AN INTERVIEW-BASED STUDY OF CYCLE TRAINING IN CHILDREN WITH COGNITIVE IMPAIRMENT

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ABSTRACT

This study aimed to identify training components in a cycle training program for children with cognitive impairments (CI) with the goal of generating requirements for potential technology interventions to support cycling skills acquisition and retention. A qualitative study was conducted comprising of semi-structured interviews with cycling trainers (n=4), and supplemented by a literature review, document analysis of students logs, and non-participatory observations of training program development to identify prominent themes and training components unique to this student cohort. Key themes identified relate to training period; importance of baseline cycling skills assessments to refine the training duration and goal-setting; role of parental involvement in supporting the learning process; and the unmet need for long-term evaluation of knowledge retention, safety behavior and overall bicycle use.

Importantly, the study identified a lack of valid measurements instruments to conduct, short- and long-term objective assessment of cycling skills and safety performance. The study concluded that instruments in the form of technology interventions could greatly improve performance assessment at multiple points of the training process. These include at baseline, for instance pre-training to set training goals and plans, during training to evaluate learning, and post-training to assess bicycle use and knowledge retention or skill degradation from disuse. Overall such technologies can help promote safety, independence, self-efficacy and overall healthier lifestyle among children with and without CI.

INTRODUCTION

Active transportation is any self-propelled, human-powered mode of transportation, such as walking or bicycling. Bicycling in particular can significantly expand independent mobility for both adults and children. In the US, cycling is a popular mode of independent transportation and recreation among children (Richmond, 2014). However, bicycling safety is a reason of significant concern. The Centers for Disease Control (CDC) estimates that in the year of 2013, 215,751 children between the ages of 05- and 19-years old were injured by cycling pedal related accidents (71% male), and 114 died (89% male) (CDC, 2016). Currently in the US, best cycling practices (e.g., Kimmel & Nagel, 1990; NHTSA, 2013; Lachapelle et al., 2013) have been incorporated into bicycle training programs that instruct children in increasing their knowledge and awareness of safe cycling and thereby decrease the risk of crashes, injuries, and accidents in general (Kimmel & Nagel, 1990).

The lack of proper bicycling infrastructure is also a known contributing factor to crashes, injuries, and death, in adults and children (Hooshmond et al. 2014; Lachapelle et al., 2013). Bicycling within the communities can is perceived as unsafe due to heavy traffic and a scarcity of sidewalks, crosswalks, and bicycle facilities (Winters et al, 2010). These factors emphasize the need for inculcating safe bicycling practices as a way to encourage safety behavior, injury prevention, and minimization of health concerns involving children and young adults (Lachapelle et al., 2013; Hooshmond et al., 2014; Richmond et al., 2014).

Bicyclists with Cognitive Impairment

The task of cycling places unique demands on physical strength and cognitive discernment. However, no predetermined boundaries on physical or cognitive capabilities exist that preclude individuals with CI from learning to ride bicycles. Limitations from CI may be manifested in a persons' communication, socialization, attention, memory, focus, logical thinking, dynamic balance and other higher level cognitive functions. The consensus is that people with cognitive impairment generally take longer to learn, but do eventually succeed in learning it (Michigan Government, n.d., National Dissemination Center for Children with Disabilities, 2011). Medical conditions, either congenital or adventitious result in cognitive or impairments affects more than 6.5 million people in the US (MDE, n.d.). Active transportation modes such as walking, bicycling, and public transit use can greatly increase the level of the mobility, independence and community participant in this cohort.

This study aimed to identify training components in a cycle training program for children with cognitive impairments (CI) with the goal of generating requirements for potential technology interventions to support cycling skills acquisition and retention.

METHODS

The study used a multi-method approach comprising: (1) Literature review on cycling training and cycling performance assessments in children with and without CI, (2) Semi-structured interviews with cycling trainers specialized in active transportation training of children and young adults with CI, (3) Observations of training program development, and (4) Document analysis of cycle training logs. Four cycling trainers working at a local organization specializing in active transportation were recruited to participate in the study. This phase of the research did not involve participation of individuals with CI. The University's Institutional Review Board approved the study.

RESULTS

1) Literature Review

Review of prior research focused on identifying studies of cycling training programs in children with CI and examining potential differences in cycle training programs in children with vs. without CI. A search on indexed research databases (including ISI Web of Science, PsycINFO, PUBMed, RESNA Journal, and TRID) using combinations of search terms as "travel training", "cognitive impairment", "intellectual disability", "cycle training", "cycling" yielded 12 articles related to either bicycle training or learning in children with CI, but not related to cycle training in children with CI. Six of the 12 papers described survey evaluations conducted pre- and post- cycle training with at most one week after the end of the training. Two papers related to long-term evaluation reported significant retention of knowledge acquired from cycling training programs in children up to five months (Ducheyne et al., 2013) and two years (Savill et al., 1996) post-training.

2) Semi-structured Interviews with Trainers

Multiple one-on-one semi-structured interview sessions (11 nos. x 30-40 mins each) with the four trainers were conducted over a two-month period that matched an on-going cycle training program at two local area schools. Interviews aimed to identify features of training program such extent of the interaction between trainers and students, capabilities and resource limitations in students and trainers, and to understand the process of evaluating and logging student-learning performance. Interviews were conducted at the organization's office premises.

Content analysis combined with findings from the literature review identified that the overall framework for cycle training sessions were the same for children with and without CI. In general, training modules and milestones were set for each student to learn how to sit on a bicycle, to be acclimated to the bicycle, adjust the seat to be in a comfortable posture. Next, the student walks the bike while seated without using the pedals, walking the bicycle in circles. This was followed by learning to glide the bicycle with their feet in the air and cruising; and finally, they will cycle in specific directions and speed. The trainers incorporated games to engage and motivate students during the training. This organization had available 15 bicycles, including an assortment of two-wheel bicycles, tricycles and tandem bikes.

Trainers also commented on the important role that parents have in deciding if the child will or will not learn how to and regularly use a bicycle. Positive instances mentioned were of parents participating in the cycling training with the children as encouragement. Other cases described parents of children with CI expressing concerns that their child would be incapable of safe or independent cycling (e.g., fear of falling, getting lost poor trip planning, and inadequate cycling infrastructure).

3) Non-participatory Observation

The lead researcher passively observed weekly meetings during the study period to document and assess trainer-to-trainer interacts (e.g., questions and discussion on program improvement), planning and organization of the following week's training activities with special attention to resource constraints such as time available, and overall goal setting for the class. Training program duration was noted to span a total of ten weeks divided in two phases with a few months in between. The first day of each phase involved understanding the training needs of the student and family, along with a subjective assessment of the student's skill level and establishing training goals. Trainers would discuss these topics during meetings comparing notes and developing a training plan for the subsequent week.

4) Documentation Analysis

During interviews, the trainers were encouraged to provide supporting documents that would help provide an understanding of the formal training process. Examples of documents shared with the research team include orientation materials, anonymized training log sheets, calendars, teaching schedules, and administrative documents. Training log sheets were particularly useful as these documents contained

notes written by the trainers such as their subjective assessment of student learning. This study analyzed thirty-five anonymized log-sheets provided by the interviewees. The log sheet template contained three blanks for trainers to list higher level training goals followed by a table with a row devoted to each training session where the trainers could write notes about the student after each session. The documentation analysis helped the researchers understand the logistics of the cycling training program, such as, how trainers divide students per instructors how trainers plan the lessons, to identify what goals do the trainers set for students, how trainers assess students' abilities and limitations, how trainers assess parental needs, and how they involve the parents in the cycling program.

Students in special education programs have different ages and educational levels ranging from high-school to post-secondary. This wide age range for students influences the number of students that can partake in the training, but usually the range is 3-4 students per trainer. The limit imposed is based on the students' needs, the greater the need of care and attention, the smaller the number of the students per site. Teaching sessions were conducted based on individual student's skills and bicycling level, assessed in the first day of training, by the trainer, by quick interviews, observation of the child motor abilities and his or her performance with a bicycle. Each session itself was based on a predefined goal or set of goals that the student wants to achieve and their proficiency at the previous session content.

Analysis of the training logs and documents identified the following goals:

- Student positioning on a bicycle (sit, feet on pedals, etc.);
- Stopping skills (smooth stop individual, in group, in certain area, use of handbrakes, etc.);
- Hold space and use of lanes (predictable space in line, follow a line, correct space on lanes when turning, etc.);
- Give signals (hand or spoken);
- Riding skills (ride predictable, straight, in line, in 8 shapes, etc.);
- Follow rules and laws (follow rules of the neighborhood, of the group, of the road);
- Ride in a group (step into a group, use a gap, follow leader, use tandem, etc.);
- Being a group leader (i.e., lead a community ride, lead a group, etc.); and,
- Building cycling endurance.

Lastly, an important component of the bicycle training program was demonstrating independence. The training program divided this trait into five levels:

1. Participant cyclist, when the student requires support from the instructor;
2. Basic skills cyclist, when the student is in the development process of bike handling skills;
3. Companion cyclist, when the student is mastering bike handling skills but still requires support of a companion;
4. Restricted independence cyclist, when the student can ride and lead; and,
5. Full independence cyclist, when the student can independently ride on selected routes in community.

DISCUSSION

This study used a combination of methods to identify training components in a cycle training program for children with cognitive impairments (CI). These relate to training period viz., contact time through more sessions, longer durations per sessions, and lower students to trainer ratio; importance of baseline cycling skills assessments to refine the training duration and goal-setting; role of parental involvement in supporting the learning process; and limited resources for long-term evaluation of knowledge retention, safety behavior and overall bicycle use. Collectively, the findings emphasize the need for multiple training sessions with adequate repetition and assessment in cycling skills and safety training.

The program considered in this study taught cycling skills in on-road conditions though without minimal traffic and correspond to features of bicycle training environments recommended by Lachapelle et al. (2013). The program also incorporated, fundamentals of bike safety such as helmet use and fit, rules of the road, behaving and riding predictable, low student to trainer ratio, longer training sessions, and active parental involvement, which reflect best practices in learning fundamental cycling skills and safe behavior (e.g., Hoohmond et al. (2014; Lachapelle et al., 2013; Macarthur et al., 1998).

Post-training knowledge retention

Prior research on cycle training provides limited information on methods to assess long-term impacts of cycling programs in children. It was also observed that neither the current organization studied nor other programs described in the literature kept track of whether students' maintained or improved in their of cycling skills and knowledge post-training.

Furthermore, multiple studies that involved three or more sessions each indicate retention in children to last for different durations post-training with at least one of showing a positive effect up to two years (e.g., Ducheyne, 2013; 2014; Hooshmond et al., 2014, and Nagel, 2003). Regarding effectiveness of bicycle training programs, Richmond et al. (2014) go as far as saying "there is no evidence to support that educational cycle interventions increase knowledge of safe cycling".

Parental involvement

The influence of parental support and attitudes on childrens' cycling skills, knowledge and safety behavior emerged as a consistent theme across trainer interviews and prior research reports on cycle training in children without impairments (e.g., Kimmel & Nagel, 1990; Lachapelle et al., 2013; Ducheyne et al., 2014). Lachapelle et al. (2013) suggest that parental mistrust or erroneous instructions toward cycling practices could result from their misunderstanding or lack of knowledge of safety behaviors; and hence both children and parents could benefit from participating in cycling programs producing a multiplicative effect. It is unclear at this time if the positive influence of parental involvement is from a proactive (i.e., how to avoid unsafe actions) or reactive (i.e., feedback after an unsafe action has occurred) mechanism or a combination of both

CONCLUSIONS

In terms of bicycle training in children, Ducheyne et al. (2014) make an important distinction between improving cycling skills and changing cycling safety behavior each requiring different approaches. Our study identified gaps in short- and long-term objective assessment of cycling skills and safety performance. Technology interventions developed to provide such objective performance assessments may be of benefit to cycling trainers and parents of children with CI towards promoting safety, independence, self-efficacy and overall healthier lifestyle among individuals with and without CI. This study observed one cycling training program with four trained staff. However, active transportation programs focusing on children with CI and with expert trainers are rare. At present, our methods were limited to studying trainers and excluded direct observations or involvement of students i.e., children with CI or their parents. Nevertheless, the study did reveal important information about training components pertinent to cycling program for children with CI, providing sufficient motivation and need for future work that might involve individuals with CI.

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