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Effect of Modifying Instructional Technology Courses
for Dyslexic Adults
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It is estimated that dyslexia affects 10% to 15% of the population (Trepocki, Druk, & Willows, 2002). Dyslexia is a lifelong disorder that impacts individuals to varying degrees. Although the translation of the term means difficulty with words, it can influence the ability to process information as applied to reading, spelling, writing, and math. In addition, dyslexics may have problems with directionality, sequencing, organizing and planning their activities, and following multi-step directions. Dyslexics are average or above average in intelligence and often excel in many fields. Dyslexia often runs in families and is related to a dysfunction in the brain (Hari, Renvall, & Tanskanen, 2001). As the characteristics of dyslexia persist into adulthood, an increasing problem is that a growing number of dyslexic adults are showing signs of difficulty in higher education technology programs (Hatcher, Snowling, & Griffiths, 2002).

These students benefit from programs designed to provide support. Schools and colleges are required to implement intervention and remediation programs for students identified as having learning disabilities, including dyslexia. Adults with dyslexia have often compensated by developing unique strategies for overcoming their difficulties. However, deficits in skills of phonological processing persist in adults and indicate a need for making accommodations in learning situations (Wilson & Lesauz, 2001). Some modifications for tests and exams include allowing more time to complete the exam, ensuring that context clues are provided, and the utilization of computers for taking tests.

Assistive technology is able to provide help for dyslexic adults. Assistive technology is any technology that has the potential to enhance the performance of a person with a disability. Although the computer is the most commonly used device

associated with assistive technology, other devices include tape recorders, word processors, spell checkers, and calculators. More complex devices such as speech synthesizers, optical character recognition systems, listening aids, and speech recognition systems are included (Raskind & Higgins, 1998).

Many studies have been focused on early identification and remediation of children with dyslexia (Raskind, M. H. & Higgins, E. L., 1999; Snowling, M. J., Defty, N., & Goulandris, N., 1996). The identification of adults and modifications and accommodations for college students have been examined in studies (Hellendoorn, J. & Ruijsenaars, W., 2000; Wilson, A. M., & Lesaux, N. K., 2001; Hari, R., Renvall, H., & Tanskanen, T., 2001). Research has identified the importance of assistive technology for dyslexics (Raskind, M. H. & Higgins, E. L., 1998). These studies mostly focus on general education programs. There is a need to explain the impact of assistive technology in technology related instructional programs for adults. Additionally, the relationship of assistive technology to the attitudes of dyslexic students in technology education programs should be explored (Raskind, M. H., & Higgins, E. L., 1998).

By examining the results of incorporating assistive technology in the design of instructional programs, the intended audience is designers of curriculum, college instructors, and trainers. The information will allow them to create more effective instruction for learners that may be dyslexic. Trainers and designers will have evidence to help them decide whether their learners will benefit from providing these additional resources.

Literature Review

Causes of Dyslexia

Dyslexia is a disorder that varies in individuals. It can be described as a discrepancy between reading ability and that predicted by age or IQ. The problems of dyslexics extend beyond the skills needed for reading. Many suffer from hearing and visual abnormalities. Balance and motor control may also be weak. Hari, Renvall, and Tanskanen (2001) searched for an answer to the problem of finding a physiological explanation for the diverse deficits in dyslexics. They questioned whether physiological differences impaired sensory functions. Nine dyslexic adults found to be slower in reading ability were studied. The participants were given visual tests that resulted in a tendency to respond to movement in the left field of vision much slower. There was a high right visual field advantage in the tests given. There was a significant difference between the dyslexic adults and the control group that had more symmetrical visual processing abilities. Hari, et al. demonstrate how this sluggish attention shifting could be an explanation for the reading difficulties faced by many dyslexics.

Speech and hearing links to dyslexia have also been studied. The problem addressed by Menell, McAnally, and Stein (1999) was whether speech perception deficits contributed to deficits in phonological awareness. The threshold of amplitude of 20 adult dyslexic participants and 20 in a control group were studied. The modulation frequency was varied for both groups while asked to read lists of words. The dyslexic participants had a significantly higher threshold for the amplitude modulation. Menell, et al. use the data collected in their argument of a deficit in auditory sensitivity in dyslexics. This could

be an explanation for the difficulties in processing faced by dyslexics by impairing their identification of speech.

A third study by Terepocki, Kruk, and Willows (2002) examined the problem of reading difficulties in dyslexics. They questioned whether children with dyslexia produce a significantly higher amount of letter reversals compared to a control group. Another question considered was what types of materials and tasks are involved in letter orientation errors. A group of ten dyslexic and ten control participants were given a variety of tests that required listening and writing. The results of these tests showed that dyslexic students may over rely on visual processes for verbal information. All three of these studies go beyond the typical explanations of dyslexia. They also have implications in the development of instruction for dyslexic students.

Assistive Technology for Dyslexics

The use of assistive technology for students with learning disabilities has recently become widespread. Raskind and Higgins (1999) described assistive technology as any technology that enables an individual with learning disabilities to compensate for specific deficits. The problem focused on in their study was reading deficiencies in dyslexics. The researchers questioned whether the use of speech recognition technology enhanced spelling and reading ability for dyslexics. Three academic tasks were given to 39 students as pretests. The students were randomly assigned to the test or the control group. After experiences with the speech recognition, midpoint and posttest scores were measured. The results indicated that the assistive technology had a positive effect on word recognition, spelling, and comprehension. The aspects of speech recognition software that were felt to have the most impact on achievement were visual and auditory

representation of text at the same time, the need to monitor the match during dictation, and practice in reading correctly spelled text.

Another form of technology was examined in a study by Dimitriadi (2001). The problem addressed in this research article was the difficulty in phonological processing faced by children with dyslexia. The question studied was whether the use of multimedia authoring tools by dyslexics would encourage them to engage in language activities and develop their authoring skills. Multimedia applications provided dyslexic learners with the ability to approach information and display their ideas in a variety of ways. By using text, sounds, video, and graphics, students with dyslexia were able to create products that go beyond purely linear, text based activities. Dimitriadi used HyperStudio with dyslexic children in 22 sessions lasting about an hour. An initial profile of reading, spelling, and math skills matched their poor school results. During the study, the students were able to develop presentations that represented a detailed writing process not evidenced before. In addition, their spelling patterns improved. This study was limited by including only two participants and by not providing a detailed analysis of the data.

Adult Dyslexics

Much attention has been given to the study of children with dyslexia. Adults are less often a focus of research. Few studies have investigated the adult reading abilities, habits, attitudes, and experiences of successful adults with dyslexia. This was the problem stated in a study by Fink (1998). The questions addressed in the qualitative study were whether different teaching approaches, assistive technology, or positive attitudes ensured more successful adults. The participants were also asked to explain methods used for compensating for their disability. The participants were 60 adults in middle to high

socioeconomic range. The instruments used were clinical interviews, questionnaires, and five literacy tests. Difficulties with phonological and decoding skills were still present in the dyslexics, but those that had been able to compensate scored at the highest levels of comprehension tests. The study offers suggestions for ways these adults were able to compensate.

In a contrasting study, Wilson and Lesaux (2001) focused on the problem of persistent difficulties in reading for college students. The questions they discussed in their study were which aspects of phonological processing persist into adulthood and with what severity. The researchers also questioned which aspects of phonological processing may be most detrimental to success in reading in college students with dyslexia. The process included 28 dyslexic students that identified themselves as having severe reading disabilities. All of these participants continued to have reading problems. Wilson and Lesaux stated that it is a fallacy to think that adults can compensate for their dyslexia and become good readers. They felt that studies like that of Fink failed to use tests that measure phonological processing and response time measures to indicate true reading ability.

A qualitative study of adults with dyslexia by Hellendoorn and Ruijssenaars (2000) focused on the problems that more and more adults face as they participate in adult education where remediation is found to have little effect. The research questions addressed issues such as how the participants view their disability, their attitude towards technology, and how it was addressed and diagnosed during their lifetime. The 27 dyslexic participants were interviewed and the results were converted to nominal or ordinal scales. The study text included lengthy accounts of the interviews along with

quantitative results. Although many of the participants received assistance with reading and writing, they were provided with little socioemotional assistance. Most felt that they could have benefited from therapy from someone familiar with dyslexia.

Concluding Statement

The major results and findings from these studies reflect three themes. First, the causes of dyslexia covered emphasize the variety of difficulties faced by dyslexics. The disability was not limited to reading alone. Second, the results demonstrated that assistive technology could be effective in assisting dyslexics. Adults with dyslexia continue to have difficulties and need support. Third, when instructional designers are creating instruction for adults, there is a possibility that some of their learners suffer from dyslexia. The variety of weaknesses should be considered in the instructional design and the use of assistive technology should also be included in the design. A study of the merits of preparing instruction with these accommodations in mind would provide the designer with direction to create instruction that would be more inclusive. The results of these studies address the problems faced by dyslexics and suggested accommodations in general education. They do not address the impact of assistive technology in instructional technology courses. Assistive technology should have an effect on the attitudes and the success of adult students participating in instructional technology courses.

Specifying a Purpose and Research Questions or Hypotheses

Statement of Purpose

The purpose of this study is to relate the use of assistive technology to scores on Microsoft Certification exams and an attitude survey taken in technology courses by dyslexic college students at a northeast Florida junior college.

Research Questions

1. How do dyslexic students provided with assistive technology compare to dyslexic students not provided with assistive technology on their scores on Microsoft Certification exams and in attitude surveys administered in technology courses?
2. How will the scores of the attitude surveys taken by dyslexic students at the beginning of course compare to their scores at the end of the course?

Null Hypothesis

There is no difference between dyslexic students that have the use of assistive technology and dyslexic students that are not provided with assistive technology in performance on Microsoft Certification exams and attitude surveys in college technology courses.

Alternative Hypothesis

Dyslexic students that are provided with assistive technology in college technology courses will score higher on Microsoft Certification exams and on attitude surveys than dyslexic students that are not provided assistive technology.

Method*Research Approach and Design*

The research approach for this study will be quasi-experimental with a between-group design. The impact of an intervention on an outcome will be investigated between an experimental and a control group. The students will be given a screening test for dyslexia and an attitude test at the beginning of the course. At the end of the course, students will complete a similar attitude survey and take the Microsoft exam. The experimental group will use assistive technology as the intervention during the entire

course of the class. The other class, as the control group, will not have access to these resources. The classes will be randomly selected, but it will not be possible to randomly assign students to the classes. The study will be limited to two classes participating in the course at the same time in order to control for extraneous factors such as having the same instructor. The study will extend over three semesters to help ensure an adequate number of participants for study. Threats to validity include mortality and selection. Students will be sure to drop out of the course over the term of the semester and there is a possibility that one class happens to have brighter students in it. These issues will have to be addressed in the data analysis.

Research Setting

The research setting is a northeast Florida community college. As the teacher of both classes, access will be requested and the permissions sought by the researcher. The equipment and software needed to provide the assistive technology has been supplied through a grant and the school is interested in comparing its use to classes not using the assistive technology. The classes are for certification in Microsoft Office. One class meets on Tuesday night and the other meets on Thursday night. They are both scheduled for the same time period each evening.

Participants and Sampling

There will be 23 to 25 students enrolled in the evening classes and they typically work during the day. Some of the students are recent high school graduates, while some are older students. Current classes have a wide distribution of ages and the male to female ratio is 5:4. The students sign up for the classes based on their own convenience. The study will extend over three semesters to include three experimental classes and three

control groups. The counseling center at the campus estimates that 10% to 15% of the students on campus may have dyslexic tendencies. This would mean a possibility of two to four students in each class for each term. Based on those figures, there could be 7 to 12 participants with dyslexic tendencies over three terms in the experimental group and the same number in the control group to make a total of 14 participants. Due to the size of the sample, it will be difficult to make generalizations about the results. As a result this study will be considered a pilot study designed to draw conclusions about the potential effect of modifying instruction to include the use of assistive technology.

Instrumentation

Operational definitions of variables. The treatment variable is an independent variable that is manipulated to determine its effect on the outcome. The treatment variable in this study will be the use of assistive technology. The participants in the experimental group will be provided with assistive technology that will enable the computer to read text to them and translate their spoken words into text. Students in the experimental group will be provided with assistive technology and trained in its use.

The dependent variables will be passing the Microsoft Certification Exam and student attitudes towards computers. The Microsoft Certification Exam will be for Microsoft Office Specialist Certification at the core level. The students will be evaluated on whether they pass any one of five exams including Word, PowerPoint, Excel, Access, or Outlook. The results of the computer attitude surveys will be examined to check for individual differences between the beginning of the course and the end. Requiring the students to take the attitude test at the beginning and the end of the course has the disadvantage of the possibility of the participants' answers at the end being influenced by

the pretest. The advantage is that it provides a clearer picture of the effect of the intervention on the participants' attitudes towards technology.

Types of data needed. A screening test will be given to each participant to determine whether he or she has any indications of dyslexia. A pretest and posttest will be given to measure whether there is a difference in attitude of the participants towards technology. Students will take the Microsoft certification exam at the end of the course.

Instruments or measures. The Computer Attitude Scale will be used to determine whether there is a difference in attitude at the beginning of the course and at the end. This test, found in Appendix A, measures attitudes relating to computer anxiety, computer confidence, and computer liking (Gressard & Loyd, 1986). Participants use a Likert-type scale to indicate their level of agreement or disagreement with statements, such as "I like to use computers" or "Computers are changing the world too rapidly." A very low score (approaching 1) would indicate high alienation and anxiety about using computers, 3 is neutral, and a high score (approaching 5) indicates a favorable attitude toward their use. Reliability is described as consistency or the ability to get the same results over and over. Validity means that the test really tests what it is expected to test. The reliability and validity of the Computer Attitude Scale were examined by Loyd & Gressard (1986). A factor analysis and subscale reliability coefficients were used to determine if the three subscales were stable. The results were compared with those of other instruments and pre-tests and post-tests were used to determine how sensitive the instrument is to attitude changes. Gardner, D.G., Discenza, R., & Dukes, R.L. (1993) found the scale valid and reliable and recommended its use. Other studies have determined the reliability and validity of the scale (Jones, T., & Clarke, V. A., 1994; Nash, J. B. & Moroz, P. A., 1997).

A computerized dyslexia screening system called Lucid Adult Dyslexia Screening (LADS) will be used to identify any of those students that may have dyslexia. It measures word recognition, word construction, working memory, and reasoning. The test takes about 20 minutes to complete and the results will be printed for use in the study. There have been detailed studies of the reliability and validity of the screening instrument involving several different institutions. A link for the studies and information on purchasing LADS is found in Appendix B.

The Microsoft Certification Exams are only provided by independent testing organizations. For links to information on the exams see Appendix C.

Data Collection Procedures

The review process will be examined to ensure that procedures are followed for seeking approval for the study. An informed consent form will be signed by each participant to guarantee them protection of their rights. All of the participants will be given the attitude survey during the first week of the course. The Microsoft certification exam is given during the last week of class. Another attitude survey will be given before the exam. Permission will be requested for giving the dyslexia screening test and it will be given on a voluntary basis with emphasis on the privacy and confidentiality of the participants.

Data Analysis Techniques

The first step in analyzing the data is to score it. Each participant will be identified as to whether or not there are indications of dyslexia. Numeric scores will be assigned to each response on the attitude scale and a summed score will be used for each participant. These scores will be analyzed to obtain a general idea of the results and to

select the type of statistic to use in testing. The data will be sorted using SPSS in order to identify responses that are outside the acceptable range. In order to account for missing data, the participants should be available to attempt completion. Missing data can be accommodated for using SPSS if there is under 15% of the total data missing.

A computer file will be devised for data analysis and the statistical analysis program, SYSTAT, will be used due to its availability. To determine differences between the experimental and control group based on outcomes, the data will be statistically analyzed using *t*-tests assuming that there is a normal distribution of scores. Descriptive statistics of variability will be used to determine overall trends and to provide information on the distribution of the data.

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*Appendix A***Computer Attitudes Scale**

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Measures of Computer Anxiety:

1. Working with a computer would make me very nervous.
2. I do not feel threatened when others talk about computers. (reversed)
3. I feel aggressive and hostile toward computers.
4. It wouldn't bother me at all to take computer courses. (reversed)
5. Computers make me feel uncomfortable
6. I would feel at ease in a computer class (reversed)
7. I get a sinking feeling when I think of trying to use a computer.
8. I would feel comfortable working with a computer. (reversed)
9. Computers make me feel uneasy and confused.

Measures of Computer Confidence:

1. I am no good with computers. (reversed)
2. Generally I would feel OK about trying a new problem on the computer.
3. I don't think I would do advanced computer work. (reversed)
4. I am sure I could do work with computers.
5. I am not the type to do well with computers. (reversed)
6. I am sure I could learn a computer language.
7. I think using a computer would be very hard for me. (reversed)
8. I could get good grades in computer courses.
9. I do not think I could handle a computer course. (reversed)
10. I have a lot of self-confidence when it comes to working with computers.

Measures of Computer Liking:

1. I would like working with computers.
2. The challenge of solving problems with computers does not appeal to me. (reversed)
3. I think working with computers would be enjoyable and stimulating.
4. Figuring out computer problems does not appeal to me. (reversed)
5. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.
6. I don't understand how some people can stand so much time working with computers and seem to enjoy it (reversed).

7. Once I start to work with the computer, I would find it hard to stop.
8. I will do as little work with computers as possible. (reversed)
9. If a problem was left unresolved in a computer class, I would continue to think about it afterward.
10. I do not enjoy talking with others about computers. (reversed)

Measures of Computer Usefulness:

1. I will use computers in many ways in my life.
2. Learning about computers is a waste of time. (reversed)
3. Learning about computers is worthwhile.
4. I'll need a firm mastery of computers for my future work.
5. I expect to have little use for computers in my daily life. (reversed) .
6. I can't think of any way that I will use computers in my career. (reversed)
7. Knowing how to work with computers will increase my job possibilities.
8. Anything that a computer can be used for, I can do just as well some other way. (reversed)
9. It is important to me to do well in computer classes.
10. Working with computers will not be important to me in my life's work. (reversed)

Appendix B

Lucid Adult Dyslexia Screening (<http://www.lucid-research.com>)

[Abridged Version of the Administrator's Manual](#)

Appendix C

Microsoft Office Specialist Certification (<http://www.microsoft.com/trainert/mcp/officespecialist/requirements.asp>)

Problem Statement (80 points) Earned = 80 Total = 362

Yes	No	Implied	Elements & Idea Flow of Problem Statement
			1. Topic for study
X			Stated in title
	X		Introduced in topic sentence
	X		Included a narrative hook
X			Clearly a subject area
			2. Research problem
	X		Used marker words - The problem is
	X		Differentiated from purpose of study
X			Is a concern or issue that needs a solution
			3. Justification of problem
			Personal experience
			Workplace experience
X			Other researcher findings
			4. Deficiencies of past research
X			Not adequate addressed
X			Not sufficient evidence to prove
			5. Related to target audience
	X		Used marker words - the intended audience is...
	X		Single audience
	X		Multiple audiences
X			Indicated how investigation will help audience

Note. Table based on Creswell, pages 73-80

Literature Review (100 points) Earned = 90

Yes	No	Sometimes	Implied	Elements
	X			Introductory Statement
X				Headings in APA Format
X				Themes identified
				Study-by-study format
X				Problem
		X		Questions
		X		Data collection
X				Results/Findings
	X			Transitional sentences
				Concluding statement
X				Theme summary
X				Deficiencies
		X		Rationale for study

Note. Table based on Creswell, pages 112-121

Purpose, Questions, Hypotheses (80 points) Earned = 70**Quantitative Investigation**

Yes	No	Implied	Elements
			Purpose Statement
X			Single sentence used
X			Begins with signal words
X			Relates, compares, describes
X			Independent, Dependent, Control
X			Participants and site
			Questions
X			Question asked
X			Begins with how, what, why
X			Independent, Dependent, Control
X			Describe, Compare, Relate
		X	Participants and site
			Null hypotheses
X			Begins with no difference
X			Independent, Dependent, Control
		X	Participants and site
			Alternative hypotheses
X			Directional/nondirectional prediction
X			Independent, Dependent, Control
		X	Participants and site

Note. Table based on Creswell, pages 140-145

Qualitative Investigation

Yes	No	Implied	Elements
			Purpose Statement
			Single sentence used
			Begins with signal words & Qualitative Research design
			Central phenomenon
			Explore, discover, describe, understand
			Participants and site
			Questions
			Central question
			Begins with how, what, why
			Central phenomenon
			Participants and site
			Subquestions: issue or procedural
			Begin with how, what, why
			Central phenomenon
			Participants and site

Note. Table based on Creswell, pages 148-153

Method (100 points) Earned = 83

Yes	No	Implied	Elements
			Statement of approach or design
X			Identified qualitative or quantitative
X			Identified with a heading
X			Sufficient explanation/description
			Setting for study
	X		Access described
			Participants
X			Clear description of who & where
X			Clear description of how selected
			Instruments
X			Data needed
X			Reliability/validity evidence
X			Copy of instrument
X			Method
			Summary of data collection procedures
X			Collecting permissions
			Sampling described (quantitative)
		X	Population
X			Sample size and why
X			Sampling process
			Sampling described (qualitative)
			Sites and individuals needed
			Process of selection
			Number of sites and individuals
			Summary of data analysis (quantitative)
X			Missing data
X			Scoring procedures
X			Input procedures for analysis
		X	Descriptive statistics anticipated
	X		Statistic(s) selected
	X		Why
	X		Assumptions met
			Summary of data analysis (qualitative)
			Source of data & tools
			Organization and analysis
			Coding and developing themes
			Validating accuracy of findings

Note. Table based on Creswell, chapters 6 and 7

APA Formatting (45 points) Earned = 39