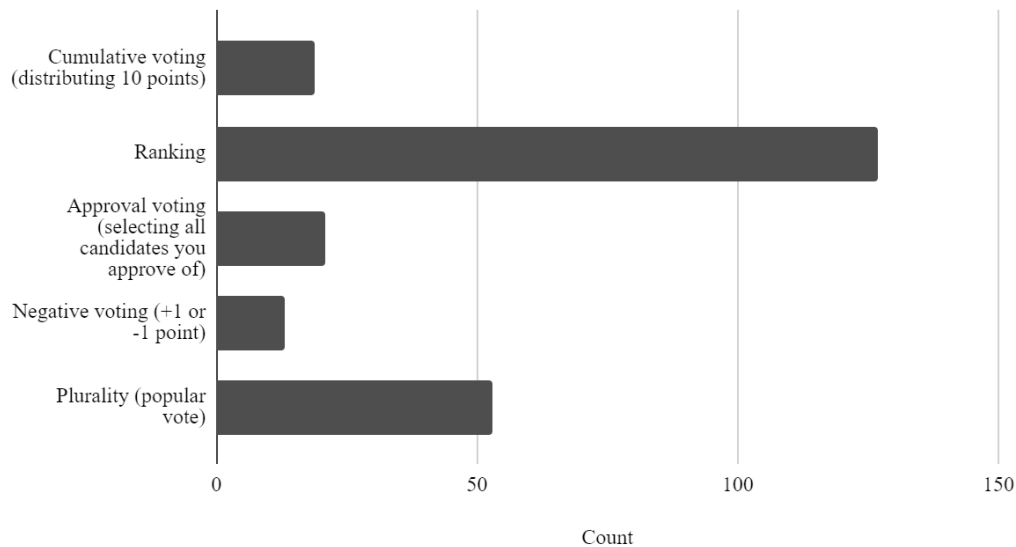


Figure 7

Which voting method did you like best?



sults of the cumulative voting election displayed the closest alignment to the results of the mock plurality election: Fetterman's overall score vastly exceeded that of every other candidate, and Oz received fourth place rather than last. Similarly, under the negative voting election, Fetterman had an extremely high number of points compared to the other candidates, whereas Oz's was extremely low. Moreover, the point values of all three third-party candidates fell close to 0, suggesting that the electorate had strong opinions regarding the major-party candidates and was less likely to "waste" votes on a third-party candidate. This concept is heavily connected to the wasted vote paradox seen in plurality voting (Riker 1982; Rosenstone, Behr, and Lazarus 1984).

Participant Feedback

Figures 6 and 7 demonstrate the participants' opinions on each distinct voting method. As shown,

ranked-choice voting was deemed to be both the most favorable and the fairest method. These findings are supported by the results of Fischer, Lee, and Lelkes's (2021) study on perceived fairness, which was higher in ranked-choice voting than plurality systems (Fischer, Lee, and Lelkes 2021).

Figure 8 displays the likelihood of participants voting for a third-party candidate in any given election. Participants were asked to report their response on a scale from 1-5: never (1), likely not (2), maybe (3), likely would (4), and definitely would (5). The average for this question was ~2.9571, falling extremely close to the "maybe" value. These rather neutral responses were not expected by the researcher. It had been assumed that, despite the findings of Jones's (2021) poll, most participants would report low levels of interest in voting third-party, considering the miniscule chances of a third-party victory under plurality.

Figure 8

Note. n=233. The values shown are based on a Likert scale of 1-5, ranging from Never (1), Maybe (3) and Definitely Would (5).

On a scale from 1 (never) to 5 (definitely would), how likely would you to be to vote third party in any given election?

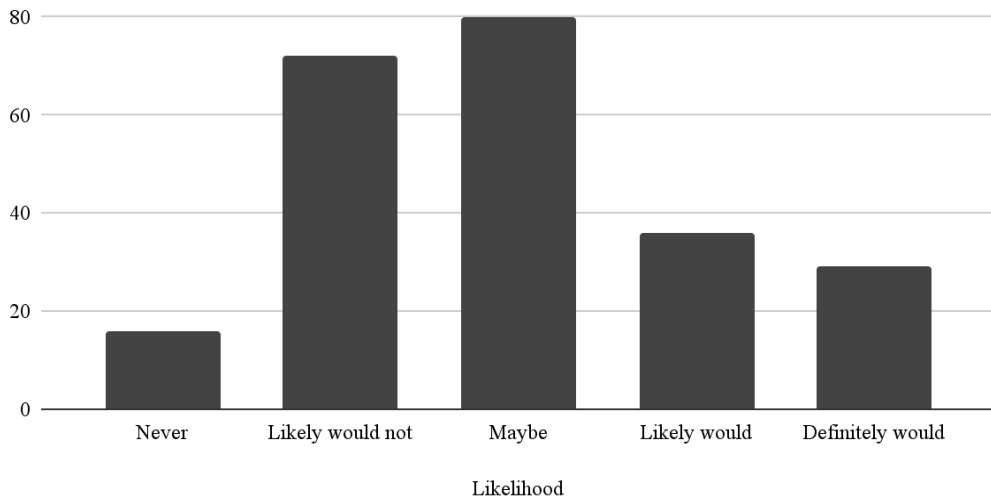


Table 9

Which candidates did you recognize prior to participating in the survey?

Candidate	Count
John Fetterman (Democrat)	225
Dr. Mehmet Oz (Republican)	213
Erik Gerhardt (Libertarian)	77
Richard L. Weiss (Green Party)	47
Daniel Wassmer (Keystone Party of PA)	30

Note. n=233

In Table 9, very few participants recognized the names of the third-party candidates. This finding suggests that despite being provided with multiple options, Americans generally focus on the platforms of major-party candidates. This once again highlights the “wasted vote” paradox, as explained by Riker (1982) as well as Rosenstone, Behr, and Lazarus (1984).

As seen in Table 10, a vast majority indicated that they would or currently do vote Democrat on a typical basis. However, a minor-party option was selected 124 times (excluding the “other/none” selections).

This finding aligns with Jones’s (2021) poll, suggesting that a significant portion of the population is not fully satisfied with major-party options.

Limitations

The researcher identified multiple limitations that acted as potential barriers to the conclusions of the study. For one, the vast majority of responses (estimated ~300+) came from posting the survey on

Table 10

What party do you typically vote for/would you typically vote for in elections? (Select all that apply)

Party	Count
Democratic	188
Republican	42
Green Party	35
Libertarian	30
Keystone Party of PA	7
Independent	46
Constitution Party	6
Other/None	11

Reddit. Although this may not inherently limit the findings of the study, the researcher came across a problem with bot responses, presumably from Reddit, on the Google form. The data was tainted with multiple identical responses that would come in within milliseconds of one another and enter fake email addresses for the raffle incentive. The researcher individually examined each response and removed those with evidently non-human responses (e.g., a series of arbitrary digits and characters in place of written responses); however, the process may have limited the overall legitimacy of the study.

Additionally, although the sample size of usable responses (233) was sufficient, the political backgrounds of those who participated were not nearly as diverse or varied as the researcher intended. The data was skewed tremendously toward left-leaning individuals, particularly Fetterman voters. This made the sample far less representative of the more politically polarized population of Pennsylvania and likely contributed to the disproportional support for left-leaning candidates in the mock election. The researcher made attempts to collect a politically diverse sample by posting the survey in Reddit groups belonging to a variety of Pennsylvania cities and counties (ex: r/Butler, r/Pittsburgh, r/Harrisburg, r/LancasterPA, etc.) and through unbiased advertisement. However, due to the left-leaning political nature of Reddit and the researcher's city of residence, some degree of skew was expected. In order to compensate for this in future studies, it may be beneficial to distribute the survey on more neutral platforms or, potentially, conduct an in-person poll throughout Pennsylvania.

Conclusion and Future Directions

Although every voting method had the same overall outcome (John Fetterman winning) Republican candidate Dr. Oz was surpassed by one or more third-party candidates in every mock election. In five of the seven non-plurality voting systems that included runner-up calculations – anti-plurality, Borda Count, Coombs' method, negative voting, and approval voting – all three third-party candidates received more votes than major-party candidate Oz. Anti-plurality was by far the most promising method, as a third-party victory was only 4 votes away. Overall, the find-

ings of this study suggest that, although subjective to each method, alternative voting methods on a general scale do increase the chances of third-party candidate victories in comparison to standard plurality voting. It can also be determined that alternative voting tends to mediate vote distribution in skewed elections where one candidate appears to be widely disliked by the population.

Additionally, the fact that the majority of participants preferred ranked-choice voting demonstrates some degree of dissatisfaction with the plurality system. Although the implementation of alternative voting methods on a national scale may not be entirely feasible, the adoption of ranked-choice voting systems in local elections is already a reality. It is likely that as Americans become aware of potential alternatives in voting, an increased number of regional governments may consider non-plurality electoral systems. As a nation so heavily influenced by politics, it is imperative to recognize potential flaws in plurality and consider alternatives in order to better represent the true preferences of the electorate.

Considering that the researcher's sample was not proportional to the distribution of votes in the real PA 2022 Senate election, it may not reflect the actual results of shifting to a non-plurality method. However, it is a strong starting point for future research. In order to further generalize these findings and apply them to a broader context, it is recommended that future researchers consider polling data from various regions across the United States and examine other types of elections besides solely Senate races. Additionally, researchers should consider recreating the study on more politically polarized samples in order to reflect the nature of the two-party system and enhance the mediating impact of alternative voting. Doing so may help determine the relative consistency of results on both a national and localized scale. Overall, as explained by Duverger's law, partisan disparities in voting are unavoidable. However, regional applications of alternative voting methods may address these limitations and challenge standard electoral outcomes.

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Appendix A: Voting Methods

These are the various voting methods that will be explored throughout the study. Please note that these methods will appear in the findings section and may be referred to at any time.

1. *Plurality voting* - an electoral system in which each voter is to select one candidate, and the candidate with the most votes wins (Pacuit 2019).
2. *Ranked-choice voting* - an electoral system in which voters rank candidates by personal preference.
 - a. *Anti-plurality* - voters choose one candidate to vote against, rather than choosing one to vote for (Pacuit 2019).
 - b. *Borda Count* - a (Borda) score is assigned to each candidate based on their ranking among other candidates. Out of n candidates, n-1 points are given to the first-place rankings, n-2 to the second-place rankings, etc. 1 point is given to any candidate with a second-to-last ranking, and 0 points are assigned to the last-place ranking (Pacuit 2019).
 - c. *Condorcet's method* - each calculation is based on the premise that "A is ranked higher than B". The Condorcet winner is the candidate that dominates the greatest number of candidates when placed in an immediate comparison (Young 1988, 1231).
 - d. *Hare method* - the candidate with the fewest first-place votes is continuously deleted from the running until one remains with a majority of votes

(Pacuit 2019).

- e. *Coombs' method* - the candidate with the most last-place votes is continuously deleted from the running until one remains with a majority of votes (Pacuit 2019).

3. *Cumulative voting* - each voter must distribute a fixed number of points among the candidates in any way they choose. The candidate with the most points wins (Pacuit 2019).

4. *Negative voting* - each voter may choose one candidate to either vote for (giving the candidate 1 point) or to vote against (giving the candidate -1 points). The positive points and negative points are then added together. The winner is the candidate with the greatest number of votes after the summation (Pacuit 2019).

5. *Approval voting* - voters are to select a subset of candidates (any candidate that they would approve of winning), and the candidate selected by the most voters wins (Pacuit 2019).

Appendix B: Complete Survey

Voting Theory in the Pennsylvania 2022 Senate Election Survey

Voting Theory in the Pennsylvania 2022 Senate Election Consent Form

You are being asked to take part in a research study on the potential influence of alternative voting methods on the results of the Pennsylvania 2022 senate election. We are asking you to take part because you have expressed interest in acting as a voter in this mock election. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

What the study is about: The purpose of this study is to analyze how the real results of the Pennsylvania 2022 senate election compare to the results of a series of mock elections, which will be conducted through experimentation with non-traditional voting methods. You must be 18 years or older and eligible to vote in Pennsylvania in order to take part in this study.

What we will ask you to do: If you agree to be in this study, we will have you fill out a survey. The survey will ask you to cast fake votes for candidates who ran in the 2022 Pennsylvania senate race through a

variety of voting methods such as rankings, point distributions, approval scales, and more. Additionally, it will include questions about your political affiliation and feelings toward each candidate. The survey will take about 10 minutes to complete.

Risks and benefits:

There is the risk that you may find this survey to be violative of your political opinions.

There are no direct benefits to you. However, this study can provide insight about how election results may vary if an alternative voting method is used as opposed to the United States' traditional voting system.

Compensation: You may be entered into a raffle for a \$50 gift card at the conclusion of the survey. You will have to provide a preferred form of contact information (phone number, email address, etc.) in order to be entered into the raffle.

Your answers will be confidential. The records of this study will be kept private. In any sort of report that we make public we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.

Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide to take part, you are free to withdraw at any time.

If you have questions: The researcher conducting this study is [redacted]. Please ask any questions you have now. If you have questions later, you may contact [redacted] at [redacted]. You can reach [redacted] at [redacted]. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at [redacted].

If you are 18 years of age or older, have you read/understood the above information and consent to participate in this study?

Yes, I am 18 years old or older and I consent to participate in this study. [continue to next section]

No, I am under the age of 18. [submit form]

No, I do not consent to participate in this study. [submit form]

Political History

Are you eligible to vote in Pennsylvania?

Daniel Wassmer

Adapted from: <https://wassmer4pa.com>



- Keystone Party of Pennsylvania
- Pro-choice
- Pro-second amendment
- Pro-immigration
- Union member
- Anti-over policing; pro "peace officers"
- Supports social security protections
- Wants greater anti-corruption enforcement
- Supports affordable healthcare

*not much information on candidate, so more information on party adapted from <https://www.keystone.party/>

- Believe legislators should spend half of their time among constituents so they can understand those they represent
- Believe state should not spend more than it receives in revenue, and that the annual budget must be balanced
- Support pardoning of convictions for victimless crimes
- Believe individuals should be allowed to exchange goods/services as currency; no fiat currency
- Support free trade

Yes [continue to next section]

No [submit form]

Did you vote in the 2022 Pennsylvania senate election?

Yes

No

If yes, which candidate did you vote for?

John Fetterman

Dr. Mehmet Oz

Erik Gerhardt

Richard L. Weiss

Daniel Wassmer

I did not vote in the 2022 Pennsylvania senate election.

Other

Which political party holds the views you most identify with?

Democrat

Republican

Libertarian

Independent

Green Party

Constitution Party

Keystone Party of Pennsylvania

Other

Erik Gerhardt

Adapted from: <https://erik4pa.com/>



- Libertarian
- Wants to "decrease taxes to their absolute minimum"
- Supports applying flat tax on sales and getting rid of property tax
- Against extra credit for unemployment benefits

-Against defunding police, but for police reform such as more/better training

-Supports the legalization and decriminalization of marijuana

-Believes abortion should not be dependent on the senate as it is the personal choice of the woman

-Supports court's decision for overturning Roe v. Wade, and believes that "the states and their people should have a constitutional question added to the ballot to have the people decide on the issue"

Richard L. Weiss

Adapted from: https://www.greenslate2022.com/us_senator



- Green Party
- Supports Medicare for All
- Advocates for securing reproductive rights
- Believes in gun regulation
- Advocates for peace in Ukraine

-Supports restorative justice reforms, believing they would reduce crime and save money

-Strongly opposes fracking; advocate for a ban on fracking

-Supports a rapid transition to renewable energy

-Platform based on using green alternatives for state grants and tax breaks given to energy/natural resource industries

-Supports transition to 100% clean energy and the creation of an environmentally sustainable economy

Dr. Mehmet Oz

Adapted from:
https://en.wikipedia.org/wiki/Mehmet_Oz#Political_positions



- Republican
- Against abortion except for rape, incest, or if mother's life is in danger
- States he would "potentially" support the death penalty for fentanyl dealers
- Pro-school choice + charter schools
- Supports same-sex marriage

-Supports fracking and the reduction of strict environmental regulations

-Supporter of Israel-United States relations

-Gun owner and supporter of 2nd amendment

-Said he would vote against Affordable Care Act

-Supports medical use of marijuana, not recreational + supports pardoning of marijuana possession sentences

-Offered support to transgender youth in 2010

-Supports prohibiting transgender people from sports that are divided by gender-based categories

John Fetterman

Adapted from:
https://en.wikipedia.org/wiki/John_Fetterman#Political_positions



- Democrat
- Stated that abortion is "between a woman and her physician"
- Against death penalty; advocate for more rehabilitation action for model prisoners
- Described as "skeptical of free trade"

-Previously opposed fracking, now supports it along with stricter environmental regulations

-Supporter of Israel-United States relations

-Supports restrictions on gun purchases

-Supporter of Medicare for All

-Supports legalization of marijuana and expunging criminal convictions related to marijuana

-Supports raising minimum wage to \$15 + unions

-Supports imposing a wealth tax

-Pro-policing and anti-defund the police

Voting Methods

The following questions will ask you to vote for candidates using a variety of methods. Some may require you to select multiple candidates, distribute points, or construct a ranking. For each method, you will be given instructions on how to properly cast your vote. Please be sure to read the instructions before proceeding with your votes. Your identity is anonymous, and your answers will be kept confidential.

Provided are brief descriptions on five candidates who ran in the 2022 Pennsylvania senate race. You may refer to these descriptions throughout the study to understand the positions held by each candidate.

Plurality

This is the traditional voting system used for senate elections (and most other elections) in the United States. Plurality voting is equivalent to election by popular vote -- whichever candidate gets the highest number of votes will win.

Please select your one top candidate.

John Fetterman (Democrat)

Dr. Mehmet Oz (Republican)

Erik Gerhardt (Libertarian)

Richard L. Weiss (Green Party)

Daniel Wassmer (Keystone Party of Pennsylvania)

Ranking Methods

Rank the candidates from 1-5. 1 represents the candidate you would most like to win, 2 the second most, etc. 5 represents the candidate you would least like to win. Your ranking will be used to calculate the winner for multiple types of methods such as the Condorcet method, Borda Count, anti-plurality, the Hare rule, Coombs rule, etc.

[multiple choice grid with choices 1-5 for each candidate]

Cumulative Voting

For this method, you will be given 10 points to distribute among the five candidates in any way you please. Please type the number of points you would like to allot to each candidate into the corresponding boxes below. The more points a candidate is given, the higher their chances of winning are. For instance, if you really like candidate A, but hate candidate C, you may want to give some points to candidate B (even though you are impartial to them) because you don't want candidate C to win. Please ensure your point distributions add up to 10 in the end.

[candidates' names with an open textbox]

Negative Voting

For this method, the voter is able to select one candidate to either vote for, or one candidate to vote against. You may select your favorite candidate to give +1 point to, or select your least favorite candidate to give -1 point to (take 1 point away from). This method is more indicative of which candidates are more positively perceived by voters and which are perceived more negatively.

+1 point to John Fetterman (Democrat)

+1 point to Dr. Mehmet Oz (Republican)

+1 point to Erik Gerhardt (Libertarian)

+1 point to Richard L. Weiss (Green Party)

+1 point to Daniel Wassmer (Keystone Party of Pennsylvania)

-1 point from John Fetterman (Democrat)

-1 point from Dr. Mehmet Oz (Republican)

-1 point from Erik Gerhardt (Libertarian)

-1 point from Richard L. Weiss (Green Party)

-1 point from Daniel Wassmer (Keystone Party of Pennsylvania)

Approval Voting

For this method, select all the candidates that are above your "threshold of acceptance", or the point a candidate would have to pass for you to be at least moderately satisfied with them winning. Mark the boxes of any candidate (even if they are not your first pick) that you would approve of winning. For instance, if you love candidate A, don't mind candidate B, but strongly dislike C and D, you may want to select both candidates A and B in order to lower the chances of having your least favorite candidates win.

Select all candidates that you would approve of winning:

[checkboxes with candidates' names]

Political Background Cont.

Prior to taking this survey, which candidates did you know/recognize? (Select all that apply)

[checkboxes with candidates' names]

What party do you typically vote for/would you typically vote for in elections? (Select all that apply)

[checkboxes with party options]

On a scale from 1 (never) to 5 (definitely would), how likely would you be to vote third party (non-Democrat or Republican) in any given election?

[Likert scale]

ALTERNATIVE VOTING METHODS IN THE PENNSYLVANIA 2022 SENATE ELECTION

Which voting method(s) did you like? (Select all that apply)

[checkboxes with each voting method]

Which voting method did you like best?

Plurality (popular vote)

Ranking

Cumulative voting (distributing 10 points)

Negative voting (+1 or -1 point)

Approval voting (selecting all candidates you approve of)

Which voting method(s) would you consider to be fair? (Select all that apply)

Plurality (popular vote)

Ranking

Cumulative voting (distributing 10 points)

Negative voting (+1 or -1 point)

Approval voting (selecting all candidates you approve of)

Which voting method did you find to be the most fair?

Plurality (popular vote)

Ranking

Cumulative voting (distributing 10 points)

Negative voting (+1 or -1 point)

Approval voting (selecting all candidates you approve of)

In your opinion, which voting method would yield a candidate that would satisfy the greatest number of people?

Plurality (popular vote)

Ranking

Cumulative voting (distributing 10 points)

Negative voting (+1 or -1 point)

Approval voting (selecting all candidates you approve of)

Thank you for completing this survey.

Project Title: Voting Theory in the Pennsylvania 2022 Senate Election

Principal Investigator: [redacted]

Department/Course: AP Research

Contact Information: [redacted]

Taking part is voluntary

Although you have already completed the survey, your involvement is still voluntary, and you may choose to withdraw the data you provided prior to debriefing, without penalty or loss of compensation offered to you. Withdrawing your submission will not

adversely affect your relationship with Hampton High School, the researchers, or any of our affiliates.

Privacy/Confidentiality

If you agree to allow us to use your data, here is how we will maintain confidentiality of the information. No personal information will be collected from your response, meaning that it is impossible to retrace your responses back to you.

The main researcher conducting this study is [redacted], a student at [redacted].

If you have questions later, or would like to know about the results of the study, you may contact [redacted] at [redacted].

If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at [redacted]. Please mark below if you do, or do not, give permission to have your data included in the study:

Do you understand the intent and purpose of your participation in the Voting Theory in the Pennsylvania 2022 Senate Election Study and give permission for your responses to be included in the study?

Yes, I agree that the data collected during the study may be included for the purpose of the study. [continue to next section]

No, I DO NOT give permission to have my data used. [submit form]

Gift Card Raffle

If you wish to participate in the raffle to receive a \$50 gift card (of your choice), please provide your cell phone number or email address below to be entered into the raffle. Whether or not you wish to participate in the raffle, please remember to submit your responses.

[short answer text box]

Consulting Editors of the Journal

Anthony
Campbell
BA, MA, PhD

Anthony Campbell established Grow for Good Urban Teaching Farm in 2013 as a business model innovation laboratory and learning centre for young entrepreneurs. He spent time working throughout North America, Europe, Australia, Asia and now resides in his hometown of Toronto. Examples of Anthony's work are documented in *The Innovator's Field Guide* (2014), co-authored by David Crosswhite and Peter Skarzynski, as well as multiple Harvard Business School and Corporate Executive Board case studies chronicling the innovation and capability-building efforts of companies such as Samsung, Whirlpool, Best Buy and McDonald's. Previously, Anthony taught Film Studies, Writing and English Literature at The University of Western Ontario.

Jeremy B. Caplan
ScB, PhD

Jeremy Caplan is an Associate Professor in the Psychology Department at the University of Alberta, where he is also the Principal Investigator at the University of Alberta Computational Memory Lab. The lab is focused on human verbal memory behaviour and its basis in cognitive and neural processes. The team takes several approaches towards research, including mathematical modeling, measures of behaviour in the cognitive psychology tradition, and measures of brain activity using electroencephalography (event-related potentials and oscillations) and functional magnetic resonance imaging. He has been a referee for 38 academic journals.

Priya Chopra
MD, FRCSC

Dr. Chopra is a practising general surgeon at the William Osler Health Centre (WOHS) in Brampton, Ontario, Canada, where she maintains a busy practice and balances involvement in various healthcare initiatives with the local cancer center. She earned her MD at Western University (London, Ontario), and completed general surgery residency at the University of Ottawa. After a year of pediatric surgical training at Université de Montréal, Dr. Chopra joined WOHS in 2001. Her clinical interests include systematic promotion of cancer care in her highly diverse catchment area. She is currently deeply engaged with her local Ontario Health Team creating innovative solutions to improve health outcomes and diminish inequities in healthcare. She has also taken on healthcare consulting engagements to improve program design and delivery. She hopes to become involved with the new TMU medical school opening in Brampton in 2025.

Nitin Deckha
PhD, CTD
MCATD

Nitin Deckha (he/him) holds a PhD in Anthropology from Rice University, Houston and is a Certified Training Development Professional (CTDP). Over the last 15 years, Nitin has taught courses on intercultural communication, social problems, social justice, gender issues and the transformation of work at the University of Guelph-Humber, Toronto. In addition to his current research on gender inclusion in police recruitment, Nitin has conducted and published research on police experiences of higher education and the gendered perceptions of career preparedness. Nitin also consults and speaks on intercultural competence, equity and inclusion, and the future of work and learning.

John Flannery
BSc, MD

Dr. John Flannery has been a specialist in Physical Medicine & Rehabilitation and physician leader for almost 30 years. His area of clinical specialty has included the entire gamut of all the physical rehab domains including amputee, burn, electro-diagnostic medicine, chronic and musculoskeletal pain, as well as all of the neurologic rehabilitation fields (ABI, Stroke and SCI). He was Residency Program Director at U of T for over 10 years (2003-13) as well as the lead for the Specialty Committee at the Royal College for four of those years (2009-12). He was the Medical Director of the MSK and Multisystem Rehab Program at Toronto Rehab since 2003- 2022 and continues his clinical, educational, and administrative collaborative trailblazing as the Medical Director of the Rehab Pain Service (RPS) since 2016. In 2013, he was selected by peers and administrators in the GTA as one of 30 top “Toronto Docs” and profiled in Toronto Life magazine (first and only time in Toronto Life magazine history) for his compassionate care and leadership in Rehab. His peer reviewed recognition as a clinical leader has continued in the North Toronto Post inaugural 2022 and follow-up 2023 edition acknowledging the Top Doctors in Toronto.

Will Fripp
BA, MA

Will Fripp is a public affairs and political risk analyst for Canadian and international clients. A B.A. in History and Political Science from Victoria University at the University of Toronto and an M.A. in Intelligence and International Relations from the University of Salford in Manchester, England, he is a historian specializing in intelligence and espionage, and its modern influences. Will anchored www.spiesintheshadows.com, a web based curriculum outlining Canadian foreign intelligence history and its impacts on Canada’s national development. An occasional lecturer, Will’s writings and review articles appear in peer-reviewed academic journals like Intelligence and National Security, and elsewhere. Currently, in his leadership role in the RPS Program, his main areas of focus include educational system level endeavors. This includes his role as the Co-Director of the “Project ECHO (Extension of Community Healthcare Outcomes) Superhub Training” with its national reach in over 40 Projects in Canada and international reach into over 35 countries with his particular interest in the facilitation process of learning. As well, as the physician lead for the RPS, he is collaborating with the research arm of the TRI and embarking on a journey from the anatomy lab to the bedside in exploring how the muscle interacts with the neurologic system and the effects of medication, exercise and other therapies on persistent pain.

Michael Gemar
BSc, BA, PhD

Michael Gemar received undergraduate degrees in Psychology and Philosophy from Rice University, and a PhD in experimental psychology from the University of Toronto. He has worked as a researcher at the Centre for Addiction and Mental Health, examining the cognitive and neural correlates of mood disorders, and was involved in a landmark study demonstrating the efficacy of mindfulness meditation to prevent depressive relapse. He has co-authored numerous journal articles, and taught for over a decade at U of T. More recently, he has worked in the area of health policy, and is currently at a Canadian non-profit.

- Jennifer Goldberg holds an M.A. in History from the University of Toronto. Her graduate studies focused on teacher misconduct in 19th century Ontario, and her research is published in *Historical Studies in Education*. She currently leads the English department and teaches at Havergal College, where she has also served as Chair of Teaching and Learning. In this capacity, she has explored the role of feedback in student learning, and has presented on this work at the National Coalition of Girls' Schools and Conference of Independent Teachers of English.
- BA, BEd, MA
- Tim Hutton is a teacher-librarian at Royal St. George's College. He has a BA in History and American Studies from the University of Toronto and a Masters in Library and Information Science from San Jose State University. At the secondary level, he has taught courses in the social sciences, humanities and communications technology, including a locally designed interdisciplinary course in urban studies.
- BA, MLIS
- Jamie Kellar is an Associate Professor – Teaching and Associate Dean, Academic at the Leslie Dan Faculty of Pharmacy, University of Toronto. She received an Honors Bachelor of Science degree in Human Kinetics (BScHK) from the University of Guelph, followed by a Bachelor of Science in Pharmacy (BScPhm) and Doctor of Pharmacy (PharmD) degree, both from the University of Toronto. She obtained her PhD from the School of Health Professions Education, Maastricht University, Netherlands. In addition to her education, she is a licensed pharmacist in Ontario. Professor Kellar's practice area is in the field of mental health. Her research explores professional identity in pharmacy education and practice. Dr. Kellar is an award-winning educator, having won the University of Toronto Early Career Teaching Award, the President's Teaching Award and the Association of Faculties of Pharmacy of Canada (AFPC) National Award for Excellence in Education
- BScHK, BScPhm, PharmD, PhD
- John Lambersky is a teacher and head of the Canadian and World Studies department at Royal St. George's College in Toronto, where he leads the AP Capstone program. He has presented his work on teaching practice at the conferences of the International Boys' School Coalition, the National Association of Independent Schools, Advanced Placement and the College Board, and the Canadian Accredited Independent Schools. His academic research is focused on school culture as a mechanism for school improvement. His work has been featured in *Leadership and Policy in Schools*, *The Dalhousie Review*, and *The Nashawaak Review*, and he is the author of *Style and Substance: Finding and Joining the Academic Conversation* from Broadview Press.
- BA, MA, BEd, PhD
- Blake Lee-Whiting is a third year PhD student in the Department of Political Science at the University of Toronto. He received his BA from Queen's University and his MPP from the University of Toronto. He is interested in Canadian politics, public policy, and electoral politics. He is a member of the Policy, Elections, & Representation Lab at the Munk School of Global Affairs & Public Policy where he is currently working on projects related to the health of politicians, electoral success, and electoral candidacy.
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Lori Loeb is Associate Professor of Modern British history at the University of Toronto. She has a Masters in Museum Studies and a PhD in History. A specialist in the Victorian period, she is the author of *Consuming Angels: Advertising and Victorian Women*. Generally, she writes about things in nineteenth-century Britain. A past Deputy Chair and Associate Chair (Graduate) of the History Department, she is currently MA Coordinator. She teaches courses in nineteenth and twentieth-century British history, Victorian material culture and the English country house.

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BSc, BEd

Gaven MacDonald is a Physics and Mathematics teacher at Havergal College, where he is the faculty advisor for the Robotics Team. He is a member of the school's Blended Learning Team, which focuses on developing methods to combine online education resources with in-person classroom teaching. Gaven has designed physics simulations on the website www.cutequbit.com, that teachers can use to assist with their teaching, or to make individualized student assessments. Gaven also runs an educational YouTube channel which focuses on electronics and programming.

Jaime Malic
BA (Hons), MA,
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Jaime Malic completed her PhD in Educational Leadership and Policy at the Ontario Institute for Studies in Education at the University of Toronto; her research focused on leadership values and practices in independent schools in Ontario. Jaime has fifteen years of experience as an educator in both independent and public schools. She currently teaches both AP Capstone Seminar and AP Research, as well as senior English courses at St. Clement's School. Jaime has served as a Reader for AP Capstone Seminar, written for Independent Teacher and Independent Ideas, and presented on various topics at the American Educational Research Association's Annual Conference, the Conference of Independent Teachers of English Annual Conference, the Ontario Advanced Placement Administration Conference, and the Advanced Placement Annual Conference.

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William McCausland is an associate professor of economics at the Université de Montréal. His research applies Bayesian statistical methods in two main areas. The first is discrete choice, at the interface of economics and psychology, where researchers study how people make choices from a small menu of available options. The second is time series modelling in economics, which has many applications in macroeconomics and financial economics. His undergraduate studies were in Engineering and he received his Ph.D. degree in economics from the University of Minnesota.

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Matt Mooney is currently a secondary teacher in the Canadian & World Studies department at Royal St. George's College in Toronto, where he also serves on the Excellence in Teaching and Learning Committee. Matt earned an Honours BA from The University of Toronto, with a double major in History and Geography, and his Bachelor of Education from the Ontario Institute for Studies in Education. He has been teaching in Ontario since 2011 and has experience with curriculum development, such as his work on the Education Committee for Magna Carta Canada. Since 2019, Matt has helped to oversee The Young Researcher.

- Cameron Raymond BSc, MSc
- Cameron is an AI policy analyst at OpenAI, an AI research and deployment company. He holds an MSc from the University of Oxford (Social Data Science) and a BSc from Queen's University (computer science and political science). Previously, Cameron was a research fellow at Stanford University's Regulation, Evaluation and Governance Lab (RegLab), and a visiting researcher at Princeton University's Stigma and Social Perception Lab, the University of Toronto's Computational Social Science Lab, and the Oxford Internet Institute. Cameron's published journal articles span policy, human-computer interaction, and computational social science.
- Kate Schumaker MSW, PhD
- Kate Schumaker is the Manager of Quality Assurance & Outcome Measurement at the Catholic Children's Aid Society of Toronto, and holds the position of Assistant Professor (status only) at the Factor Inwentash Faculty of Social Work, University of Toronto. She has worked for over 20 years in child welfare and children's mental health, including front-line clinical positions and 10 years producing and implementing child welfare policy for the provincial government. In 2011-12 she worked for the Commission to Promote Sustainable Child Welfare, supporting accountability framework development, including the establishment of a set of standardized performance indicators for the child welfare sector in Ontario. Her areas of practice and research interest include poverty, child neglect, trauma-informed practice, child welfare decision-making, and evidence-informed policy and practice.
- Eva Serhal BA, MBA, PhD
- Eva Serhal is the Director of Virtual Mental Health and Outreach at the Centre for Addiction and Mental Health in Ontario, Canada and Director of the ECHO Ontario Superhub, a collaboration between CAMH and UHN that provides training and implementation support to new ECHO telementoring projects throughout Canada. Eva completed a PhD in Health Services Research at the University of Toronto, with a focus on outcomes and evaluation in virtual models of healthcare. Eva's current research assesses the implementation, adoption and economic factors of virtual care in Ontario. Eva also has significant experience with leadership and governance; she currently co-chairs the Toronto Telemedicine Collaborative and sits as a board member of the Children's Aid Society of Toronto.
- Sarah Naomi Shaw BA, MSW, EdD, MD, CCFP, FCFP
- Sarah Naomi Shaw is a family physician in Toronto at Taddle Creek Family Health Team and adjunct faculty at the University of Toronto, Department of Family and Community Medicine. Prior to medical school, she trained as a Developmental Psychologist, obtaining a doctorate at Harvard University focusing on the psychology of girls and women. She also trained as a clinical social worker and began her career as Director of Stepping Stone, an outreach program for sex workers in Nova Scotia.
- Sydney Stoyan B.A., M.A., Ph.D.
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Alumni Editor

Nicholas Bethlenfalvy is a master's student at the London School of Economics and Political Science pursuing an MSc in International Social and Public Policy. In 2018, he graduated from Royal St. George's College while studying in the two-year AP Capstone program, where his AP Research paper analyzed the root causes of rising pedestrian fatalities in Toronto. After completing the Trinity One Program, he graduated from the University of Toronto in 2022 with a Bachelor of Arts in Economics and American Studies. As part of his master's degree, Nicholas intends to focus his dissertation on American consumption patterns by state child poverty levels during the temporary expansion of the United States Child Tax Credit in 2021.

Jacob Buchan is a third-year undergraduate at the University of Toronto studying History with a Focus in Law, Political Science, and English. He is passionate about research and recently completed two scoping reviews on smart home surveillance and data ethics with researchers from the University Health Network. After presenting at the AGE-WELL and ICAIR conferences, Jacob is now working with Professor Linda White at the Munk School for Global Affairs and Public Policy on education policy research.

Andrew Pyper is an analyst at Charles River Associates in Washington DC, working in the Antitrust & Competition Economics Practice; in this role, he produces economic analysis for clients with antitrust-related litigation and regulatory issues. He graduated from the University of Chicago in 2022, where he majored in economics and political science, and graduated from Royal St. George's College in 2018, where he completed the AP Capstone program. His AP Research paper, published in *The Young Researcher*, examined RSGC students' perceptions of the school's implementation of formative assessment. In university, he continued his education work by advising local high school students on the university application process and continued to engage with academia as a data research assistant for a suicide attack research project and as an intern for the Milken Institute, supporting research on building more sustainable capital markets in developing countries.

Guidelines for Contributors

The Young Researcher is a peer-reviewed journal dedicated to publishing the best original research from secondary school students.

The journal's mission is to provide a larger audience for the original academic research of ambitious secondary students, provide a forum for peer-review, and create a community of young researchers. In addition, the journal strives to advance the quality of academic writing in secondary schools.

The Young Researcher is edited by secondary school students working closely with scholars and active researchers at universities and in the community. The journal operates a blind peer-reviewed review process, following those found in academic research journals.

The journal encourages submissions of original research (including relevant replication studies) from a wide range of academic disciplines within the social sciences, humanities, and sciences.

Submission Guidance:

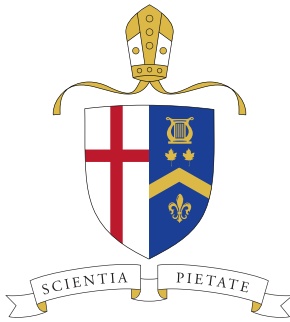
- No more than 5,000 words, excluding references and appendices (in English)
- Articles should have the following sections or equivalent:
 - Introduction
 - Literature Review
 - Method, Process, or Approach
 - Findings or Results
 - Discussion, Analysis, and/or Evaluation
 - Conclusion and Future Directions
 - References
- Papers should be formatted using discipline-appropriate methods (MLA, APA, and Chicago are acceptable).
- Papers should have an abstract (no more than 150 words) and have 4-6 keywords
- All units of measurement should be in metric wherever possible
- All studies involving human participants must have been approved by a Research Ethics Board

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