Research Methodology and Writing, Part B

Dissertation Proposal

Comparing Learning Speeds for Mouse and Trackpad in Elementary School Students with Developmental Delays

Jeanne Stork

Blue Marble University

Mouse Versus Trackpad: Speed to Learn

This study will investigate if students with moderate through severe developmental delays are able to learn more quickly to use the computer mouse or the trackpad. Schools have two primary choices when purchasing general use computer input devices – mice or trackpads (sometimes called touch pads). Trackpads are generally used on laptop computers, but some companies, such as Apple, have desktop computer models that can ship with trackpads instead of mice. The Apple iMac currently ships with either the Magic Mouse 2 or the Magic Trackpad 2 depending on the purchaser's preference (Apple, 2018, near bottom of page). The idea for this study came from two personal experiences. First, I have witnessed students with developmental delays and fine motor difficulties learn to use the trackpads on their laptop computers. Second, another teacher in my school told me that she learned to use the trackpad first and still has difficulty with the mouse. I have been told by instructional technology coaches that it is easier for students with disabilities to learn to use a computer mouse than a trackpad, but I no longer believe that a mouse is a necessity.

Literature Review

This is a preliminary literature review. I will be gathering additional information at the same time that I am running the experiment. A full literature review will be included in the final dissertation document. I was unable to locate any papers comparing the speed at which students learn to use a computer mouse versus a trackpad after visiting the university libraries at both Hunter College and New York Institute of Technology.

There has been little research comparing mouse and trackpad use. The closest article dealt with teaching adults who already knew the mouse to use a trackpad (Cakir, et al., 1995, pp. 246-247). Their research determined that there were minimal benefits for using a mouse instead

of a trackpad and that the small differences that they noted were not statistically significant.

Computer skills continue to be important in today's schools. For instance, many assessments are now taken on computers. Students need a variety of computer skills, including mouse skills and keyboarding, in order to achieve success with these assessments (Gullen, 2014). It is important for "teachers to individually assess and support students' technological skills" (Fink, 2015, p 37). Although these articles deal with computerized assessments, in my personal experience as a technology teacher, mouse and other input device skills are important in all areas of computer-based learning.

Several researchers have addressed the mechanics of teaching mouse skills. Two studies investigated teaching preschoolers with disabilities to use the mouse to move the computer screen's cursor to desired items on the screen before clicking (Shimizu & McDonough, 2006, and Shimizu, et al., 2010). Lane and Ziviani (2010) studied mouse use in children ages five to ten. These three reports agree that the mouse is an important tool for accessing the computer, but a trackpad can do almost everything that a mouse can. Like other touch devices, a trackpad cannot activate the roll-over effect that was once common in educational activities created in Adobe's Flash (formally produced by Macromedia). But with Flash winding down (Rodriguez, 2017), the trackpad is a viable input device for using educational software and educational websites.

The study that I am proposing builds on my unpublished master's thesis (Stork, 2007) where I determined that students with developmental delays due to severe autism more easily learned to use the computer when they interacted with software that was specifically designed for students with developmental disabilities than for general use software with adaptations provided by school staff members. The following passage is from that paper's literature review.

> J. B. Carroll's article *Human Cognitive Abilities: A Survey of Factor Analytic Studies* listed several characteristics of students with cognitive disabilities that make using computers difficult: "(a) language, communication, & auditory reception, (b) reasoning, idea production, & cognitive speed, (c) memory and learning, (d) visual perception, and, (e) knowledge and achievement" (as sited in Wehmeyer, Smith, Palmer, & Davis, 2004, p 8). In addition, Wehmeyer, *et al* stress that when the concepts of Universal Design are applied to technology hardware and software, scaffolding to assist learners with cognitive disabilities needs to be included, but is often left out. This assistance includes easy to operate devices, simple directions presented in "multiple modes" (spoken, print, & graphic), & "tolerance for error" (p 12). Wehmeyer, *et al* conclude by stating that teachers need to consider "student characteristics and universal design features" (p 16) when matching learners with appropriate technologies.
>
> Technology is playing an increasing role in the educational and personal successes of people with disabilities (Germann, Broida, Kaufman, Broida, & Thompson, 2001; and Langone, Clees, Rieber, & Matzko, 2003). (Stork, 2007)

Now, instead of studying two different types of educational software, I propose to study the speed at which students learn two different common computer input devices – mouse and trackpad. Although this study will specifically relate to students with disabilities, the information may be helpful to any school that is deciding whether to invest in mice or trackpads.

Hypothesis

Students in elementary school with developmental delays who have not yet learned to use the computer will demonstrate no statistically significant difference in speed with learning to control the computer using the mouse versus using the trackpad.

Method

Participants

The study will be conducted with thirty of my students with autism and/or intellectual disabilities who have not yet learned to effectively control the computer. All of the students will have participated in computer classes for a minimum of two months prior to the start of this study. The students have learned to attend to the computer activity by watching the computer screen's presentation and listening to the accompanying sounds, but they are not yet using any input devices in a functional manor. For this study, the students may use either hand; I will not interfere with ambidextrous students by insisting that they choose a dominant hand.

Setting

All of the students attend computer class in a specialized computer lab with a teacher (me) who has New York State teaching licenses in both special education and instructional technology. The students all have one computer class per week. Students are assigned individual computers with software that is appropriate for their developmental and educational levels. There is at least one teaching assistant in the room with the students and teacher. Each session will last approximately thirty-five to forty minutes.

Material

Supplies The computer lab has two computers per table (one table has one computer). The tables and chairs are adjusted to four different heights to accommodate the students' sizes. Cardboard dividers can be placed on either side of students who have difficulty focusing on their computers. The students in the mouse group will use single-button mice and mice with all of the buttons programmed as the primary (left) click. Likewise, the trackpads will all be simplified so that the students will not be confused by the whole range of multi-touch functions.

The computers are all iMacs with macOS 10.11 (El Capitan). The computers are due to be upgraded, but I do not expect that to happen until the 2019-2020 school year because some of the classroom computers are even older. If the computer lab does get updated computers, the upgrade will impact both groups equally and will not be a factor in the outcome of this study.

Software Students will use either Ablenet's Classroom Suite or www.helpkidzlearn.com (I have a HelpKidzLearn subscription). Classroom Suite is no longer produced, but it has simple cause-and-effect and mouse learning activities, so I continue to use it. Both of these start students with a simple click then progress to moving the cursor to an object on the screen before clicking. Students are free to choose the activity and do not have to remain in the same software package or website throughout the class. Both Classroom Suite and HelpKidzLearn were chosen because they have a wide variety of highly motivating activities that combine animation with music.

Research Design

This study is a School Based Action Study with an Imperfect Experimental Design. The experimental design is imperfect because I will not be using a true randomization process. The school-based designation is because the study will be conducted only at my school. As an action study, I will be able to recommend that my school and schools with similar students purchase computers with mice or trackpads (or no preference) based on experimental data instead. One advantage of School Based Action Studies is that my school does not require parental releases because my students will benefit from the data that I collect and analyze.

Procedure

The students will be randomly placed into two groups, ten students per group. One group will use computer mice and another group will use trackpads. A modified randomization method will be used to ensure that the two groups are balanced based on age. This adjustment will

eliminate age as a factor in the outcome allow for age comparisons between groups. It is possible that students learn one of the tools quicker at different ages.

All students will be given a pretest to determine baseline data in five areas: click the mouse button or trackpad, click only when needed to activate an interactive presentation (such as an animation with accompanying music), move the cursor to an item on the screen then click on the target, drag an item from one section of the screen to another (such as a virtual crayon for coloring or moving a ball into a box), and drag an item to a specified target before releasing. Students will be rated on a scale of one through four for each area using the rubric on the following page.

Difficulty	**Skill**	**1**	**2**	**3**	**4**
1	Click Mouse or Trackpad	Physical Assistance	Both Verbal and Gestural Prompting	Either Verbal or Gestural Prompting	Complete Independence
2	Click Mouse or Trackpad Only at Appropriate Times	Physical Assistance	Both Verbal and Gestural Prompting	Either Verbal or Gestural Prompting	Complete Independence
3	Move Cursor to Appropriate Target Before Clicking	Physical Assistance	Both Verbal and Gestural Prompting	Either Verbal or Gestural Prompting	Complete Independence
4	Click, Drag, then Release	Physical Assistance	Both Verbal and Gestural Prompting	Either Verbal or Gestural Prompting	Complete Independence
5	Drag target to Specified Area then Release	Physical Assistance	Both Verbal and Gestural Prompting	Either Verbal or Gestural Prompting	Complete Independence

Behavioral data will be recorded during both the pretest and the posttest to determine if one group has a greater reduction in interfering behaviors than the other group. Behaviors that interfere with learning to use the computer include looking around the room, talking to or

touching other people, talking or singing to oneself, and physical aggression. The examples in the behavioral rubric are for guidance only. Other behaviors similar to the ones listed may be present and recorded on the appropriate boxes. Along with the chart, behaviors will be noted in antidote fashion as per the school's normal routine and data collecting procedures.

	Behavior	1	2	3	4
1	**Work Avoidance**	Refuse assistance (noncompliant)	Repeatedly stop working	Consistent but partial attention to task	Remain on task
2	**Disrupt Other People**	Take supplies from other people	Scream or loudly talk – distract multiple people	Quietly talk to others – distract one or two people	Leave other people alone
3	**Aggression Toward Supplies**	Hit, bite, or (try to) break the computer, mouse, keyboard, headphones, or other supplies.	Attempt level one aggression but stop after behavioral management intervention	Interact with supplies inappropriately but not severe enough to cause damage	No aggression toward supplies
4	**Aggression Toward Other People**	Bite, hit, kick, or pinch others (leave mark or require intervention to avoid mark)	Bite, hit, kick, or pinch others (not strong enough to leave a mark)	Gently tap others, play with others' hair or clothes	No aggression toward other people
5	**Aggression Toward Self**	Bite, hit or pinch self; head-banging, (leave mark or require intervention to avoid mark)	Gently hit or pinch self, hands/arms in mouth (not strong enough to leave a mark)	Gently tap self, bite nails	No aggression toward self

Students will have over two months of direct instruction and practice with the input devices. Instruction will be provided by the computer teacher (me) and the teaching assistants (with my supervision).

A posttest will be administered using the same rubrics as the pretest to measure growth in all four experimental areas and to collect measurable behavioral data.

A simple survey will be given to the students to assess personal preferences and their opinions about the technology. These students are primarily non-readers, so the survey will be administered verbally when necessary. Pictures and familiar picture communication symbols will be used to assist non-verbal students in understanding and answering the questions.

Analysis

The mouse and track pad improvement data will be analyzed to determine if there is a statistical difference between the improvements of the two groups. The mouse group will take the control group position because that is the traditional graphical user interface input device used in computer labs. The trackpad group will thus become the experimental group. The two groups will be compared to each other and each age within each group will be compared.

The behavioral data will be analyzed to determine if one device or the other corelates with a greater reduction in interfering behaviors. This data does not directly relate to the hypothesis, but the findings may be of interest to some readers. Some people may want to base purchasing decisions in part on which device, the mouse or the trackpad, yields the greater reduction in interfering behaviors.

The student survey also does not directly relate to whether or not the hypothesis is valid, but the information gained may be of assistance to administrators and other decision-makers.

I have found and am still reviewing the statistics notes and Excel spreadsheets from my master's program. I am confident that by the time experimental phase of this project is complete I will be ready to analyze the data and present my findings.

Discussion

The discussion section is of primary importance and will provide detailed information on both the process of the study and the conclusions derived from the data analysis. The hypothesis is considered to be supported if there is no statistical difference between the two groups and null if there is a statistically significant difference between the rate in which the two groups learned their devices. No single study can prove or disprove an educational hypothesis. Possible topics might include the validity of the research process, ideas about the amount of data collected, recommendations for schools based on data and anecdotal evidence, ideas for future study, and observations from teaching assistants and classroom teachers (interviews). Conclusions will include any patterns that may be drawn from the research and why they are important to students, teachers, and schools. If it is determined that there is an age-related difference in the data, such as students of different ages learning different devices quicker, then that information will also be discussed.

Timeline

This time line will be modified as needed based on the needs of the research and mu school's schedule.

November 5, 2018 – November 9, 2018

Obtain approval from Blue Marble University to begin this study. If necessary, revise this document based on input from my dissertation adviser (Germaine Wilson) and other personnel. Set up mice and keyboards. Prepare the computer lab, staff, and students as necessary.

November 12, 2018 – November 16, 2018

Conduct device use baseline data and corresponding behavioral information.

November 19, 2018 – February 8, 2019

This time period has several projects.

1. Provide students with direct instruction on their assigned input devices.

2. Gather additional resources and complete the literature review section of the paper.

3. Organize my statistical/evaluation process so that I am ready to analyze the data, behavioral observations, and the survey by the time the instructional process is complete.

4. Choose a potential publisher and learn what their requirements are for writing and submitting a paper.

February 11, 2019 – February 15, 2019

Administer the posttest, collect concluding behavioral data, and administer the survey.

February 18, 2019 – March 15, 2019

Analyze the quantitative data (from both rubrics), organize the qualitative evidence (antidotes and interviews), and write the paper. Submit the dissertation to my advisor for review by March 15th at the latest.

March 18, 2019 – April 19, 2019

Complete revisions to my dissertation as deemed necessary by my advisor and other Blue Marble University personnel.

April 22, 2019 – April 26, 2019

Submit the paper to a publisher. I hope to submit my dissertation to a publisher on or before April 26th to allow for the necessary time that it takes to actually get published. If the revisions are completed sooner, than the article will be submitted earlier than stated here.

Before Mid-August 2019

As soon as I am a published researcher, I will complete the dissertation page of my website and include a link to my dissertation online. I have not put a date for this because it is

impossible for me to predict how long it will take for the paper to get published. I do not want to add my topic to my dissertation page before I am published because I am concerned that someone will like my idea and publish first.

References

Apple. (2018). iMac: The vision is brighter than ever. Retrieved November 6, 2018 from https://www.apple.com/imac/

Cakir, A., et al. (1995). The TrackPad -A study on user comfort and performance. *CHI '95 Conference Companion on Human Factors in Computing Systems*. New York, NY: Association for Computing Machinery. DOI 10.1145/223355.223565 Retrieved from https://dl.acm.org/citation.cfm?doid=223355.223565.

Fink, J. (2014). CC play book. *Scholastic Administrator*, 13(6), 34-37.

Germann, C., et al. (2001). Improving access using simulations of community resources. In *EN-MEDIA 2001 World Conference.* Tampere, Finland, 576-581.

Gullen, K. (2014). Are our kids ready for computerized tests? *Educational Leadership*, 71(6), 68-71.

Lane, A. E. and Ziviani, J. M. (2010). Factors influencing skilled use of the computer mouse by school-aged children. *Computers & Education*, 55, 1112–1122.

Langone, J., et al. (2003). The future of computer-based interactive technology for teaching individuals with moderate to severe disabilities: Issues relating to research and practice. *Journal of Special Education Technology*, 18(1), 5-16.

Rodriguez, S. (2017). Adobe to pull plug on Flash, ending an era. *Technology News*. Retrieved from https://www.reuters.com/article/us-adobe-systems-flash-idUSKBN1AA22R

Shimizu, H. and McDonough, C. S. (2006). Programmed instruction to teach pointing with a computer mouse in preschoolers with developmental disabilities. *Research in Developmental Disabilities*, 27,175–189.

Shimizu, H., et al. (2010). *Teaching skills to use a computer mouse in preschoolers with developmental disabilities: Shaping moving a mouse and eye–hand coordination*.

Research in Developmental Disabilities, 31, 1448–1461.

Stork, J. (2007). Teaching computer mouse skills to students with autism and developmental delays (unpublished master's thesis). New York Institute of Technology, New York, NY.

Wehmeyer, M. L., et al. (2004). Technology use by students with intellectual disabilities: An overview. *Journal of Special Education Technology,* 19(4), 7-22.