Completed Theses and Projects 2019

Theses:

Hazard Perception Training for Adolescents with Autism Spectrum Disorder on the Interactive Driving Simulator: Using Eye Tracking Technology to Determine Effectiveness

Researcher: Tara Jean Baran under the direction of Dr. Anne Dickerson

Purpose: This pilot study utilized a training protocol on the driving simulator that included hazard perception to determine its effect on overall driving performance. Eye tracking technology was used to determine if there was a change in hazard perception and response to non-social and social hazards after training.

Methods: This study was a one group, pretest-posttest intervention design. There were 17 participants between the ages of 15 and 22 with a self-reported diagnosis of Autism Spectrum Disorder and a desire to learn to drive independently. Each participant completed a pre-test and post-test on the driving simulator while wearing eye tracking technology. Each participant also completed a protocol of 30 learning modules with scenarios related to driving skills and hazard detection and response in one-to-one training. Driving performance was measured by a quantitative score from a standardized observational tool for driving. Eye tracking measure*s* including *fixation duration, fixation count,* and *time to first fixation* were analyzed using a Wilcoxon Signed Rank Test.

Results: Participants significantly increased their overall driving performance scores pre-test to post-test (Z = -3.259, p = 0.001). Results of hazard perception using eye tracking technology tended towards improvement overall, but specific hazard results were inconsistent and varied for both non-social and social hazards in terms of fixation duration, fixation count, and time to first fixation.

Conclusion: Findings from this study indicate driving simulator training related to hazard perception was effective in improving overall driving simulator performance in adolescents with high functioning Autism Spectrum Disorder. Additionally, findings indicate hazard perception and response differs for this population after hazard perception training, but specific eye tracking measures may increase or decrease, and results may not be specific to non-social or social hazards.

Using Eye Tracking Technology to Compare Hazard Detection in Vehicle Driving Versus Interactive Driving Simulator Across Two Age Groups

**Researcher:** Mary-Grace McDonald under the direction of Dr. Anne Dickerson

Purpose: To assess the validity of using a driving simulator compared to on-road driving for evaluation of hazard detection and to explore age differences in hazard detection across these two driving conditions utilizing eye-tracking technologies.

Methods: This study was a 2x2 factorial design with repeated measures. Participants were 13 younger adults (ages 22-39) and 12 older adults (ages 65+). Each participant completed a simulated drive and on-road drive in their personal vehicle while wearing the eye-tracking glasses. Standardized pedestrians served as potential hazards and were placed throughout each driving condition in similar locations (*three-way stop sign, pedestrian by the car, four-way stop light*). Eye tracking metric including *total fixation duration*, *fixation count, total visit duration*, and *visit count* were analyzed. These metrics were compared between driving conditions and age groups.

Results: Results showed significant differences between driving conditions for *fixation count* ($F(1, 20)$, p=0.045) at the *four-way stoplight* and for *total fixation duration* ($F(1, 20)=13.669$, p=0.001), *total* visitation duration ($F(1, 20)=12.876$, p=0.002), and *visit count* ($F(1, 20)=9.547$, p=0.006) at the *three-way stop sign* hazard. For the secondary analysis using paired samples t-test, results within the older adults indicated there was a statistically significant difference between driving conditions for *fixation duration* ($t(10)=3.491$, p=0.006) and *visit duration* ($t(10)=3.406$, p=0.007) at the *pedestrian by the car* and for *fixation duration* ($t(9)=3.833$, p=0.004), *visit duration* ($t(9)=3.841$, p=0.004), and *visit count* ($t(9)=2.751$, p=0.022) at the *three-way stop sign.* Two sample t-test compared older and younger adults' performance on the simulated drive. Statistically significance difference between older and younger drivers included *fixation duration* ($t(20)= 3.255$, p= 0.030) and *visit duration* ($t(20)= 3.236$, p= 0.034) at the *four-way stoplight.*

Conclusion: The results of this study indicated that hazard detection behavior was similar across the driving conditions, with a few exceptions. Therefore, supporting the use of driving simulators as a safe mechanism to observe driving habits, behaviors, and mistakes without risk to the driver, evaluator, or environment. Additionally, these findings indicate that, despite age-related visual decline, older adults detect hazards similarly to younger adults, especially when assessing on- road performance.

Projects:
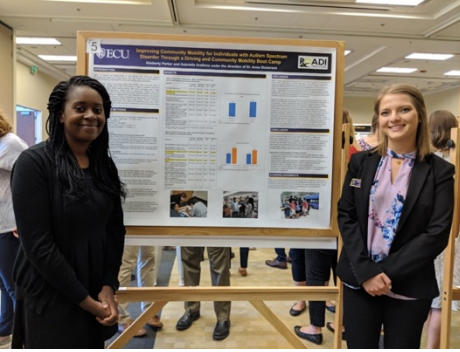
Improving Community Mobility for Individuals with Autism Spectrum Disorder through a Driving and Community Mobility Bootcamp

Researcher: Kimberly Parker and Gabriella Avellone under the direction of Dr. Anne Dickerson

Purpose: The purpose of this research was to answer the question of "How effective was the Driving and Community Mobility Bootcamp for Teens and Young Adults with ASD in improving the community mobility of the participants?"

Methods: The driving bootcamp was developed to teach high-functioning teens and young adults with autism spectrum disorder, the skills needed to independently navigate within their communities. The bootcamp spanned over 5, 8-hour days. Each day was broken down into smaller sessions which included the following topics: mapping (paper and electronic), traffic signs, rules of the road, hazard recognition and community mobility (community safety skills and planning a trip). Two questionnaires were developed via *Qualtrics* to assess the perceived outcomes of the Bootcamp by both participants and their parents/guardians. Each participant (and at least one parent) was required to complete the questionnaire prior to the Bootcamp and upon conclusion. Pre/Post data was used to measure the efficacy of the Bootcamp. To specifically address our research focus, the questions used from the questionnaire are specific to community mobility, with the intention to determine the impact of the participant's experience and perception of knowledge and competence in the IADL of driving and community mobility.

Results: According to pre-test (M=3.91) and post-test comparison (M=4.45), participants perceived they learned how to use a GPS or their phone to navigate the community (p=.025). While not significant, likely due to the small sample size, participants appeared to have learned how to read a map and use public transportation (paired t test approached significant at p=.08). Additionally, parents of the participants perceived their child's ability to use both public transportation and a taxi service improved from participation in the Bootcamp.

Conclusion: It is our belief that this Bootcamp was successful in facilitating the development of skills needed for teens and young adults with HFASD to safely and effectively navigate within the community. Participants demonstrated progressive improvements in knowledge of driving and community mobility skills. Additionally, both participants and parents expressed increased confidence in the participants' ability to use public transportation and mapping skills to navigate efficiently within their communities, as a result of the Bootcamp.

Driving with Autism Spectrum Disorder: The Effectiveness of a Driving and Community Bootcamp for Developing Driving Skills, Knowledge and Abilities Needed for a Driver's License

**Researcher:** Kayla House and Kimberly Fitzgerald under the direction of Dr. Anne Dickerson

Purpose: The research aimed to answer the question of "How effective was the Driving and Community Bootcamp for Teens and Young Adults with ASD in improving the driving knowledge, skills, and abilities of the participants?"

Method: All participants and parents completed a pre- and post-intervention survey to measure the effectiveness of the bootcamp intervention on driving skills and knowledge. These surveys were conducted with the intention to determine the impact of the participant's experience and perception of their potential to drive in the future. The intervention consisted of one week (5 days, 6 hours a day) of specialized classroom and hands-on driving instruction related to rules of the road, hazard detection, specific driving scenarios, and parts of the vehicle.

Results: A paired t-test was used to analyze the pre/post questionnaire data. The participants reported significantly increased knowledge and ability in identifying the components of a car and understanding and obeying traffic rules and regulations following the Bootcamp. They also expressed significantly improved ability to respond appropriately to traffic situations, make turns appropriately both with and without indicators, yield to other cars and pedestrians, use turn signals, and maintain appropriate driving distance between vehicles following the Bootcamp. Notably, the Bootcamp also significantly decreased the participants' level of anxiety about obtaining a driver's license and driving.

The parents' perceptions of their teens' ability to identify car components were significantly increased following the Bootcamp. Additionally, the parents reported a significant increase in the perceptions of their teens' awareness of traffic situations and responses, ability to make appropriate turns at traffic lights, and ability to make safe left and right turns at intersections without indicators.

Conclusion: We learned that personalized driver's education catered to these individuals' learning needs was effective. For many of the participants, the Bootcamp marked their first experiences learning car components, hazard identification, road rules, and traffic regulations. While the quantitative data collected is limited, the significant differences found through the questionnaires indicate that both the participants and parents viewed the Bootcamp as successful in developing driving skills, knowledge, and abilities needed to obtain a driver's license.
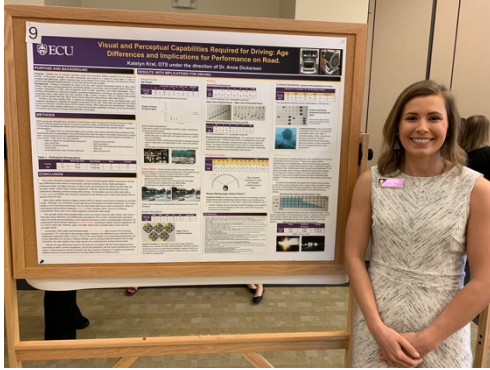
Visual and perceptual capabilities required for driving: Age differences and Implications for Performance on the Road

Researcher: Katelyn Kral under the direction of Dr. Anne Dickerson

Purpose: This study illustrated the age differences in an array of visual tests for a population of healthy adults.

Method: The Optec Plus, an electronic digital vision screener, was used to measure visual outcomes of young and old adults prior to participating in an eye tracking study. Specifically, the tests included: contrast sensitivity, visual acuity, color sensitivity, glare recovery, depth perception, peripheral fields, phoria and visual fusion.

Results: Age differences were found in visual acuity, contrast sensitivity, phoria, depth perception, peripheral fields, and glare recovery as older adults demonstrated less refined acuities than the younger adults. Under North Carolina regulations, however, almost all participants are only restricted to wearing corrective lenses while driving. An exception was one older adult with a visual **acuity** of 20/200, who should be restricted to day driving and on roads with speed limits no greater than 45 mph. More older adults required a higher contrast (60%) to detect visual stimuli compared to younger adults, although, one participant in each age group had impaired contrast sensitivity. While all participants demonstrated adequate phoria, or lack of double vision- which is a licensing requirement- there were more varied responses among the older adults.

The younger adults demonstrated better depth perception than the older adults, with most in that age group detecting visual differences equivalent to 50' on-road. All participants demonstrated adequate peripheral fields according to North Carolina regulations, 60° or more in each eye. However, again, the older adults had a narrower field of view than the younger adults.

Conversely, older adults demonstrated faster glare recovery, with a mean of 9.0 seconds compared to 10.1 seconds for the younger adults. However, this difference was not found to be statistically significant ($t(46) = 0.53$, $p = 0.57$).

Conclusion: Overall, the age differences found in this study are consistent with the normal aging process. According to North Carolina regulations, all but one participant met the visual requirements for the state. A comprehensive driving evaluation that also includes evaluation of cognitive and physical abilities and an on-road assessment is the best determination for fitness to drive.
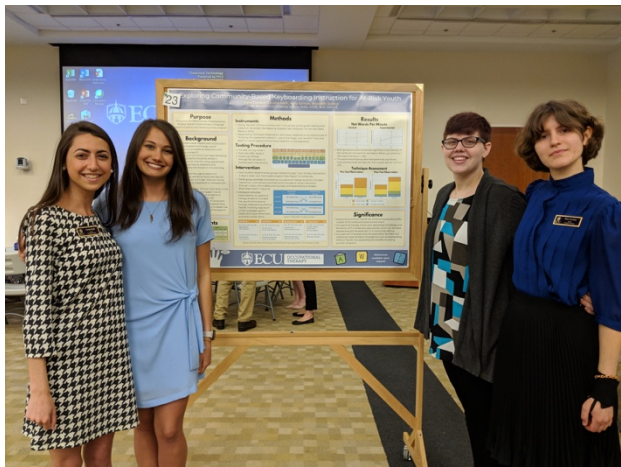
***Exploring Community-Based Keyboarding Instruction for At-Risk Youth***

Researcher: Cecelia Rabil, Meredith Stancill, Kelly Semon, and Rose Condon under the direction of Dr. Denise Donica

Purpose: This study adapted an established keyboarding program (Keyboarding Without Tears®) for use as a community outreach within the summer programming at a local Boys & Girls Club serving the low-income, at-risk youth in Ayden, North Carolina.

Method: Students offered participation in this project included rising first through fifth grade students at the selected club. Students were assigned to one of two groups. The experimental group (n=21) participated in programming at the club; the control group (n=14) had access to the program at home. Experimental students were offered programming on site which included two components: (1) structured keyboarding instruction program and (2) small group computer-related activities. These activities occurred four times per week for 6 weeks for all enrolled participants who were at the club the day of the session. The structured keyboarding instruction curriculum is game-based and self-directed. We used these games for approximately 30 minutes per day to enhance keyboarding speed, accuracy, and technique. In addition, students participated in an interactive small group-based session of 30 minutes to address digital citizenship in addition to songs and activities to facilitate memory of the location of the keys on the keyboard. Students in the control group would be emailed a link for off-site access. However, none of the control group participated in the program.

Results: A repeated measures ANOVA was completed and indicated significant changes in net Words per Minute over time (p=.020) but not between groups (p=.552). Control and experimental groups showed improvement in net Words per Minute from Time 1 pre-test to Time 3 follow-up (control p=.016; experimental p=.032), but the experimental group also had statistically significant improvement from Time 1 pre-test (M=3.17) to Time 2 post-test (M=5.17, p=.037).

Conclusion: Research supports that keyboarding instruction is essential for developing functional keyboarding skills. By utilizing a developmentally-appropriate keyboarding program known as Keyboarding Without Tears®, keyboarding skills can be enhanced outside of the traditional school environment. Occupational therapy draws upon specialized knowledge and familiarity with multisensory approaches to learning, which can facilitate keyboarding skill development in a small group community setting. Therefore, occupational therapists have the potential to facilitate non-traditional implementation of programs, such as Keyboarding Without Tears®, to expand the benefits of existing summer programs.
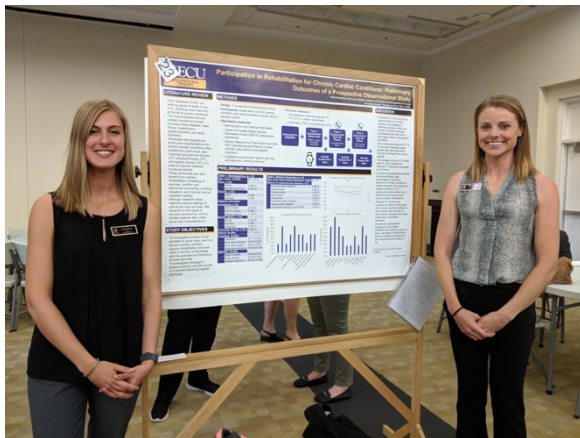
***Rehabilitation services and functional outcomes for people with chronic cardiac conditions***

Researcher: Faith Hardison and Lara Hulcher under the direction of Dr. Young Kim

Purpose: The purpose of this study was to investigate whether those admitted to acute care, due to a chronic cardiac condition, receive rehabilitation services within 3 months of discharge with the purpose and frequency of those services.

Method: A prospective, observational cohort design was used for this study. Researchers investigated changes in physical activity over the course of 3 months following hospital discharge. Some eligibility criteria included: 1) diagnosis of a chronic cardiac condition, 2) recent discharge from acute care hospital, 3) intact cognition, and 4) community residents prior to the admission. All participants were recruited from Vidant East Carolina Heart Institute or home health agencies. Participants' medical records were obtained, and participants were initially evaluated at their home within 4 weeks of their discharge from the acute care hospital (Time 1). Participants also wore ActiGraph GT9X Link at least for 7-full days at Time 1, Time 2 (1-month post Time 1), and Time 3 (3-month post Time 1).

Results: Six participants (mean age 68.7 years) completed this study, half of which received post-acute rehabilitation services. Post-acute services including occupational and physical therapy were provided through home health and skilled nursing facilities. Of those who received services, occupational therapy goals primarily addressed energy conservation, home safety, and independence in completing activities of daily living and instrumental activities of daily living. Physical therapy goals included fall prevention, balance, strength, range of motion, and mobility. According to the ActiGraph results (n=5), the median % sedentary times were 56.19% (range 48.80-62.95%) at Time 1, 44.52% (range 34.59-61.67%) at Time 2, and 49.48% (range 39.03-57.46%) at Time 3.

Conclusion: This study provides preliminary knowledge regarding usage of post-acute rehabilitation services and changes in physical activity levels among those living with chronic cardiac conditions. Further research needs to be conducted with a larger sample size, given the limited generalizability of these findings.
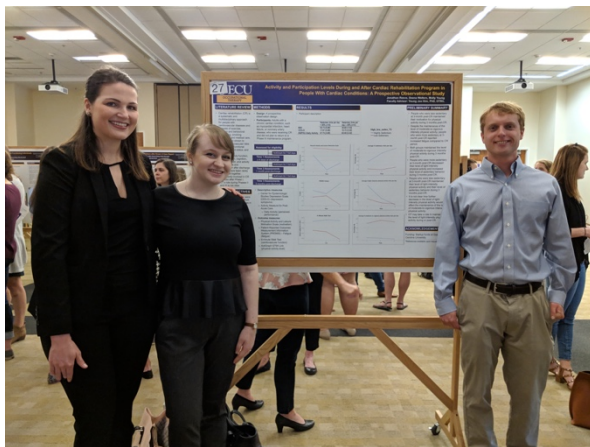
Activity and Participation Levels During and After Cardiac Rehabilitation Program in People With Cardiac Conditions: A Prospective Observational Study

Researcher: Jonathan Reeve, Deena Walters, and Molly Young under the direction of Dr. Young Kim

Purpose: The purpose of this study was to determine how walking distance, sedentary time, and the motivation for participation in physical activity change after completing cardiac rehabilitation in people with chronic cardiac conditions in the community.

Method: A prospective observational design was used. Eligible participants were currently receiving cardiac rehabilitation due to a primary diagnosis indicating a chronic cardiac condition, such as heart failure, myocardial infarction, coronary stent, and coronary artery disease, without sternal precautions. Participants were referred by clinicians at Vidant Cardiovascular and Pulmonary Rehabilitation in Greenville, NC and Vidant Wellness Center in Washington, NC. Participants were assessed three times; at discharge from cardiac rehabilitation, 4-weeks post-discharge, and 12-weeks post-discharge. Descriptive measures included demographic and medical information, the Center for Epidemiologic Studies Depression Scale (CES-D), and the Patient-Report Outcome Measurement Information System (PROMIS)-Fatigue Scale. Outcome measures included the physical activity level and sedentary time obtained from ActiGraph GT9X Link, the Six-Minute Walk Test, and Physical Activity and Leisure Motivation Scale.

Results: Ten participants completed the study. The mean scores for CES-D and PROMIS-Fatigue Scale were 16.90 (SD = 4.89) and 50.90 (SD = 8.76). The results were analyzed in two groups based on their average percent sedentary time per day at Time 3; Low Sedentary (<36%, n=6) and High Sedentary (>36%, n=4). There was a significant difference between the groups in the changes of average percent moderate-to-vigorous intensity physical activity time per day (p =.016), and a significant decrease in average percent light-intensity physical activity time per day for the high sedentary group (p =.016). No trend of changes in walking distance or motivation for physical activity was found.

Conclusion: This study shows trends toward decreased light-intensity physical activity and increased sedentary time post cardiac rehabilitation in those with high sedentary time. The results may indicate a need for maintaining light-intensity physical activity post cardiac rehabilitation to maintain moderate-to-vigorous intensity physical activity.

Universal Design for Learning in Occupational Therapy Education

Researcher: Lindsey Fleury and Brooke Sudano under the direction of Dr. Lynne Murphy

Purpose: Although the benefits of Universal Design for Learning (UDL) have been identified in K-12 and undergraduate education, its use in graduate allied health programs has not been explored.

Method: A nationwide survey was distributed to Occupational Therapy (OT) educators using Qualtrics to gather information on educators' knowledge and use of UDL principles in their teaching. In addition, relationships between educators' academic preparation and use of UDL principles was explored through chi-squared and Cramer's V (post-hoc) tests for association. Finally, differences in educators' background and use of UDL was examined through ANOVA and Tukey (post-hoc) testing.

Results: Of the 273 respondents, 73.6 % stated they had prior knowledge of UDL, yet only 44.3% were able to correctly define UDL. The most frequently used means of engaging students were displaying enthusiasm of the content and providing applications or examples to learners. The most frequently used means of representing information to students were class discussions and lab experiences. The most frequently used means of expression or demonstration of learning were in-class discussions and projects. No statistically significant relationships existed between OT educators' academic preparation and use of UDL principles. However, the type of OT program, the educators' years as an OT educator and faculty rank had the most influence on educators' use of UDL. In OTA programs, educators used brochures, incentives, games and direct feedback as strategies to facilitate learning; however, in OTD programs self-directed learning was utilized more frequently. The years as an educator influenced how class discussions, audio strategies and self-reflection were used. Finally, faculty rank influenced on the educators' use of articles and papers.

Conclusion: OT educators are using UDL in limited ways that are tailored to the student's level of educational program rather than individual learner needs. Increased knowledge and awareness of UDL.
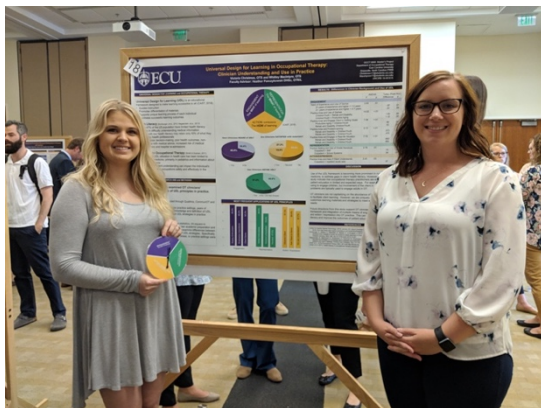
*Universal design for learning in occupational therapy: Clinician understanding and use in practice*

Researcher: Victoria Christmas and Whitley MacIntyre under the direction of Drs. Lynne Murphy and Heather Panczykowski

Purpose: This study examined occupational therapy clinicians' understanding and use of Universal Design for Learning (UDL) principles in various practice settings.

Method: A nationwide, sixteen-question Qualtrics survey was distributed to occupational therapy clinicians via email and social media platforms. This survey collected clinician demographics including degree type, years of experience, practice area, and practice setting. Clinicians ranked frequency of their use of various UDL strategies on a scale of never to always. Descriptive statistics were used to understand current use of teaching and learning strategies. One-way ANOVA and Tukey (post-hoc) testing were used to determine if differences in UDL implementation exist between clinician background and use of UDL.

Results: Findings revealed that emphasizing importance of content, using pictures, and observing the client were the top methods used in the areas of engagement, representation, and understanding, respectively. Significant differences in engagement of clients were noted with more experienced clinicians used games more than novice clinicians. Representation of information also yielded significant results. Handouts were used by outpatient and home care more than clinicians in skilled nursing facilities. Further, there were differences in methods used to determine client understanding. Outpatient clinicians asked clients if they understand what is being taught more than inpatient clinicians.

Conclusion: Clinicians are using traditional methods of educating clients and are not capitalizing on the abundance of methods available when applying the UDL framework to guide intervention. Increased awareness and use of UDL principles should be promoted in occupational therapy to improve therapeutic outcomes.
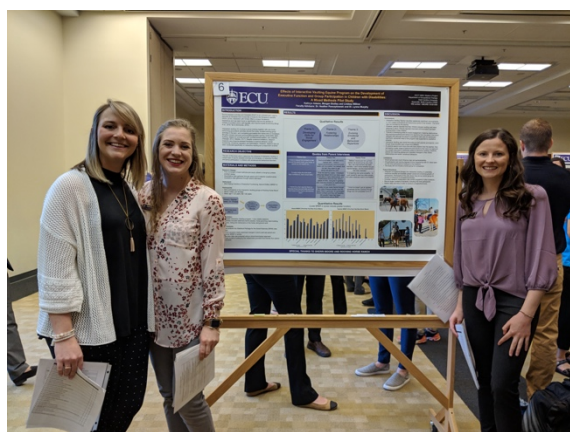
Effects of interactive vaulting equine program on the development of executive function and group participation in children with disabilities: A Pilot Study

Researcher: Kathryn Adams, Morgan Bralley, and Lindsey Millner under the direction of Drs. Lynne Murphy and Heather Panczykowski

Purpose: The aim of this study was to research the influence of interactive vaulting (IV), a subtype of equine assisted activities and therapies, on executive function and group participation in children with disabilities.

Method: This convergent mixed-methods pilot study utilized a one-group pretest-posttest design. Convenience sampling identified children with disabilities (n=9; mean age 11.22 years) who participated in a 10-week IV program. Interventions include a group of children who work together in problem-solving activities both on and off the horse, which included performing horse care, and gymnastics-like maneuvers on horseback,. Paired t-tests analyzed instructor and parent responses measured by the Behavior Rating Inventory of Executive Functioning (BRIEF-2). Parental interviews, conducted at the end of the program, were analyzed following a phenomenological approach to explore parental perceptions of the benefits and challenges experienced throughout the program.

Results: Quantitative results of the instructor responses on the BRIEF-2 identified statistically significant improvements on the following scales: Self-Monitor, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, and Organization of Materials. BRIEF-2 parent responses identified improvements; however, results were not statistically significant. Qualitative analysis of the parent interviews identified three themes regarding benefits of the program: developing skills for social

engagement, fostering relationships, and evolving emotional and behavioral repertoire.

Conclusion: The IV program demonstrated improvements on executive functioning scales as indicated by the BRIEF-2. Parent interviews yielded themes supporting the effectiveness of the program. Future endeavors should include larger sample sizes and a control group to determine the efficacy of the IV in children with disabilities.