Completed Theses and Projects 2022

Theses:

The Relationship Between Instrumental Activities of Daily Living and Naturalistic Driving Performance: Implications for Mild Cognitive Impairment Detection

Researcher: Emily Mitchum under the direction of Dr. Anne Dickerson

Purpose: This thesis explored the relationship of naturalistic driving performance, driving evaluation performance, functional performance in instrumental activities of daily living based on standardized tests. Specifically, the study examined if there is a statistically significant difference in the scores of the Assessment of Motor and Process Skills (AMPS) between participants with greater and participants with fewer driving errors recorded during naturalistic driving in order to offer an evidence-based occupational therapy tool that can be used to identify driving risk and/or detect cognitive impairment.

Method: Forty healthy, community-living older adults (65-87 years) in the Greenville, NC area participated in this descriptive study. Participants agreed to drive with a computer chip in their vehicle for 20 weeks. The chip collects data similar to GPS as well as driving performance including sudden stops, location of drives, and number of trips, contributing to the calculation of three driving "behaviors": aggression, daylight driving, and trip frequency. Each participant completed the AMPS assessment and a comprehensive driving evaluation (clinical assessment and on-road).

Results: Significant correlations were found between aggressive driving behavior and age ($p = 0.040$, $r = -.326$), between amount of daytime driving and age ($p = 0.009$, $r = .409$), between amount of daytime driving and scores on the Montreal Cognitive Assessment (MoCA) ($p = 0.030$, $r = -.344$), and between number of trips and "orients" scores of the P-Drive ($p = 0.035$, $r = -.355$). When testing differences between participant groups, a one-way ANOVA revealed a non-significant ($p = 0.081$) trend in the sample showing that those with average AMPS performance exhibit the least amount of aggression, while those who perform below and above average AMPS performance have higher instances of aggression. The low performance group (less than 25 %) demonstrated the *highest mean aggression* (.687 instances per trip, on average), indicating that lower process scores may have contributed to the differences in aggressive driving behavior between groups.

Conclusion: The negative relationship found between aggression and age suggests that aggressive driving declines with age, while the positive relationship found between daytime driving and age suggests that daytime driving increases with age. These results are not surprising, as older adults may be more likely to employ "self-limiting" driving habits as they age (controlling speed, avoiding poor weather, not driving at night). However, the significant, negative relationships between daytime driving and the MoCA and between number of trips and "orients" abilities may be explained and/or influenced by a number of factors, including the effects of subnormal average MoCA score in this sample. The differences in aggressive driving frequency between AMPS performance groups suggests potential use of the AMPS as a clinical tool to assess driving ability. Future research should continue to employ

naturalistic methods of driving collection, with larger, and more diverse samples, to determine if a stronger relationship between aggressive driving and impairment in process skills may exist, in efforts to detect these cognitive changes at an early stage of impairment.

The Influence of Visual Supports on Driving Performance in Autistic Individuals

Researcher: Haley Poythress under direction of Dr. Anne Dickerson

Purpose: This study explored the effectiveness of visual supports as an occupational therapy intervention for driving performance. Visual supports are intervention tools that provide visual and/or tangible information to improve an individual's understanding of an activity. One such intervention used in this study is Drive Focus®, an interactive app designed to target visual attention, scanning and hazard detection while driving.

Method: Participants in this pre- and post-test design (n=14) were teens and young adults aged 14 – 30 with less than 3 years of driving experience and autism spectrum disorder. Each completed a pre-test including two interactive driving simulator scenarios followed by six 45-minute intervention sessions utilizing the app. Finally, a post-test was completed in which participants completed two different, but matched drives on the interactive simulator. All driving scenarios were randomly assigned and counterbalanced in terms of critical hazards. In addition to the P-Drive, participants wore the Tobii Pro 3 eye tracking glasses during each measurement time. These glasses tracked and recorded pupil glances at specific hazards on an interactive driving simulator. Outcomes include total fixation duration (how long they look at a hazard), fixation count (how many times they see a hazard), and time to first fixation (how long it takes to see a hazard) for critical and non-critical items during simulated drives.

Results: Statistically significant improvements were found in P-Drive scores for maneuvering a vehicle in urban drives ($t(12) = -2.635$, $p = 0.011$) and orientation while driving in rural drives ($t(14) = -2.929$, $p = 0.006$). Additionally, significant increases in the average amount of time participants spent looking at critical items during rural drives from pre- to post- drives ($F(1, 92) = 0.208$, $p = 0.007$) was found with *signs* being the hazard with a statistically significant increase ($F(1, 10)= 8.139$, $p = 0.017$). In urban drives, a significant increase in average fixation duration was observed in participant's visual attention toward *pedestrians* ($F(1, 11)= 5.035$, $p = .046$).

Conclusion: Results indicate that visual supports such as Drive Focus® have good potential to improve certain aspects of driving performance and visual attention while driving for autistic individuals. Specifically, these include visual processing of specific critical items such as *signs* and *pedestrians* as well as improvements in aspects of driving performance (i.e., maneuvers and orientate). In addition to these findings, several other differences were approaching significance indicating the need of additional future research in this area.

Feasibility and Usability of the Virtual Reality System, RecoVR, for Children with Cerebral Palsy

Researcher: Rachel Sorensen under the direction of Dr. Denise Donica

Purpose: This study explored the feasibility and usability of *RecoVR* focusing on motor repetitions for children with cerebral palsy. Specifically, it explored if the *RecoVR* was an engaging supplemental therapeutic activity, children had a positive experience with the system, and parents had a positive experience facilitating its use.

Methods: Children between the ages of 6-15 years old (n = 5) who had some active motion at the shoulder and elbow and could follow two-step directions were recruited. Children were trained on usage of the system. Each child's family borrowed a system for the child to play 1 hour/day, 5 days/week for 4 weeks at home. Repetitions and time were recorded by *RecoVR* during each use. Children completed the NASA-TLX after each use to determine perceived workload (play experience), and parents completed the Weekly Log – Parent Questionnaire on their experience using Likert-style questions. Following the 4 weeks, the parent(s) and child were interviewed in-person regarding their experiences.

Results: Children (n=2) who used the system more than 50% of expected time (M = 649 minutes, SD = 16.97 minutes) completed more repetitions (M = 11789, SD = 5264.41), compared to those (n = 3) who used the system less than 10% of the expected time (M = 41.33 minutes, SD = 44.28 minutes) who had much lower repetitions (M = 436, SD = 677.23). None of the participants reported a high average perceived workload, (24.4-60.9) on a 0-100 scale, meaning this therapeutic activity likely fit the just-right challenge and needs of their therapy goals. High system satisfaction, ≥4.0 on a 0-5 scale, was found among parents of children who had moderate usage and were more engaged playing the system.

Conclusion: Preliminary data suggests that more research should be completed using the data collected and information learned in this study to help better determine the feasibility and usability of the *RecoVR* as a supplemental therapeutic activity for children with cerebral palsy.

Projects:


Description Through Case Examples of a Participant in a Driving and Community Mobility Bootcamp

Researcher: Maggie Bowman and Madison Heavner under the direction of Dr. Anne Dickerson

Purpose: This research presents qualitative outcomes of two participant's perceived level of anxiety and skills related to driving after participating in driving and community mobility boot camp for teens and young adults with Autism Spectrum Disorder (ASD).

Method: Two individuals with a diagnosis of ASD participated in driving and community mobility boot camp, a 5-day occupational therapy student-led course designed to develop driving confidence and competence for individuals with ASD. Objective and subjective data from pre and post parent and participant surveys and a modified Canadian Occupational Performance Measure were analyzed to determine the bootcamp's perceived effects on the participant's anxiety and skill levels related to driving.

Results: Both participants showed an increase in perceived average performance and satisfaction scores for their specific driving-related goals indicated using a modified Canadian Occupational Performance Measure. Data from participant and parent surveys show that both participants experienced reduced anxiety levels pertaining to driving after participating in the bootcamp.

Conclusion: The driving and community mobility boot camp can improve driving competence and reduce driving related anxiety symptoms for individuals with ASD.


Significance of Virtual Driving Simulation for Individuals with Autism Spectrum Disorder

Researcher: Brooke Capps and Taylor Cotellese under the direction of Dr. Anne Dickerson and Dr. Lauren Turbeville

Purpose: The purpose of this study is to describe the standardized occupational therapy outcome used to measure changes in driving performance. Objective data are presented regarding significant changes between pre and post scores of the interactive driving simulator.

Method: The Performance Analysis of Driving Ability (P-Drive) was used to measure the pre and post scores on the interactive driving simulator. The P-Drive is a standardized observational assessment tool used by occupational therapists to score driving performance on road. Two different drives, although similar, were used for pre and post assessment and were scored by two occupational therapy graduate students. In addition to the other activities, each participant participated in a 30-minute session per day on the driving simulator. Participants completed a pre and post survey regarding their perceived driving ability.

Results: Most participants increased their P-Drive score between the pre and post test assessments with the exception of one whose score remained the same. There was also a statistically significant difference in the mean scores between the pre and post tests through the driving simulator. Prior to the bootcamp, the majority of participants rated their confidence in their ability to successfully break in response to stimuli as fair or good. Post test results indicated most participants rated their ability as very good or excellent. Prior to the interactive driving simulator, the majority of participants rated their confidence in ability to make turns appropriately at traffic lights as good. Post test results indicated most participants rated their ability as good or very good.

Conclusion: Our results indicate the use of a driving simulator can be an effective means to address driving for this population. This shows that our method of providing individualized driving instruction with the use of a driving simulator is effective and beneficial in improving overall driving ability.

Using Digital Literacy Tools to Enhance Virtual Handwriting Interventions

Researcher: Samantha Alexander and Taylor Faircloth under the direction of Dr. Denise Donica

Purpose: The purpose of our study was to determine the effectiveness of virtual handwriting instruction on the improvement of children's handwriting legibility and self-perception.

Method: Participants (n = 4) were 5-7-year-old elementary school students with handwriting difficulties that were able to undergo a 6-week virtual handwriting program. The study focused on improving the handwriting legibility (as measured by The Minnesota Handwriting Assessment) and handwriting skill self-perception of the participants (as measured by Here's How I Write). Each week, the participants logged onto Cisco WebEx to attend a 75-minute session (beginning with a 15-minute group session followed by two 30-minute small sessions). The participants were instructed to focus on either two or three lowercase letters of the alphabet during each small session, working to identify and print each letter, with each week building on the previous week's knowledge.

Results: The results of each participant's post-test for Here's How I Write improved from their pre-test with an average increase of 13.75 points, signifying an increase in their own perception of their handwriting and increasing their motivation to participate in handwriting activities in other settings. All participants showed improvements in at least two of the five Minnesota Handwriting Assessment components, with the majority of participants' scores improving in the categories of form (n = 3), size (n = 3), and alignment (n = 2). There are also some categories in which participants' performance decreased, such as that of rate (n = 2). This decrease may be due to the participant's choice to spend more time writing neatly and carefully on the post-test. Overall, the improvements associated with each participant's post-test varied.

Conclusion: The use of digital literacy tools can be used to help enhance students' handwriting skills through virtual intervention. Utilizing occupational therapy skills in conjunction with the digital literacy tool in virtual interventions can aid in the prevention of the potential need for additional occupational therapy services in the school setting while providing extra support for children struggling with this foundational school-based skill.


Exploring the effectiveness of a 6-week in-person handwriting program for improving handwriting legibility, speed, and self-perception for 6–7-year-old students

Researcher: Chelsea Carre and Christine Johnsen under the direction of Dr. Denise Donica and Dr. Lauren Turbeville

Purpose: This study examined the effectiveness of a 6-week in-person handwriting program designed to improve handwriting legibility, speed, and self-perception of handwriting in 6–7-year-old students.

Methods: Three students engaged in a 6-week in-person handwriting program, based on the handwriting curriculum, Learning Without Tears. Sessions occurred weekly for 75 minutes. Before the start of the program, participants were assessed using the Minnesota Handwriting Assessment (MHA) to evaluate legibility, form, alignment, size, and spacing. Here's How I Write (HHIW) was used to determine the participant's perception of their own handwriting. Both the MHA and HHIW were used prior to the program for baseline evaluation and following the program as a post-test to determine changes for each participant.

Results: The results of the MHA varied for each participant, as Participant 1 saw improvements in only two categories, and Participants 2 and 3 improved in four out of the five categories. These categories included legibility, form, alignment, and size. These increases in scores show that the program has helped the fundamental components of handwriting. However, scores also showed discrepancies between the HHIW pre and post test scores. We believe the large score discrepancy on HHIW for one participant was due to inattention in the post test. This is reflective of real life, which is why distracting and uncontrolled environments throughout the entire study is a future study suggestion.

Conclusion: The Learning Without Tears handwriting program was effective to improve the handwriting in two out of the three participants, in accordance with the results of the MHA. The program was also effective by showing improvement of the perception of two of the participants according to the result gathered from HHIW.


Measuring Activity Levels Using an Activity Monitor During Daily Activities: Which Measurement Site to Use?

Researcher: Meghan Caison and Sarah Collins under the direction of Dr. Young Kim

Purpose: This study investigated the differences in activity levels using ActiGraphs during instrumental activities of daily living and physical activity among dominant and non-dominant wrist and hip measurement sites in adults.

Method: Participants (n = 38) were young adults aged 18-39 years without cognitive impairment who can perform 40 mins of moderate-intensity activities. Activity levels were measured by total activity

counts and MET levels using ActiGraphs during bed-making, vacuuming, dishwashing, and walking 3mph activities. All activities selected were moderate-intensity activity (3-3.3 METs). ActiGraphs were placed on participants' non-dominant and dominant wrists and hips.

Results: There were significant differences in total activity counts among non-dominant wrist, dominant wrist, non-dominant hip, and dominant hip measurement sites for bed-making, vacuuming, dishwashing, and walking in both female ($p < 0.001$) and male ($p < 0.001$) participants. In addition, there were significant differences in MET levels among non-dominant wrist, dominant wrist, non-dominant hip, and dominant hip measurement sites for bed-making, vacuuming, dishwashing, and walking in both female ($p < 0.001$) and male ($p < 0.001$) participants. However, these differences were mostly found between wrist and hip measurement sites, not between non-dominant and dominant measurement sites of wrist or hip.

Conclusion: Fewer ActiGraph placements may be necessary for future research studies with similar populations to reduce costs needed for the study and improve participant recruitment and retention.

The Differences Among Instrumental Activities of Daily Living and Physical Activity

Researcher: Michela Vitagliano and Leah Whitehurst under the direction of Dr. Young Kim

Purpose: The purpose of this study was to determine the differences in objective activity levels among instrumental activities of daily living (IADLs) (vacuuming, bed-making, and dishwashing) and physical activity (walking) in healthy young adults between the ages of 18-39.

Method: We recruited 38 adults (15 male, 23 female) who completed 40 minutes of moderate-intensity physical activity in 10-minute intervals. Data were collected using the ActiGraph™ GT9X Link to determine total activity counts and MET levels.

Results: We found significant differences in highest total activity counts and highest MET levels among bed-making, dishwashing, vacuuming, and walking in both male and female participants. Bed-making was shown to be the most active task based on the highest total activity count, and walking had the highest MET levels for males and females. All of the activities showed MET levels higher than 3.0.

Conclusion: The findings may be related to the three-dimensional movements required of the task and may indicate health benefits of IADLs. Our findings may contribute to alternative ways to increase physical activity, thus creating new channels for populations that are less physically active to achieve their health goals.



Impact of Children with Cerebral Palsy's Enjoyment and Feedback on Mastery Motivation and RecoVR System Usage

Researcher: Sarah Dickey, Kelly MacDonald, and Mallory Serpan under the direction of Dr. Young Kim

Purpose: This study investigated the relationships between child enjoyment/feedback and RecoVR System usage and between child enjoyment/feedback and mastery motivation.

Method: This study used a cross-sectional design. Participants (n=5) were children with cerebral palsy aged 6-15 years who showed the minimum amount of movement and control required to use the RecoVR System. After receiving the training and interview, participants were instructed to use the RecoVR System at least for one hour/day, five days/week, four weeks at home. RecoVR System usage was tracked by recording total playing time and number of sessions for four weeks. Their motivation and feedback towards the RecoVR System were measured with the Child Questionnaire, a weekly log. Mastery motivation was measured with the Revised Dimensions of Mastery Questionnaire rated by parents before the intervention began.

Results: Descriptive data with graphs showed that participants who reported better enjoyment/motivation had higher RecoVR system usage. In addition, participants who reported better enjoyment/motivation had higher mastery motivation.

Conclusion: Our findings indicate positive relationships between enjoyment/motivation and a virtual reality system usage and motivation towards challenging tasks in children with cerebral palsy. Further research with more sample size is needed to study the impact of motivation toward a virtual reality system and challenging tasks on a virtual reality system.




How Older Adults Experience the Transportation Planning Process: A Case Study

Researchers: Emily Britt, Brittany Copeland, Makayla Dillion, and Grace Lee under the direction of Dr. Lynne Murphy

Purpose: The purpose of this study was to explore how older adults who are planning for driving retirement experience transportation planning, and to examine how occupational therapy may contribute to successful transportation planning.

Method: This case study was taken from a quasi-experimental study which used a single group, pre-test/post-test design. Researchers met with the participant three times during three months to administer assessments, discuss community mobility preferences and methods, and to facilitate the integration of alternative methods of transportation into routines and community occupations. The following assessments were administered to measure readiness for transition, quality of life, driving habits, and social participation: Assessment of Readiness for Mobility Transition (ARMT), Control - Autonomy - Self-Realization - Pleasure Scale, 19 items (CASP19), Modified Driving Habits Questionnaire (MDHQ), and Patient-Reported Outcomes Measurement Information System (PROMIS) Satisfaction with Social Roles and Activities. Qualitative data was collected through a semi-structured interview at the conclusion of transportation planning.

Results: The study found that the transportation planning process provided the participant with the resources and knowledge to overcome barriers to driving cessation and facilitated readiness to transition to alternative methods of transportation. Challenges of the study included limited opportunities for client contact, barriers in using the local transportation service, and limited participant preferences for alternate methods of transportation.

Conclusion: This case study supported the use of transportation planning as a means to help individuals successfully explore and utilize new methods of transportation, laying the groundwork for additional intervention and research in transportation planning.



Effects of a Collaborative Occupational Therapy Interactive Vaulting Program on Executive Function and Group Participation in Children with Disabilities

Researchers: Madison Foulke, Kristen Maselli, and Anna Tyson under the direction of Dr. Heather Panczykowski

Purpose: This research aimed to explore the influence of a collaborative occupational therapy interactive vaulting program on activity participation, social interaction, and group membership in children with disabilities.

Method: This study utilized a quasi-experimental, one group, pretest-posttest design to explore the impact of a collaborative occupational therapy group on 15 children with behavioral dysfunction over a 10-week period. Interventions were designed using the Cognitive Orientation to Daily Occupational Performance Approach in occupational therapy where participants played an active role in designing their own goals to focus on throughout the program. The Social Profile was used to objectively assess behavioral interactions of children to evaluate level of activity participation, social interaction, and group membership. The Wilcoxon Signed Ranks test was used to compare pre and posttest results of activity participation, social interaction, and group membership within parallel, associative, and basic cooperative aspects.

Results: Results indicated statistically significant improvement on Activity Participation and Social Interaction Rating Scales. Decreases in median parallel scores and increases in median scores in associative and basic cooperative scores on the group function continuum indicate growth in participants' ability to participate and seek and provide help to others. No statistical change was observed in parallel scores on Group Membership and Roles rating scale indicating that children have not gained significant skills in their ability to understand their role and the overall goal(s) of the group. However, statistically significant gains were noted in their ability to interact with others with cooperation and in ways that are more socially acceptable.

Conclusion: The study provides preliminary evidence supporting the effectiveness of collaborative occupational therapy interactive vaulting program in improving activity participation and social interaction in children with various disabilities. Further research would increase evidence on the efficacy of this technique which has the potential to be used to address the gaps in service expressed by the parents in meeting the diverse needs of their children.