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Madeline McWatters

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The Effect of Animal-Assisted Therapy on Fine Motor Skill Development

Madeline McWatters

This study investigated the effect of weekly animal assisted activities utilizing guinea pigs on the fine motor development of children in grades kindergarten through third while also aiming to find more engaging and effective methods of occupational therapy for children in particular. An experimental research method was used to obtain quantitative data measuring fine motor ability through three different baseline data tests before and after a four week period. These baseline tests were implemented on both a control group and an experimental group. However, the experimental group had weekly interaction with guinea pigs between the two baseline data tests while the control group made no change to their daily routine. Ultimately, it was found through correlational research methods that animal assisted activities can be beneficial for fine motor development as the experimental group, on average, showed a much greater improvement in the tests over four weeks than the control group.

Keywords: occupational therapy, animal assisted activities, animal assisted therapy, fine motor skills

Introduction

The term motor skill incorporates both gross and fine motor (FM) skills. As a whole, motor skills “are actions that involve movement of muscles in the body” (Fine Motor Skills, para. 2). While gross motor skills encompass larger movements in body parts such as the arms, legs, and feet; FM skills encompass smaller movements found in the hands, wrists, fingers, and toes (Fine Motor Skills, para. 2). The development of FM skills starts at a very young age and has lasting effects. Losse et al. (1991) affirmed the fact that children who struggle with developing their FM skills have difficulty performing basic tasks such as dressing and feeding themselves. As a result, these children are more dependent on others, more open to peer ridicule, and less likely to meet the expectations of school. In addition, establishing poor FM skills at the

beginning of childhood can have lasting effects as it is hard for children to outgrow bad habits if they did not develop good habits from the start (as cited in Rule, 2002, p. 9). Therefore, the development of FM skills is very important for children, notably in preschool and elementary school.

Unfortunately, many children have difficulty developing their FM skills or have a disability that puts them at a disadvantage in this regard. Therefore, many families use occupational therapy (OT) as an outlet to improve FM function. Rule (2002) revealed in his study that “occupational therapists work with individuals and communities in order to enhance their participation in occupations they currently have or want to have by improving their skills or by modifying their environment or their activities” (p. 10). While OT can be very effective, little innovation in treatment methodology has occurred over the past couple of years.

Specifically, the field of OT has not yet adopted animal-assisted therapy (AAT) techniques that are present in psychological, physical and speech therapy.

Literature Review

Fine (2011) defined AAT as “a form of therapy that involves using an animal as a fundamental part of the person’s treatment” (p. xv) and revealed that it is primarily used for patients coping with stress and emotional distress. According to Ernst (2014), “the therapeutic potential of animals was first recognized in the late 1800s, when Florence Nightingale, considered the founder of modern nursing, made substantial discoveries regarding AAT” (para. 2) and its ability to mitigate anxiety for those living in psychiatric institutions. However, AAT did not become popular until the early 1960’s when Boris Levinson, a respected psychotherapist also known as the “father of AAT”, realized that the presence of his dog during therapy treatments improved patient outcomes (para. 4). Today, the effectiveness of ATT is up for debate. While many studies have found ATT to be very beneficial, other studies have concluded that ATT is not actually as effective as the general public believes. This is due to the fact that people are more prone to have a bias towards companion animals. In other words, people’s love for animals tends to yield greater reviews for AAT than might actually be present (Crossman and Kazdin, 2018).

As mentioned earlier, AAT is primarily used for psychological, physical, and speech therapy purposes. Therefore, there is a need to apply it to OT contexts as similar benefits could be seen in this field of therapy. In the psychological therapy field, AAT has been used for improving social anxiety, stress, and behavior. To illustrate, Dilts, Trompisch, and Bergquist (2011) found in their study done on a variety of children with special needs that dolphin-assisted therapy can be beneficial in improving socialization, anxiety and attitudes towards therapy (p. 63). In addition, Jones, Rice, and Cotton (2019) explain in their study surrounding canine-assisted psychotherapy, or using canines in the treatment of mental disorders by psychological means, that canine-assisted therapy can be beneficial in easing PTSD, depression, anxiety, and disruptive behavior in adolescents. Furthermore, secondary

factors of canine-assisted psychotherapy included increased participation and socialization even though those outcomes were not the intended results of the study (p. 18).

More recently, AAT has shown to be beneficial in the physical and speech therapy fields as well. Neagu and Zsuzsanna (2017) explained that hippotherapy, or AAT utilizing horses and horseback riding, can be very beneficial in improving posture, muscle tone, and balance in children with disabilities (p. 402). Furthermore, Machová et al. (2018) concluded that for children with developmental dysphasia, a language disorder that develops in children, speech therapy utilizing canines significantly improved the children’s ability with “narrowing and shutting of the eyes, as well as filling up the cheeks with air and smiling” (para. 1).

As far as the types of animals used in ATT, Fine (2011) revealed that the most common animals used are dogs, followed by cats (p. xv). Therefore, there is a need to do more extensive research on the role that “pocket pets” or small, pocket-sized mammals, as defined by Kršková, Talarovičová, and Olexová (2010), can have within AAT (p. 141). While smaller animals have been used in AAT before, they are primarily used for psychological therapies when they are used. An example of this would be the study done by Kršková (2010) which examined the psychological effects of AAT utilizing guinea pigs and concluded that guinea pigs can be beneficial in improving socialization for children with autism (p. 148). In addition, more extensive research is also revealing some of the unique benefits that working with small animals makes possible. For example, Law & et al. (1995), revealed that “pocket pets” are unique in that their small size actually increases a sense of responsibility within the child interacting with them (as cited in Kršková, 2010, p. 141).

In addition to AAT, animal-assisted activities (AAA’s) are also a very common therapeutic and educational tool. Ernst (2014) explains that AAA’s use animals in order to enhance the quality of life much like AAT. However, unlike AAT, treatment goals are not planned out for each AAA visit and a credentialed therapist is not necessary to perform the AAA (para. 20). For example, Daly and Suggs (2010) concluded that doing informal activities with class pets in elementary school classrooms significantly fosters moral development particularly in regards to empathy. In

addition, Kirnan, Siminerio, and Wong (2016) found that dog-assisted reading programs that allow children to read to dogs boost enthusiasm, self-esteem, and reduce disruptive behaviors as compared to traditional reading programs. Similarly to those 2010 and 2016 studies, this study will utilize AAA's as opposed to AAT because a credentialed therapist and set treatment goals were not feasible for this particular study.

Ultimately, this research project is designed to address the research gaps in OT and AAT previously mentioned in order to pioneer new treatment methods within OT. This is important because animals are rarely used in OT but doing so could pave the way for more engaging methods of treatment which is very important for children as they have shorter attention spans and need more interactive treatment. This study will also help fill in the gap of research surrounding pocket-pets as it will be specifically focusing on the guinea pig. Ultimately, this study poses the question of to what extent can weekly interaction with guinea pigs over a four week period improve the FM skills of children in grades kindergarten through third? These interactions will most likely prove beneficial for developing fine-motor skills in some way, however, it is unclear as to whether the AAA's will be just as effective as traditional OT methods.

Methods

In order to obtain the most accurate results, quantitative data was used to determine the change in FM skills. As a result, any changes in FM skills were supported by concrete data and evidence. In addition to this, quantitative data was also used to see if there were any secondary results of the study related to levels of engagement and enthusiasm when the animals were introduced as compared to the baseline data tests representative of traditional OT therapy methods. The previously mentioned study done by Jones et al (2019) serves as a good example for a study with both a primary and secondary result as they found that canine-assisted psychotherapy was beneficial for primary factors of the study including anger-management and anxiety as well as secondary factors similar to the study including increased engagement and activity. This quantitative approach is supported by many studies such as the one done by Kakebeeke and

others (2019) which measured changes in gross motor skills resulting from physical therapy with quantitative methods similar to the study at hand. The children in this study were timed while doing a variety of different tasks including standing on one leg, walking in a straight line, and hopping on one leg. These quantitative results then allowed researchers to be able to objectively see whether or not the physical therapy was effective.

An experimental research method was primarily used in order to note changes in FM skills for both an experimental group and a control group. Both groups utilized in this study were similar in age, gender, and background, however, the control group carried on with their daily routine while the experimental group interacted with the guinea pigs over the course of the research study. Then, a correlational research method was used to see if there was actually a correlation between any FM development and the AAA's. Finally, a survey research method was used to note secondary factors such as increased enthusiasm and engagement that also resulted from the study. An experimental research method was the most effective for this study as it ensured that other outside factors were not the cause for development in FM skills. An example of an experimental study being done utilizing AAA's was conducted by Kirnan and others (2016) mentioned earlier. This study measured the effects of dog-assisted reading programs on the reading skills and attitudes towards reading for children. The study incorporated a control group that followed a traditional reading program and an experimental group that participated in the dog-assisted reading program. While the experimental group showed stronger reading skills than the control group, both groups improved significantly. Thus, a control group is needed to see the true extent of the improvement due to a child's natural development.

As far as subject selection, five students were chosen for the control group and five students were chosen for the experimental group. There were no notable differences between the students chosen for each group so they were divided simply by availability. While a larger test group would have been favorable, time and availability limitations made two groups of five ideal. These two groups were similar in gender ratio with the experimental group consisting of five males and zero females and the control group con-

sisting of four males and one female. In addition, the groups were relatively similar in age distribution with two five-year-olds, one six-year-old, and two seven-year-olds in the control group as well as one five-year-old, one six-year-old, two seven-year-olds, and one eight-year-old in the experimental group. Finally, it is important to note that as all of these students attended the same school; they have completed similar curriculums and in theory have a relatively similar rate of FM development.

As far as the students that did end up being chosen, sampling procedure was non-random and a sample of convenience. It was not favorable for students to be taken out of class to participate in the study; therefore, it was necessary to rely on students who would be able to participate in the study before the start of school. Thus, a sampling procedure based on convenience was necessary for the feasibility of the study and everyone that was interested was allowed to participate. This sampling procedure can also be seen in a 2010 study done by Krscova et al. which utilized all willing participants found in a special education class to see how interaction with guinea pigs improved anxiety and anger.

Internal validity was maintained throughout the experiment through the experimental research method as it helped ensure that other outside factors were not causing changes in FM skills. In addition, the students did not alter their behavior or react to the experiment as they were unaware of the study and thought of the baseline data tests as games rather than as a research study. As far as external validity, the real-life setting with elementary students in their actual classrooms made the study replicable in other classrooms.

Data Collection

In order to collect data, both the control group and the experimental group participated in three baseline data tests to measure their FM abilities at the start of the study. Two of these tests, the Box and Blocks Test as well as the Nine-Hole Peg Test, were recreations of real tests commonly used by occupational therapists to improve FM skills. The Box and Blocks test times a patient to see how long it takes them to remove 20 large blocks (20 in this particular study) one at a time from a box and then place them back into the box one at a time after they are all removed (see

appendix A). The Nine-Hole Peg Test times children to see how quickly they can individually remove 14 small pegs (14 for this particular study) from a peg board and then place them all back into the pegboard after taking them out (see appendix B). For the third test, the children were tasked with screwing four large plastic nuts onto large plastic bolts and then unscrewing them all afterwards (see appendix C). These tests encompassed muscles in the fingers, palms, and wrists of the hand. For the Blocks and Box Test and Nine-Hole Peg Test, students were instructed to switch the hand that they were using halfway through in order to make sure that both hands were being incorporated.

After the first three baseline tests were recorded, the control group was told to make no change to their daily routine while the experimental group interacted with two guinea pigs every week for 45 minutes over the course of four weeks. The use of the guinea pigs and elementary students was approved by the school's internal review board beforehand. Students directly interacted with the guinea pigs by petting them, holding them, and picking them up. In addition, students indirectly interacted with the guinea pigs by filling up water bowls, rearranging the cages, ripping up vegetables for them, and making mazes out of blocks for the guinea pigs to run through. After four weeks, the three baseline data tests were repeated for both the control and the experimental group and the data was recorded to note any changes between the pre and post assessment.

The results were obtained by calculating the average time difference between the pre and posttests of all three activities for both the experimental and control group. This made it possible to see which group showed the most improvement, if any, for each of the three tests. It was then possible to analyze these results in order to determine whether or not animal-assisted interactions are indeed beneficial for FM skills.

The primary limitation of the study thus far was the small test sample due to time and availability limitations as a larger test sample would have made the data a better representation of elementary students in general. In addition, time limitations also restricted the study to a time span of four weeks while more sessions interacting with the guinea pigs would have been ideal. Finally, due to the timid nature of most guinea pigs, precautions had to be taken to ensure that the guinea pigs were not distressed or anxious. Therefore, it was not

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Table 1
Pre and post baseline data test results for experimental group

	Box & Blocks Test		9 Hole Peg Test		Nut & bolt test	
	Pre	Post	Pre	Post	Pre	Post
Participant 1	:46	:33	1:00	:44	:38	:30
Participant 2	:45	:40	1:00	:43	1:02	:57
Participant 3	:58	:52	:53	:57	1:19	1:17
Participant 4	:48	:44	1:11	:57	1:09	:56
Participant 5	:40	:35	:47	:49	:42	:36

possible to have hands-on interaction with the guinea pigs throughout the entire 45 minute time span which is why the indirect interaction was so important.

Results

To reiterate, this study posed the question “to what extent does weekly interaction with guinea pigs over the course of four weeks improve the FM skills of children grades kindergarten through third?” with the purpose of finding out whether or not animal assisted activities utilizing guinea pigs are beneficial for FM skills. If so, this study could then be used to see whether or not AAAs can compare to traditional methods of OT. In the end, the experimental group showed a much more significant improvement as compared to the control group, and all students in the experimental group preferred the AAAs over the traditional baseline data tests. As seen below, these results were rounded to the nearest second. Table 1 shows the pre and post test data for all three tests of the experimental group that interacted with the guinea pigs while table 2 shows the pre and post test data for the control group which made no change to their daily routine over the course of the four weeks.

The original predictions of this study were that both groups would show improvement in their FM skills due to a child’s natural development; however, the experimental group would show greater improvement over the course of the four weeks. The results

ultimately supported this hypothesis. While some students actually performed some of the posttests slower than the pretests, the overwhelming majority of trials showed improvement between the pre and post-tests. However, the experimental group showed greater improvement than the control group. Figure 1 shows the average time increase (shown as a positive value) or decrease (shown as a negative value) for all three tests of both the experimental and control group. A decrease in time showed improvement while an increase in time showed deterioration. In addition, it shows the average time difference for all three tests combined.

Therefore, it can be seen that the experimental group had an average 7.2 second decrease in time over the three baseline tests while the control group only had a 2.4 second decrease in time over the three baseline tests.

In addition to this data, a short survey question was posed to each student in the experimental group after the entire study. The question asked whether the students preferred doing activities in which they were interacting with the guinea pigs or the baseline test activities that were representative of typical activities that one may do in traditional OT sessions. The students had the options of picking the guinea pigs, the baseline data tests, or no preference. In the end, all five of the students said that they preferred doing activities with the guinea pigs over the baseline tests. Therefore, this data helps answer the secondary question regarding whether or not animal assisted activities are more engaging and enjoyable. This secondary

Table 2
Pre and post baseline data test results for control group

	Box & Blocks Test		9 Hole Peg Test		Nut & bolt test	
	Pre	Post	Pre	Post	Pre	Post
Participant 6	:37	:40	:50	:54	1:00	1:00
Participant 7	:51	:46	1:00	1:12	1:15	1:06
Participant 8	:41	:38	:44	:47	:49	:38
Participant 9	:42	:46	1:02	:53	1:08	:50
Participant 10	:47	:43	:52	:48	:59	:59

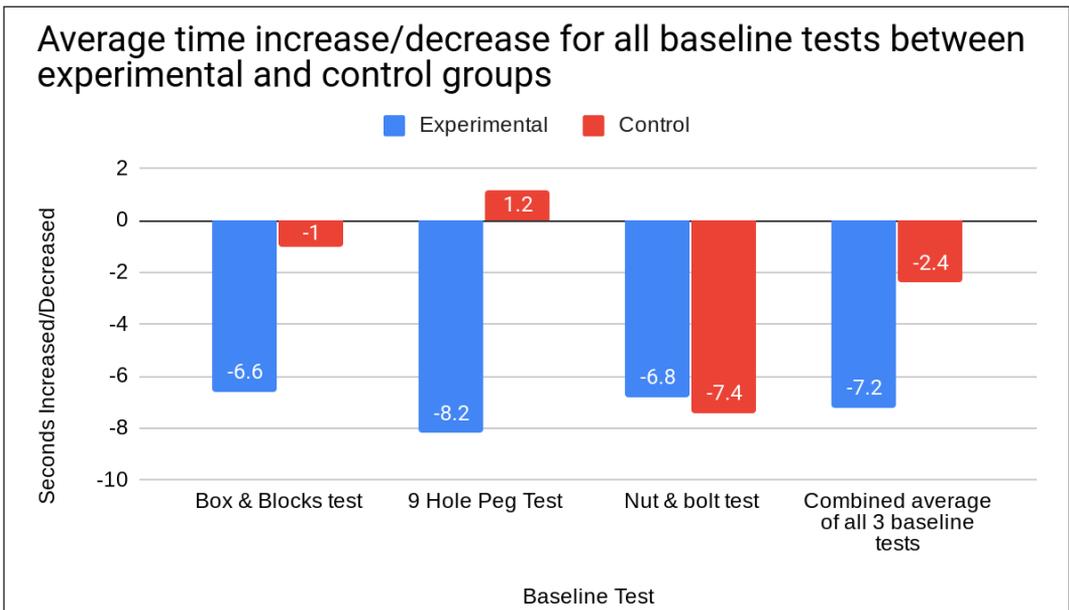
question could serve as rationale for why AAAs could stand up to traditional methods of OT.

Discussion

Ultimately, after conducting three different baseline tests with both an experimental group and a control

group, the results inferred that AAAs can indeed be beneficial for FM development. This inference is due to the 7.2 average second decrease in time between the pre and post baseline tests for the experimental group as compared to the 2.4 average second decrease in time for the control group. To put into context the significance of these numbers, the time taken to complete the baseline tests took between 30 seconds (the

Figure 1: Average time increase/decrease for all baseline tests between both experimental and control groups



fastest time out of all trials) and 79 seconds (the slowest time out of all trials).

Therefore, due to the 4.8 average second difference in time improvement between the experimental group and control group, it can be inferred that AAA's with guinea pigs including petting, holding, caring for, and playing with them do indeed have an impact on a child's FM development as compared to not making any change. To answer the research question posed, weekly interaction with guinea pigs over the course of four weeks for 45 minutes each week can have a significant impact on FM development according to the data collected in this study.

These results also mirror the results of many similar studies mentioned in the literature review. To illustrate, the study done by Neagu and Zsuzsanna (2017) found a connection between hippotherapy and posture as well as balance. In addition, the study done by Dilts, Trompisch, and Bergquist (2011) reported a connection between dolphin assisted therapy and the behavior of special needs children. Similarly to the results at hand, these studies found AAT to have positive benefits, however, the researchers of these studies did not conclude the results to be sufficient enough to stand alone and recommended that they be used as complementary methods to traditional therapy programs. With future research, the results of this study will most likely mirror these results and be deemed a good complementary method to traditional OT rather than a stand-alone method of therapy.

While these results do not show how AAA's compare to traditional methods of OT, the results of the survey question posed could serve as rationale for why they may be able to stand up to traditional methods. 100% of the students in the experimental group stated that they preferred the sessions where they interacted with the guinea pigs as opposed to the sessions where they were completing the baseline data tests. This means that the guinea pig interaction was very engaging and enjoyable for children, making them much more willing to unknowingly improve their FM skills.

Another factor of the data worth mentioning is the difference in time between all three tests for both groups. The experimental group had very consistent averages of decrease between all three tests with a 1.6 second difference between the test with the most improvement and the test with the least improvement. On the other hand, the control group saw a 8.4 second

difference in time between the test with the most improvement and the test with the least improvement. This 8.4 second difference is because while the nut and bolt test recorded a 7.4 second decrease in time for the control group, the 9 hole peg test saw a 1.2 second increase in time. Some rationale to explain this data could be that students were doing activities in school during the month of January, the month that the study was conducted, that primarily strengthened the wrist muscles in their hand, which the nut and bolt test was meant to target, whereas the experimental group got to improve on a wide variety of hand muscles throughout interacting with the guinea pigs.

This data is significant for the field of study as it could serve as rationale for why it might be beneficial to incorporate AAA's and specifically pocket-sized pets into OT programs. The large gap in research regarding this makes it especially important in paving the way for more innovative methods of treatment that not only improve motor skills but do it in a fun and engaging way which is very important for children with short attention spans and tendencies to get distracted. However, before incorporating the results of this study into OT programs, it is important to do more research surrounding AAT

To elaborate, as most OT patients are individuals with a specific medical condition or developmental issue, it is important that this research is also applied to this demographic of children as all children used in this study had no known medical condition pertaining to their FM abilities. In addition, while this study was geared towards children as they have a particular affinity towards animals and a low attention span, this same research can be applied to an older audience whether it be middle schoolers, high schoolers, or adults. Finally, it would be beneficial for future studies to address the limitations mentioned in the methods section such as the small sample size, short time span, and amount of direct exposure that the children actually had with the guinea pigs, as well as the limitations that will be mentioned in the next paragraph.

Additional limitations of this study include the fact that while a significant amount of FM development does occur between kindergarten and third grade, much more happens in the first few years of one's life before they even start school. Therefore, to see an even greater impact on FM skills, it would have been beneficial to use an even younger demographic

of students that were not feasible for this study. Another limitation of this study was the inconsistency of working with elementary aged children. No matter how many times the rules of the baseline data tests were explained to the children, there were often times where the children would not do exactly what they were told because they were between the ages of five and eight. These included things like picking up two blocks at a time or forgetting to switch which hands they were using right away. If the errors could be fixed with a quick reminder, the child would be permitted to continue the test; however, if the error took more than a second or two to resolve, the child would be asked to restart the test.

Alternative explanations for the results of this study could include that the students in the experimental group were more comfortable in the setting as they actively participated in the study over the four week period. Due to this, there was also an increase in competition in the experimental group as the children wanted to beat the times of the other children that they knew in the experimental group. On the other hand, the control group did not know who else was in the control group and thus did not have the same competitive motivation.

Conclusion

To conclude, this study found that AAT has the potential to be very beneficial for FM development and with further research may improve the field of OT. This conclusion was made due to an experimental study that found a 4.8 second difference between an experimental group that interacted with guinea pigs over the course of four weeks and a control group that made no change to their daily routines. The 4.8 second difference was between pre and post baseline data tests that were designed to be a good representative of the student's FM skills. In addition, the survey responses found that AAT was much more engaging than traditional methods of therapy.

Thus, this study is significant for the field of OT as well as AAT research. Specifically, it is significant as it fills in a gap of knowledge surrounding the use of smaller animals, such as guinea pigs, in AAT as well as the potential of AAT within OT. This new information with further research could improve OT treatments to make them more engaging and interactive especially for children.

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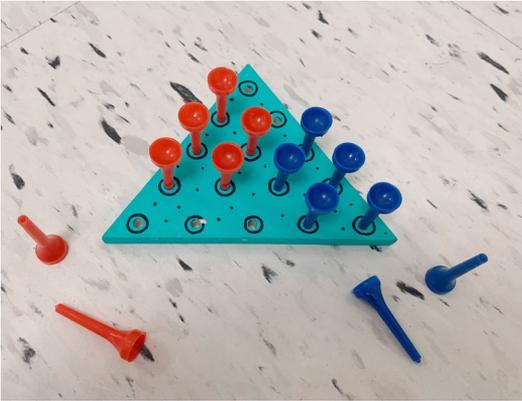
Appendix A

Box & Blocks Test



Appendix B

9 Hole Peg Test



Appendix C

Nut & Bolt Test

