EFFECTS OF INTERACTIVE VAULTING FOR CHILDREN WITH SOCIAL AND BEHAVIORAL NEEDS

by

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A Signature Honors Project Presented to the

Honors College

East Carolina University

In Partial Fulfillment of the

Requirements for

Graduation with Honors

by

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Greenville, NC

December 2019

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Abstract

This study explored the association of interactive vaulting with the social and behavioral skills of children with special needs. A one group quasi-experimental study was utilized to determine whether there were improvements or deterioration in the social and behavioral skills of the children participating in interactive vaulting. Following a completed BRIEF-2 pre- and post-test by the parents of the seven children in the interactive vaulting program, paired mean t-tests indicated that the social and behavioral skills of the children declined during the interactive vaulting intervention. However, none of the changes in the pre-test and post-test were statistically significant at the $p < 0.05$ level. As one of the first research studies in interactive vaulting, continued research of interactive vaulting and additional interventions for children with special needs are encouraged. Discussions regarding the implications of interactive vaulting and suggestions for future research are provided.

Keywords

interactive vaulting, social skills, behavioral skills, children with special needs

Cover Page Footnote

The research support of Dr. Lynne Murphy and Dr. Heather Panczykowski of the Department of Occupational Therapy at East Carolina University and East Carolina University Occupational Therapy students Lindsey Fleury and Mary Vieregge is acknowledged, as this research was completed in partial fulfillment of the requirements for the East Carolina University Honors College Signature Honors Project for the author.

Effects of Interactive Vaulting for Children with Social and Behavioral Needs

Interactive vaulting, a type of equine-assisted activity and therapy (EAAT), is an activity when a rider moves on and around the horse (Professional Association of Therapeutic Horsemanship, International [PATH, Int.], 2018). EAAT is a wide term that describes activities and therapies involving human interaction with horses, which includes interactive vaulting, therapeutic horseback riding (THR), and hippotherapy (Lanning, Matyastik Baier, Ivey-Hatz, Krenek, & Tubbs, 2014). While there have been research studies completed with children participating in EAAT and THR with positive impacts, there have not been studies conducted specifically on the effects of interactive vaulting. Thus, to fill this research gap, a research project was conducted to discover the effects of interactive vaulting on the social and behavioral skills of children with special needs. It was hypothesized that the participants would improve their social and behavioral skills during their involvement in interactive vaulting. This hypothesis was tested through analyzing changes between the *Behavioral Rating Inventory of Executive Functioning* (BRIEF-2) pre-test and post-test completed by the parents of the interactive vaulting program participants. The overall purpose of this research study was to discover the effects of interactive vaulting on children with special needs, specifically the effects on their social and behavioral skills.

Literature Review

Interactive vaulting is “an activity in which the participants perform movements on and around the horse” (PATH, Int., 2018). Part of therapeutic horseback riding (THR), interactive vaulting is specifically an equine-assisted activity and therapy (EAAT) for those with and without special needs. Whereas equine-assisted activities (EAA) include THR, interactive vaulting, and non-riding activities with the horses, equine-assisted therapies (EAT) include

psychotherapy and hippotherapy (Lanning et al., 2014). While EAT is "led by a medical professional such as an occupational, speech, or physical therapist," (Gabriels et al., 2012, p. 579) interactive vaulting lessons are taught by a certified therapeutic riding teacher. Through interactive vaulting, participants learn to balance in different positions on a moving horse. Positions range from low intensity of the basic seat position, where the participant is in "an astride position (the vaulter sits on the horse as a rider would), with the arms held to the side and the hands raised to ear level," to high intensity of the stand position, where the participant "moves from the astride position onto the shins and immediately onto both feet, and releases the grips," standing straight up (Taylor, n.d.). Interactive vaulting introduces team building activities, social interaction, and nurtures independence for children with special needs (PATH, Int., 2018).

EAAT has been utilized as an intervention since early European history, with physicians encouraging horseback riding as a treatment for physical weaknesses, motor deterioration, and mental well-being (Lanning et al., 2014). It has been shown that horses are very therapeutic animals, as "a horse's muscles generate warmth while moving, which can calm and relax the rider" (Gabriels et al., 2012, p. 586). While the goals of THR have always been to improve "balance, posture, gross and fine motor skills, and communication," (Jenkins & DiGennaro Reed, 2013, p. 722), research has shown that there is a significant improvement in sensory limitations, attention and focus, behavior, and socialization (Jenkins & DiGennaro Reed, 2013).

Research completed for the effects of THR and EAAT for those with special needs, specifically for children with autism and cerebral palsy, has demonstrated positive results. Gabriels et al. (2012) completed a pilot study in which 42 children with autism spectrum disorder were observed during 10 weekly THR lessons, which identified significant improvements in the

behavior, communication, movement, and planning skills in the children who had participated in the THR intervention (Gabriels et al., 2012). A follow-up study (Gabriels et al., 2015) examined the effect of THR on self-regulation, socialization, communication, and behaviors in children with autism. With a larger sample of 116 participants, the researchers found that there was a significant improvement in each of the scales in the treatment group compared to the control group (Gabriels et al., 2015). Lanning et al. (2014) explored the participants' characteristic changes through the rating of behavioral and quality of life domains from the perspective of their parents, rather than the EAA instructor and the researchers. When compared to a control group, the treatment group of participants showed a significant improvement in the behavior domain according to their parents (Lanning et al., 2014). In overall quality of life domains, those in the treatment group showed improvement in physical, social, and emotional functioning during the treatment period (Lanning et al., 2014).

In a similar study, Ward, Whalon, Rusnak, Wendell, & Paschall (2013) examined the effects of THR on social communication and sensory processing in children with autism. However, in contrast to the other experiments, the researchers were interested in whether or not the affected characteristics would transfer into the classroom performance of the children. Thus, from the perspective of the teacher and their ratings of each participant, the results showed an improvement in overall communication, sensory processing, and a decrease in the known characteristics of autism spectrum disorder (Ward et al., 2013). Additionally, while the improvements were not shown to be maintained after a 6-week break from THR, they were "recovered once [THR] was reinstated," (Ward et al., 2013, p. 2190).

Although research of the effect of THR on children with autism has demonstrated positive outcomes, there has also been research on children with different special needs

diagnoses, including cerebral palsy (Zadnikar & Kastrin, 2011). In a meta-analysis by Zadnikar & Kastrin (2011), 8 studies measuring the effects of THR on children with cerebral palsy were identified. The researchers discovered a pattern, and it was shown that there was significant effectiveness of THR for improvement in posture and balance in children with cerebral palsy (Zadnikar & Kastrin, 2011).

While each of these aforementioned research studies showed improvement in overall communication and behavioral functioning, in a similar study, there were no significant effects on "participant affect, off-task behavior, problem behavior, compliance, or language" (Jenkins & DiGennaro Reed, 2013, p. 738), showing only a benefit to the posture of some participants. The observations during the lessons and several observations at home, the researchers failed to find a link between THR and behavior of children with autism. However, there were several drawbacks to the study, including the loss of some recorded sessions from faulty equipment and a shorter amount of 9 weeks of the treatment period during the study (Jenkins & DiGennaro Reed, 2013). This may account for some of the differences in results from prior research.

Research Problem and Study Objective

As supported in the literature, EAAT and THR often had a significant positive impact on the physical skills, socialization, and behavior of children with autism and cerebral palsy. However, research has not been conducted on the effectiveness of interactive vaulting, as a specialized form of THR in improving the social and behavioral skills of children and adolescents with special needs. This research project was designed to fill this research gap. With many interventions and treatment plans for children with special needs, it was hypothesized that interactive vaulting, a specific type of EAAT, was an effective intervention plan for facilitating the social and behavioral skills of children with special needs. Thus, the goal of this research

project was to explore the effects of interactive vaulting on the social and behavioral skills of children who engage in this EAAT.

Methods

To determine the effects of interactive vaulting on the social and behavioral skills of children with special needs, a one group quasi-experimental study was undertaken in the Interactive Vaulting Program at Rocking Horse Ranch (RHR) in Greenville, North Carolina. At RHR, a certified interactive vaulting instructor implemented Interactive Vaulting with children, organized into two small groups (no more than 6 children), that met for 1-1.5 hour lessons weekly for 10 weeks in fall 2018 and 12 weeks in spring 2019. The lessons consisted of working in a partnership with a horse specially trained in Interactive Vaulting, as well as group activities with the other children, such as tacking the horse together or playing games related to the horse and vaulting. For example, during one lesson, each child created four activities using a bouncy ball, one in each of the four corners of the arena. Another child travelled to each corner of the area to participate in other group members' activities while completing interactive vaulting tricks on the horse to reach the corner. Examples of those tricks included, riding backwards, doing a 360 degree turn in the saddle, or performing a balanced innovative position on the horse. The instructor facilitated these vaulting tricks that were an appropriate challenge for each rider. While the children were learning equestrian vaulting movements, they also were asked to improve their teamwork and social skills when relating to the other children, as well as their confidence, and respect for the horse, with assistance from their instructor (Rocking Horse Ranch [RHR], 2019).

Instruments

The *Behavior Rating Inventory of Executive Function, Second Edition* (BRIEF-2) was completed by the parents to measure the executive functioning in the academic, social,

behavioral, and emotional domains. The BRIEF-2 consists of 63 items in which respondents use a Likert scale to rate each statement. These 63 items are grouped into nine clinical scales, which are used to understand behaviors related to the domains of executive functioning. These scales are as follows: 1) **Inhibit** scale evaluating inhibitory control and impulsivity; 2) **Self-Monitor** scale or awareness of the impact of their behavior; 3) **Shift** scale assessing the ability to transition between activities or situations when needed; 4) **Emotional Control** scale or assessing emotional expression and responses; 5) **Initiate** scale measuring the ability to problem solve independently; 6) **Working Memory** scale evaluating the ability to remembering information to complete a task; 7) **Plan/Organize** scale assessing the ability to manage activity requirements; 8) **Task-Monitor** scale or checking performance habits; and 9) **Organization of Materials** scale measuring the organization of work and play spaces (Isquith, Gioia, Guy, Kenworthy, & PAR Staff, 2019).

The clinical scales are then grouped into the following three indexes: Behavior Regulation Index (BRI), Emotion Regulation Index (ERI), and Cognitive Regulation Index (CRI). The BRI includes the Inhibit and Self-Monitor scales, the ERI includes the Shift and Emotional Control, and the CRI includes the Initiate, Working Memory, Plan/Organize, Task-Monitor, and Organization of Materials scales. Following the completion of the BRIEF-2 by the parents, the raw score for each clinical scale was determined and then converted to T scores and percentiles, to allow for greater analysis and comparison to standardized values. The Global Executive Composite (GEC) comprises the summed scores of the BRI, ERI, and CRI (Isquith et al., 2019). For the nine clinical scales and the indexes, a lower score is considered a positive change, or a decrease in negative skills or behaviors.

Additionally, the validity of responses on the BRIEF-2 is measured through the following three scales: Inconsistency, Negativity, and Infrequency scales. The Inconsistency scale assesses the inconsistency of respondent answered on comparable items, the Negativity scale measures whether or not the respondent answered certain items in an overall negative manner, and the Infrequency scale evaluates the degree to which the respondent answered specific items in an unusual fashion (Isquith et al., 2019). The acceptable range of both the Inconsistency and Negativity scales are 0 to 6, whereas the acceptable score for the Infrequency scale is 0 (Gioia, Isquith, Guy, & Kenworthy, 2015).

Data Analysis

The BRIEF-2 was completed by the parents before and after their child's participation in the interactive vaulting program at RHR. The pre-test and post-test measures were compared using paired, repeated measures t-tests, with a significance level of $p < 0.05$, to determine if statistically significant differences in the measured scales after the two sessions of interactive vaulting occurred.

Timeline

The study group was compiled through convenience sampling, in which participants were identified and organized into small groups by the interactive vaulting instructor. Researchers obtained Institutional Review Board (IRB) approval and informed consent prior to the beginning of the interactive vaulting sessions. The BRIEF-2 pre-test was completed by the parents for each child in the research group during the first week of the program in fall 2018. The children then completed a 10-week fall 2018 session and a 12-week spring 2019 session of interactive vaulting at RHR. Following the program, the BRIEF-2 post-test was completed by the parents for each child during the last week of the spring 2019 program.

Results

The participants in this research were the parents whose children attended the interactive vaulting program as they completed the BRIEF-2, based on their observed behaviors of their children. The children who attended the interactive vaulting sessions were observed but were not included on the IRB as research participants, as they did not complete the BRIEF-2 or complete any other activities related to the research measures.

Of the 11 children who started interactive vaulting in fall 2018, only 9 children participated in both sessions. Seven children finished in spring 2019, with 7 parents completing both pre- and post-test BRIEF-2 Parent forms describing the social and behavioral skills of their children with special needs. The parents of 5 males and 2 females were included in the study. The children's ages ranged from 9 years 0 months to 13 years 10 months. Diagnoses of the children taking part in the interactive vaulting sessions included developmental delay, autism spectrum disorder, attention deficit/hyperactivity disorder, intellectual disability, disruptive mood dysregulation disorder, and pragmatic language disorder. The validity of the BRIEF-2 was established, as each of the participants' BRIEF-2 forms were in the acceptable ranges for the Inconsistency, Negativity, and Infrequency validity scales.

In the BRIEF-2 scoring results, the Inhibit mean score increased by 3.00, the Self-Monitor mean score increased by 8.00, and the BRI Total mean score increased by 5.28 from pre- to post-test (see Table 1). For these clinical scales, an increased mean score indicates an increase in negative behaviors. Thus, the children participating in interactive vaulting showed an increase in negative behaviors and a decline in performance from the pre-test to the post-test in the mean of the Inhibit and Self-Monitor scales, as well as the overall BRI Total, according to the BRIEF-2 completed by their parents. The use of paired t-tests showed that none of these

changes in the BRI scales were determined to be statistically significant at the $p < 0.05$ level (see Table 1).

Table 1
Comparison of Behavioral Regulation Index T-scores from Pre-Test to Post-Test

	Pre-Test		Post-Test				
	Mean	SD	Mean	SD	Difference	t-value	p-value
Inhibit	65.86	11.782	68.86	11.725	3.00	1.348	0.226
Self-Monitor	59.57	4.392	67.57	8.018	8.00	2.231	0.067
BRI Total	64.29	9.105	69.57	9.624	5.28	2.049	0.086

Additionally, the Shift mean score increased by 3.00, the Emotional Control mean score increased by 3.15, and the ERI Total mean score increased by 3.29 from pre- to post-test (see Table 2). Thus, the children participating in interactive vaulting demonstrated an increase in negative behaviors and a decline in performance from the pre-test to the post-test in the mean of the Shift, Emotional Control, and the ERI Total scales, revealed in the completed BRIEF-2 by their parents. Paired t-tests indicated that none of these changes in the ERI scales were statistically significant at the $p < 0.05$ level (see Table 2).

Table 2
Comparison of Emotional Regulation Index T-scores from Pre-Test to Post-Test

	Pre-Test		Post-Test				
	Mean	SD	Mean	SD	Difference	t-value	p-value
Shift	69.00	11.804	72.00	6.952	3.00	0.785	0.463
Emotional Control	62.71	12.093	65.86	10.637	3.15	1.252	0.257
ERI Total	66.71	11.131	70.00	7.832	3.29	1.152	0.293

From pre- to post-test, the Initiate mean score increased by 6.00, the Working Memory mean score increased by 3.29, the Plan/Organize mean score increased by 5.72, the Task-Monitor mean score increased by 0.00, the Organization of Materials mean score increased by 5.00, and the CRI Total mean score increased by 4.43 (see Table 3). Thus, according to the BRIEF-2 scores from their parents, the children participating in interactive vaulting showed an

increase or no change in negative behaviors and a decline in performance from the pre-test to the post-test in the mean of the Initiate, Working Memory, Plan/Organize, Task-Monitor, and Organization of Materials scales, as well as the CRI Total. However, when a paired t-test was conducted, none of these changes in the CRI scales were determined to be statistically significant at the $p < 0.05$ level (see Table 3).

Table 3
Comparison of Cognitive Regulation Index T-scores from Pre-Test to Post-Test

	Pre-Test		Post-Test				
	Mean	SD	Mean	SD	Difference	t-value	p-value
Initiate	59.14	13.031	65.14	8.494	6.00	1.120	0.306
Working Memory	65.71	8.920	69.00	7.853	3.29	1.068	0.327
Plan/Organize	58.71	10.874	64.43	8.423	5.72	1.541	0.174
Task-Monitor	62.14	8.355	62.14	10.542	0.00	0.00	1.000
Organization of Materials	55.14	8.821	60.14	9.353	5.00	1.063	0.329
CRI Total	62.14	9.082	66.57	9.217	4.43	1.266	0.252

The overall GEC Total mean score increased by 4.72 from pre- to post-test (see Table 4), which showed an increase in negative behaviors and a decline in total performance of the children participating in interactive vaulting. Consistent with all other comparisons, analysis using a paired t-test demonstrated that the change in the mean for GEC Total was not statistically significant at the $p < 0.05$ level (see Table 4).

Table 4
Comparison of Global Executive Composite T-scores from Pre-Test to Post-Test

	Pre-Test		Post-Test				
	Mean	SD	Mean	SD	Difference	t-value	p-value
GEC Total	65.57	10.212	70.29	7.740	4.72	1.663	0.147

Discussion

While prior research has studied THR and EAAT therapies in broad or generalized terms, research specifically on the effects of interactive vaulting for children with special needs was still needed. This study served as a pilot to begin to fill that research gap.

There were several limitations to this research study. First, the small sample size, due to limited enrollment in the program, convenience sampling, and attrition of some participants, makes it difficult to confirm that the results of this study can be generalized to larger populations. Secondly, the lack of control group makes it difficult to rule out other factors that may influence results. Thirdly, the month-long break between the fall 2018 and spring 2019 interactive vaulting sessions may have influenced the behavioral and social skills of the children. However, Ward et al. (2013) discovered that following a break in their THR study program, the improvements in communication and behavior skills of the participants were reinstated. In future research, in which the limitations are addressed, the full impact of interactive vaulting might be more accurately represented in the BRIEF-2 pre- and post-test results.

This research has shown a negative trend in the social and behavioral skills for children with special needs during their participation in an interactive vaulting program, according to their parents who completed the BRIEF-2. It is possible that the parents could not limit their responses on the items to just interactive vaulting. Thus, they would continually base their answers to the BRIEF-2 items on situations that only they see in their home and other settings, not in the interactive vaulting setting. If the BRIEF-2 form was completed by the interactive vaulting instructor, these scores may have been different, as the instructor only saw the children in the interactive vaulting setting. Additionally, a limitation of the BRIEF-2 was that each item was a negative statement. These statements could have encouraged the parents to primarily think of the

negative behaviors rather than the positive behaviors of their children when completing the form. Consideration of other instruments may be used to ensure accuracy of results.

Conclusion

Before the research study was conducted, it was hypothesized that interactive vaulting would facilitate improved social and behavioral skills of children with special needs. However, this pilot study showed that the children that participated in interactive vaulting experienced a decline in social and behavioral functions, according to the parent data. While this result was unexpected, our research shows that the intervention of interactive vaulting may not be effective alone. As many of the participating children were interested in attending each interactive vaulting lesson and engaged in this group activity with the horses, there is an opportunity for positive change. Specifically, changes to the current interactive vaulting program could make it more beneficial in facilitating positive change in the children.

Additional to an improved interactive vaulting program, future research should include a large sample, a control group, a longer time period for the intervention program, exploration and comparison of BRIEF-2 forms completed by both the parents and instructor, and consideration of additional research instruments. While the parents and instructor both have bias in different ways, each of their perspectives are important to research, as parents may see the translation of the program in the home setting and the instructor may see a breakthrough during the intervention program. Overall, future research on an improved interactive vaulting program has the potential to more fully understand how this equine assisted therapy may improve the social and behavioral skills of children with special needs.

References

Gabriels, R. L., Agnew, J. A., Holt, K. D., Shoffner, A., Zhaoxing, P., Ruzzano, S., … Mesibov, G. (2012). Pilot study measuring the effects of therapeutic horseback riding on school-age children and adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6*(2), 578-588. DOI: 10.1016/j.rasd.2011.09.007

Gabriels, R. L., Pan, Z., Dechant, B., Agnew, J. A., Brim, N., & Mesibov, G. (2015). Randomized controlled trial of therapeutic horseback riding in children and adolescents with autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(7), 541-549. DOI: 10.1016/j.jaac.2015.04.007

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2015). *BRIEF-2: Parent form*. Lutz, FL: PAR, Inc.

Isquith, P. K., Gioia, G. A., Guy, S. C., Kenworthy, L., & PAR Staff. (2015). BRIEF-2: Parent form interpretive report. *PAR, Inc*. Retrieved from http://www4.parinc.com/WebUploads/samplerpts/BRIEF2%20Parent%20PiC%20Interpretive%20Sample%20Report.pdf

Jenkins, S. R. & DiGennaro Reed, F. D. (2013). An experimental analysis of the effects of therapeutic horseback riding on the behavior of children with autism. *Research in Autism Spectrum Disorders, 7*(6), 721-740. DOI: 10.1016/j.rasd.2013.02.008

Lanning, B. A., Matyastik Baier, M. E., Ivey-Hatz, J., Krenek, N., & Tubbs, J. D. (2014). Effects of equine assisted activities on autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*, 1897-1907. DOI: 10.1007/s10803-014-2062-5

Professional Association of Therapeutic Horsemanship, International [PATH, Int.]. (2018). Learn about EAAT. Retrieved from https://www.pathintl.org/resources-education/resources/eaat/27-resources/general/200-learn-about-interactive-vaulting

Rocking Horse Ranch. (2019). Programs. Retrieved from https://www.rhrnc.com/programs

Taylor, G. (n.d.). Interactive Vaulting [PDF file]. Retrieved from https://www.pathintl.org/images/content/regions/region-2/Interactive-Vaulting.pdf

Ward, S. C., Whalon, K., Rusnak, K., Wendell, K., & Paschall, N. (2013). The association between therapeutic horseback riding and the social communication and sensory reactions of children with autism. *Journal of Autism and Developmental Disorders, 43*, 2190-2198. DOI: 10.1007/s10803-013-1773-3

Zadnikar, M. & Kastrin, A. (2011). Effects of hippotherapy and therapeutic horseback riding on postural control or balance in children with cerebral palsy: a meta-analysis. *Developmental Medicine and Child Neurology, 53(*8), 684-691. DOI: 10.1111/j. 1469-8749.2011.03951.x