Educators: Are Web-based Resources an Effective Means for Increasing Knowledge in Higher Education?

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Abstract: Many institutions of higher education (IHEs) that prepare teachers encounter the challenge of increasing requirements of general education preservice teachers so they are properly prepared to teach all students, including those with disabilities. This study examined the impact of a Web-based resource on preservice general education teachers' knowledge regarding assistive technology in the general education classroom. A total of 99 participants enrolled in general education content courses participated in the study. Five different conditions were assessed involving various aspects of a Web-based resource as compared to traditional lecture. Results indicate that required use of a Web-based resource with a graded assignment produced the same results as traditional lecture. However, the Web-based resource as a stand-alone program was not an effective means for increasing preservice teacher knowledge of assistive technology. A Web-based resource could potentially be an efficient and effective way under specific conditions to prepare preservice teachers for diverse classrooms in the 21st century

Keywords: Online Learning, Face-to-Face Learning, Institutions of Higher Education, Assistive Technology, Preservice Teacher Learning,

Introduction

When current general education teachers graduate from preparing institutions, they will encounter a higher number of children with disabilities in general education classrooms than in previous years (U.S. Department of Education, 2006). In 1995, 45% of students with disabilities spent 80% or more of their school day in the general education classroom. By 2005, this number increased to 52% of students with disabilities spending 80% or more of their school day in the general education classroom (U.S. Department of Education, 2007). Legislation such as No Child Left Behind Act of 2001 and the re-authorization of the Individuals with Disabilities Education Improvement Act of 2004 continues to emphasize this trend by formally endorsing the education of students with disabilities in the general education classroom.

Even though the federal guidelines have been in place for several years, general education teachers often feel ill-equipped to teach students with disabilities in their classrooms (Skiba, 2006) and frequently report a perceived lack of training during their preservice years in proper interventions for students with disabilities, including modification, accommodations and assistive technology (AT; Andrews, 2002; Kamens, Loprete, & Slostad, 2003). AT has the potential to improve the functional capabilities of students with disabilities and provide a tool in the general education classroom to promote inclusion (Edyburn, Higgins, & Boone, 2005). AT holds considerable promise for students with disabilities (Derer, 1996; Dorman, 1998; Edyburn, 2000; Lewis, 1998; Zhang, 2000).

Previous research suggests one special education preservice course is sufficient to positively affect attitudes, knowledge

outcomes, and perceptions of educating students with disabilities in general education (Carroll, 2003; Cook, 2002; Kirk, 1998; Powers, 1992). Since previous research indicates one course can positively affect preservice educators' knowledge, it is reasonable to suggest more classwork around the intended topic as a solution to preservice teachers feeling as if they are unprepared to teach students with disabilities, However, some barriers involved with the solution of more courses/credits exist.

For example teacher educators identify time constraints as one of the biggest barriers in providing an effective overall class on how to educate students with disabilities in the general education classroom (LaMontagne et al., 2002). Two types of time constraints are identified: the lack of time to collaborate with members from different programs, such as those from general education and special education (LaMontagne et al., 2002) and the amount of available time a preservice teacher is enrolled at that institution. Support to collaborate among higher education faculty often is not present in the inherent organization of institutions (Duchart, Marlow, Inman, Christensen, & Reeves, 1999; Pugach, 2005) and student's time limitation is based on fulfilling the highly qualified teacher requirement specified under NCLB, which stipulates that more subject content knowledge is required of preservice teachers than in prior years (U.S. Department of Education, 2004). This creates increased competition for the attention of preservice teachers during their time at institutions of higher education (IHE; Little & Crawford, 2002).

Because of these barriers, IHEs that prepare general education teachers must incorporate, in an efficient and effective manner, the knowledge that teachers will encounter related to working with a very diverse population in their future classrooms. One potential solution to educating preservice general education teachers about methods for working with diverse students involves online instruction (OLI; i.e., a class accessed via the Internet from a location other than the traditional classroom). Previous research has shown that online instruction has aided in the preparation and retention of special education teachers (Dymond & Bentz, 2006; Knapczyk, Frey, & Wall-Marencik, 2005). Online learning is experiencing increased attention given that it provides flexibility for students to move at their own pace, students can learn from a certified institution, regardless of the student's geographic location, students can arrange course instruction to fit their own schedules, and there is less expense to an IHE once the course is created (Fisher, Deshler, & Schumaker, 1999; Schrum, 1998).

Online Learning Verses Traditional

OLI and traditional lecture, or face-to-face (F2F) classroom instruction, have been compared in a variety of studies (Andrews, 2002; Caywood & Duckett, 2003; Cornell & Martin, 1997; Gallagher, 1999; LaMontagne et al., 2002). These studies indicate no difference in achievement between students enrolled in an online course and those instructed in a traditional classroom. While this does not directly address all the constraints institutions of higher education face in preparing preservice teachers, it does provide an indication that other avenues besides traditional classroom instruction can be accessed that would be, at the very least, as effective as traditional classroom models.

In 2006, Sitzmann, Kraiger, Stewart, and Wisher completed a meta-analysis comparing OLI to F2F. The meta-analysis consisted of 96 research reports and included studies where the learning was related to job and/or academic performance. The authors concluded that Web-based instruction was more beneficial for declarative knowledge

with an "effect size of .15 indicating that, on an average…6% more effective than classroom instruction for teaching declarative knowledge" (Sitzmann et al., p. 640). These investigators also noted that declarative knowledge is represented by "how knowledge is organized and cognitive strategies for accessing…knowledge" (p. 627). In the same meta-analysis the authors concluded OLI compared to F2F instruction was equally effective for teaching procedural knowledge as defined as how to perform a task, application of knowledge and included grouping steps in more complex production (e.g. work environment; Sitzmann et al.).

Other research comparing student achievement across three different conditions F2F, OLI, or class-in-a-box (DVDs with recorded class material to be played by the demand of the student), found no significant difference in student achievement (Skylar et al., 2005). Fisher and colleagues (1999) compared the knowledge and understanding of inclusive practices of preservice teachers who were enrolled in a traditional workshop versus those who used a computer-based 'virtual' workshop. Both conditions improved participants' knowledge and understanding of inclusive practices, which suggests that virtual workshops could be another means of instructing preservice teachers. Steinweg, Davis, and Thomson (2005) compared the performance outcomes and attitude of preservice general educators enrolled in an introductory to special education course in two different formats-one a traditional 16-week course and the other as on online format. There was no difference in performance or attitude of the two groups.

In 2005, Zhao, Lei, Yan, Lai, and Tan completed a meta-analysis intending to isolate factors that make distance education effective. In their meta-analysis of 51 articles they found the amount and type of interaction students had with peers and instructors greatly influenced learning preferences of students in OLI or F2F. It also appeared that college level courses and those students with a high school diploma had learning outcomes that favored distance education, indicating that content of the class and level of the student should be factors considered when looking at the benefits of OLI or F2F (Zhao et al., 2005). The studies reported indicated that OLI has previously shown positive learning outcomes when used with certain demographics, content, and knowledge. However, OLI required a significant amount of time in both student and faculty resources due to the necessary of the duration to learn material and creation of the course.

A common practice in higher education classrooms is to have guest lectures present special topics during a traditional 16-week course (Kumar & Lightner, 2007), to provide simple informational knowledge on special topics. Guest lectures provide students with information the instructor is unable to or uncomfortable to present, and provides the opportunity for students to be exposed to a variety of information. Guest lectures in educational colleges provide an inexpensive way for IHE to prepare perservice teachers for a diverse student body, enabling them to feel better prepared.

If using OLI to inform preservice teachers' knowledge has positive outcomes, especially given the various factors such as content of the information and audience intended, could a Web-based resource have the same effect as a guest lecture in a traditional F2F situation? A Web-based resource could provide at the minimum, declarative knowledge on subject matter that general educators report they lack (i.e., information, accommodations, and adaptations; Kamens et al., 2003). Given the positive results of OLI especially for declarative knowledge and the possibilities of AT aiding students with disabilities in the general education (Derer, 1996; Dorman,

1998; Edyburn, 2000; Lewis, 1998; Zhang, 2000), it might be possible for a Web-based resource to change preservice teachers' declarative knowledge of specialized topics in the same manner as a guest lecture, however, with the convenience of OLI. This study attempted to answer the following question: Can the use of a Web-based resource compared to a traditional guest lecture be an effective means to change the knowledge about AT for preservice teachers? The curriculum at the university indicated a desire for general education preservice teachers to have information about AT; however, at the time of this investigation the university did not offer courses addressing AT. Also, a review of the syllabi for these courses and consultation with the instructor indicated there was no discussion or demonstration of AT. Hence, the participants had little prior knowledge of AT for students with disabilities.

Method

Participants

Ninety-nine undergraduate students from a large Midwestern university participated in the study. The students were enrolled in multiple sections of the institution's Teacher Education (TE) preparation program course entitled 'Teaching of Subject Matter to Diverse Learners.' This five-credit course is intended for upper-level students; no freshman or sophomores are allowed to enroll. The majority of participants identified themselves as having senior-level status in the university (96%; n = 95). Students enrolled in this course must be accepted into the teacher education program. This course consists of traditional lecture and lab time in local area schools. The course framework is situated around diverse learners and their access to the general education curriculum at the elementary level. The majority of participants also declared themselves as general education majors (90%; n = 90). In addition, a large number of participants were female (90%).

Materials

Web-based resource. The Web-based resource for this study was Resources in Special Education (RISE), originally created for interns at the same university (Okolo et al., 2006). This Website served as a resource to general education teacher interns facing the challenges of teaching students with disabilities in general education classrooms while engaged during

Table 1
Condition Description

Condition 1 (n = 20)	Condition 2 (n = 23)	Condition 3 (n = 22)	Condition 4 (n = 18)	Condition 5 (n = 16)
Web-based exposure	Web-based with non-graded assignment	Web-based with graded assignment	Lecture	Lecture with non-graded assignment
Participants were asked to view Web-based resource only.	Participants were asked to view Web-based resources and complete a non-graded assignment.	Participants were asked to view Web-based resource and complete a graded assignment.	Students received a traditional face-to-face lecture using *PowerPoint*™.	Students received a lecture and completed a non-graded assignment.

the student teaching phase of preparation. The Website included sections such as *Professional Resources*, *Frequently Asked Questions*, *Case Studies*, *Tip of the Week*, and *Classroom Tools*. The AT section under 'Classroom Tools' was updated prior to the start of the study so that it could reflect the content that was presented in the lecture conditions. In this section there was a variety of links to aid in the retrieval of the information.

The Web-based resource provided demonstrations through AT multimedia clips. When a visitor to the Website clicked on the one of three video links they could see demonstrations of OCR scanners, magnifiers, and screen readers. Also included on the Website were links to examples of AT devices primarily used for literacy activities (e.g., AlphaSmarts, Inspiration, and various commercial text-to-speech and speech-to-text software). Other links included articles geared to teachers applying AT to the classroom and AT guides. The page also contained links for state AT resource centers and national AT groups. All links that were available to visitors of the site are included in Appendix A.

Face-to-face lecture (F2F). The F2F consisted of a general overview of AT. It described the principles of AT and how AT enables students with disabilities to access the general curriculum. A *PowerPoint*™ presentation with examples of AT devices, primarily for literacy, was embedded into the presentation. These devices were the same items displayed on the web-based resource. The presentation included multimedia clips that demonstrated AT being used by students with disabilities. Again, the same multimedia clips were available on the Web-based resource. In fact, all items pictured in the *PowerPoint*™ presentation along with multimedia clips were also located on the Web-based resource. This was an effort to assure that the same topics, resources, and information were available to the entire population of participants regardless of the assigned condition. The lecture time was approximately 95 minutes in length.

Knowledge test. To evaluate the participants' knowledge, an assessment of AT was created. The same assessment was used for pre- and posttests. There were 14 questions weighted at 23 points for this assessment. The assessment consisted of two sections based on question type. Section one was comprised of declarative knowledge questions. Questions 1-8, and 12-13 were multiple-choice questions weighted at one point for each correct answer for a maximum total of 10 points. Questions 9-11 consisted of short answers; each correct short answer was worth one point. These questions required students to name a type of AT or student characteristic using AT. The maximum score for this section was seven points. The final question was made up of two case studies more qualitative in nature and requiring procedural or application knowledge. There were two different answers for each case study. Students could score a maximum of six points for the qualitative answer. This question required the student to synthesize knowledge and relate it to practical knowledge. The questions were scored using a rubric and answer key. The maximum score for the total correct was 23 points.

Included with the post-knowledge test were two questions asking about the number of times students accessed the suggested Web-based resource and the number of times they accessed any other Web-based source that provided AT information. The students were to self-report the number by circling a range of numbers indicating the frequency of visits to the site. The student could choose 0, 1-2, 3-5, 6-8, or over 9 times visiting a site (see Appendix B for copy of the knowledge test).

Assignment. Students in three of the five conditions received an assignment as part of the study. The assignment was created using

material from the Web-based resource and lecture. Six questions were created for this assignment so the participants could review information about AT. Four of the six questions were short answers and multiple-choice questions. One question asked participants to identify potential AT for students in a general education classroom. The last question asked students to describe how to implement AT in lesson plans.

Procedure

This study compared five different conditions. At the start of the fall semester an e-mail was sent to all listed instructors of the course (n = 12). The e-mail explained the study and asked the instructors to participate. Eight instructors responded to the initial e-mail; five instructors agreed to participate in the project. Students in each course section volunteered to have their data analyzed as part of the study. A total of (n = 99) students participated across the five conditions. Course sections were assigned to conditions using random assignment at the class level. The participants were included in the study if permission was received along with a pre- and post-test match. The numbers of participants along with total enrollment numbers according to the online schedule were as follows: Condition 1, 20 participants of 27 students enrolled; Condition 2, 23 participants of 25 students enrolled; Condition 3, 22 participants of 23 students enrolled; Condition 4, 18 participants of 20 students enrolled; and Condition 5, 16 participants of 23 students enrolled.

Conditions

Web exposure only condition. Condition 1 was exposure to the Web-based resource. The participants were asked to read information on the Website four times in a two-week period. Students were told that they would be tested again using the same assessment and that the answers were on the Website. During a brief presentation given by the researcher, students were provided with an orientation and presented with information from the Web-based resource. All students received a sheet of paper with the Website's URL.

Website exposure with optional assignment condition. Condition 2 consisted of students using the Web-based resource along with a short assignment outside of class. The participants were asked to view the Website approximately four times in the next two weeks to complete the assignment. The researcher told the students that the assignment would be collected at the post- test. Students were given a piece a paper with the URL; the URL was also listed at the top of the assignment.

Website exposure with required assignment condition. Condition 3 was similar to Condition 2 in that it was a Web-based condition with an assignment. The participants were to view the Website approximately four times in the next two weeks to complete the assignment, which the instructor told the students was required as part of their course grade. The researcher graded the assignment and returned it to the instructor. The URL was included on a slip of paper and placed on top of the assignment.

Traditional lecture condition. Condition 4 consisted of the traditional lecture with multimedia components given by the researcher during the class period.

Traditional lecture with optional assignment condition. Condition 5 consisted of a traditional lecture and assignment. The assignment was not part of the grade.

Research Design

All conditions were given the pre- and posttest to determine the student's knowledge

of AT before and after the intervention. Two visits to the scheduled classroom time occurred in the Web-based conditions (Conditions 1 through 3). Participation and administration of the pretest took place in the first visit. The second visit occurred two weeks later to administer the posttest. The lecture conditions (Conditions 4 and 5) received three visits during the regularly scheduled classroom time. The first visit solicited participation and administration of the pretest. The lecture occurred during the second visit. The third and final visit occurred two weeks after the lecture, when the participants took the posttest.

Scoring

Pre- and post-knowledge tests were scored blindly in the following manner. Each multiple choice and short answer questions were scored as 'correct,' 'incorrect,' 'does not know,' or 'blank.' Examples of answers that were scored as 'does not know' included responses in which students wrote, "I don't know" next to a question or placed a question mark. Questions left blank were coded as 'blank.' The maximum score for correct answers for the short answer and multiple choice questions was 17.

The last questions contained two case studies that required two different qualitative responses. Participants read details about a student in a general education classroom who might benefit from AT. After reading the details, participants were asked to name a device that could support the student and why they would choose this device. The researcher reviewed the answers and developed a response rubric based on the answers. Based on accuracy, the two responses could receive a score of '1,' '2,' '3,' 'not answered,' or 'does not know' for each question for maximum total of six points. Participants were awarded one point if they could name an AT device but provided no other information or offered incorrect information. Participants naming an AT and describing its function accurately received two points. If a participant named an AT and addressed its function but did not explain why he or she chose that technology or if the technology was not appropriate for the student they also received two points. Participants received three points by naming the AT, knowing how the AT worked, and why it was appropriate for the student. Questions left blank were coded as such and questions with an "I don't know" or question mark were coded as not known by the participant and therefore did not receive any points.

A second rater, who is a certified general education teacher working at a middle school, scored 25% of the assessments to determine inter-rater reliability. The researcher trained the second rater on the expected content of the assessment. There were no disagreements on the multiple choice questions. For the last question, the initial inter-rater reliability score was 86%. When disagreement occurred, the raters met for a retraining on the use of the rubric. After the retraining, the raters rescored assessments and achieved 96% agreement. The researcher independently completed the remaining assessments.

Data analysis. An ANOVA was used to determine if there were significant differences among the conditions in the pretest scores. Running comparisons using the pretest as the dependent variable and condition as a factor (to test if the pretest had a significant difference among the conditions) yielded no statistical significant difference among condition means.

An ANCOVA was then utilized with the pretest as the covariate. A power analysis showed that this model had sufficient power .995 ($F_{(5,\ 93)} = 6.8,\ p = .00$) to detect a difference at the .05 level according to the test between subject effects. After running the

Table 2
Mean Scores and Standard Deviations on Pre- and Post-Knowledge Test and Question Type

Condition	Pre- *M* (*SD*)	Post- *M* (*SD*)	Pre-Declarative *M* (*SD*)	Post-Declarative *M* (*SD*)	Pre-Procedural *M* (*SD*)	Post-Procedural *M* (*SD*)
Web-based only (C1)	6.7 (2.6)	10.1 (1.8)	6.0 (2.2)	9.2 (2.1)	1.2 (.93)	2.7 (1.1)
Web-based, non-graded assignment (C2)	6.3 (1.7)	8.7 (2.6)	5.4 (1.3)	7.6 (2.4)	1.0 (.82)	1.9 (.94)
Web-based, graded assignment (C3)	6.0 (2.0)	11.2 (2.4)	5.3 (1.8)	10.0 (2.5)	2.0 (1.1)	3.1 (1.4)
Lecture only (C4)	5.2 (1.7)	12.0 (3.0)	4.6 (1.7)	10.9 (2.9)	2.3 (1.8)	3.3 (1.4)
Lecture with assignment (C5)	6.3 (1.8)	12.7 (2.4)	5.3 (1.7)	11.5 (2.9)	1.5 (.71)	3.8 (1.1)

Comparison by question type.

ANCOVA, a pairwise comparison using Bonferroni adjustment was utilized. This was model was significant $F_{(4, 93)} = 8.4$. $p = .00$, with an observed power of .998. There were three different scores to consider: the score of the entire assessment, the score of the short answer and multiple-choice questions, and the score of the case study questions for three separate analyses. Pretest and posttest means and the mean gains are listed in Table 2.

Applying comparisons by two types of questions (declarative knowledge and procedural knowledge) was utilized for analysis. An ANCOVA was used on basic recall questions; a perfect score was 17 points. A power analysis showed that this model had sufficient power .995 ($F_{(5, 93)} = 6.2$, $p = .00$) to detect a difference at the .05 level according to the test between subject effects. After running the ANCOVA a pairwise comparison using Bonferroni adjustment was utilized. This was model was significant, $F_{(4, 93)} = 7.7$. $p = .00$, with an observed power of .997. There were significant differences in the adjusted means between conditions two, and, three, four, and five.

Results for total questions. The first ANCOVA examined the total results from the pre- and posttests. The independent variable was the condition; the dependent variable was the posttest score with the covariate being the pretest. A significant main effect was found for condition, $F_{(5, 93)} = 6.8$, $p = .00$, $\beta = .995$. Pairwise comparisons were used to determine differences among the five conditions. The Web-based condition with an optional assignment (C2) was significantly different from the Web-based assignment with required assignment condition (C3; $p = .01$), lecture-only condition (C4; $p = .00$), and lecture with assignment condition (C5; $p = .00$). C5 showed a significant difference compared to C1 and C2.

Comparison by question type. Differences were examined across question types. There were two types of questions. An ANCOVA was performed on the basic recall questions consisting of short answer and multiple choice and revealed a significant main effect for condition, $F_{(5, 93)} = 6.2$, $p = .00$, $\beta = .995$. Results for the basic recall questions were as follows: C2 < C3, C4, and C5 ($p = .02, .00, .00$) and C5 > C2 ($p = .00$). These results were similar to the overall ANCOVA. The only change is that C1 was no longer considered significantly different from C5.

The last question type was an open-ended question requiring synthesis of knowledge. These were the case study questions and required application of knowledge; these questions had a potential score of six points. The ANCOVA revealed a significant main effect for condition, $F_{(5, 48)} = 5$, $p = .00$, $\beta = .973$. The results for the pairwise analysis for this question were as follows: C5 > C2 ($p = .01$). The only significant differences that occurred in the procedural questions were between the lecture with a non-graded assignment and Web-based with a non-graded assignment.

A note of interest for the case study questions is the number of students that left part of the questions blank or answered "I don't know" in the pretest. This data indicates that 43% of the participants did not attempt to answer the question or stated they did not know the answer. The participants during the posttest attempted the last question at a much higher rate; only 9% left the question blank or wrote that they did not know the answer.

Self-reported time of access to site. C1 participants ($n = 20$) self-reported that 20% ($n = 4$) never accessed the Web-based resource; 30% ($n = 6$) accessed the Web-based resource 1-2 times; and 50% ($n = 10$) accessed the Web-based resource 3-5 times during the two-week period. C2 participants reported accessing the Web-based resource at least 1 to 2 times (39%, $n = 9$), and more than half accessed the Web-based resource 3 to 5 times (52%, $n = 12$). Only 9% ($n = 2$) accessed the resource 6-8 times during the two-week period. Condition 3 participants reported 9% of the students ($n = 2$) accessing the Web-based resource 1-2 times, 73% ($n = 16$) accessing 3-5 times, and 18% ($n = 4$) accessing the resource 6-8 times. Condition 4 participants reported 83% of the students ($n = 15$) accessing the Web-based resource 1-2 times, 17% ($n = 3$) accessing 3-5 times. In condition 5, 86% ($n = 14$) participants accessed the Web-based resource 1- 2 times, 13% of the students accessed the site 3 to 5 times ($n = 2$).

Discussion

This study attempted to determine if the use of a Web-based resource can be an effective means to change preservice teachers' knowledge about AT compared to a traditional classroom guest lecture as measured by an AT assessment. This study also discovered that overall AT knowledge by general education preservice teachers is generally low. The data suggest that a Web-based resource can be as effective as changing knowledge if a graded assignment is included in conjunction with a Web-based resource. The Web-based condition in which students knew they were going to receive a grade for the assignment consistently performed as well the two lecture-based conditions.

AT Knowledge

The discouraging finding is the AT knowledge demonstrated by the preservice teachers. Overall the scores of posttests ranged from 8.7 to 12.7 correct out of 23. The highest group mean at the end of the intervention was from the condition that participated in the lecture and assignment. If the posttest had been a teacher-created test, the highest mean

would have only scored 55%, which is traditionally a failing classroom grade. Although the overall AT knowledge reflected by preservice general educators is poor, gains were found in every condition. This result possibly indicates that preservice teachers have little knowledge of AT but can quickly improve their knowledge base with minimal instruction.

AT knowledge is important for general educators because it can result in skills among teachers that help students with disabilities improve their participation in a general education classroom (Edyburn, 2005). AT can enhance instruction in the classroom, provide students with access to the curriculum, allow students to work at their own pace, and improve students' engagement time (Blackhurst, 2005; Edyburn, 2000; Lewis 2005). Abner and Lahm (2002) discussed the need for teacher preparation programs and other professional development venues to increase the competence of AT for teachers so they more readily will use these devices in general education classrooms. If general educators have a working knowledge of AT it may help dispel some of the myths surrounding students with disabilities and AT that accompanies them into the classroom (Maushak, Kelley, & Blodgett, 2001). AT allows students with disabilities to participate meaningfully in the general education classroom (Dorman, 1998) as required by NCLB and IDEA. Yet, general educators possess little knowledge about AT and how to incorporate AT into the general education classroom (Ashton, 2005).

Learning Condition

Unfortunately, using a Web-based resource as a stand-alone program (C1 and C2) did not yield the same results that other online technology tools have in the past (Caywood & Duckett, 2003; LaMontagne et al., 2002). When comparing a traditional multimedia lecture using *PowerPoint*™ to a Web-based resource, the lecture with an assignment was a better learning medium as measured by the knowledge test then a Web-based resource only and the Web-based with non-graded assignment. Previous studies concluded that multimedia presentations or virtual classrooms were just as effective for content knowledge as traditional means in OLI (Skylar et al., 2005); however the same does not appear to be true for a Web-resource.

When analyzing the data by question types, it appears that questions requiring some type of synthesis of information, the delivery model is not critical; only one significant difference appeared. Again, the lecture condition with an assignment (C5) was significantly different than the Web-based resource with assignment (C2). Both the conditions had the same assignment that required some synthesizing of information; yet, on the performance on the knowledge test, those two conditions showed a significant difference.

The Web-based condition with a graded assignment contained an accountability component that no other condition used. Even the lecture-based conditions did not have a grade requirement for an assignment. A study by Scheines, Leinhardt, Smith, and Cho (2005) found that students did not utilize comprehension checks of online course material, a similar function to this study's assignment. They concluded the reason for this was that effort is exerted on those activities that contribute to their grades. It appears that if students did not feel it was directly related to their grades (such as the Web-based resource without the assignments condition) they chose not to complete an assignment/activity or did not devote the proper attention to it. However, when the instructor of that class announced to students that the assignment would be graded, the students statistically performed just as well as the lecture condition.

It seems that the graded assignment forces students to interact with the Web-based resources. This interaction possibly aids in the retention of the material. The assignment also provides students a framework or an immediate purpose to gather information from the Web-based resource to increase knowledge gains. While viewing a Web-based resource tends to be a student-initiated activity, the graded assignment provides the student motivation to view the Web-based resource.

Limitations

When the researcher visited the classroom for the posttest, some participants reported they had not accessed the Website at all during the 2-week period. This seemed especially true of Conditions 1 and 2 where there was no accountability for completion of the assignment. However, when looking at the self-reports of the amount of time students accessed the Website, Conditions 1 and 2 appear to have fairly equivalent access times with the exception that 20% of the students in Condition 1 never accessed any Website. These results bring into question the quality of engagement with online material. Simple access counts do not 'paint a picture' of how a student is interacting with the material. While the information was provided for the students, this study is limited regarding how the students actually used the resource.

A caveat in the interpretation of results of this study, in comparison to previous research, is that this study had an extremely short duration. One class period or accessing a Web-based resource during the duration of the investigation is not a comparable amount of time as in other studies. The use of the same pre- and posttest measure limits the results within the short timeframe, too. In other studies conducted, where there was no recorded difference, and a longer or more intense duration could possibly influence the outcomes (Caywood & Duckett, 2003; LaMontagne et al., 2002).

Motivation is also a key component to online learning and may arguably be a factor in this study. Cornell and Martin (1997) discussed some of the key components that can influence motivation in online learning: interaction that students have with one another and the role of an on-site facilitator. Neither of these components existed in the Web-based resource utilized in this study. Students' lack of interest and motivation to view the Web-based resource might have been affected by the lack of these components. This presents questions whether the importance of this topic should be emphasized to preservice teachers during their preparation at the university level.

Other limitations are typical of research in this genre. For example, some instructors and students chose not to participate in the research. It is unknown why certain class members and instructors did not participate in the research. The inclusion of these students could have changed the results. The volunteers were not a very diverse group, which caused limited generalization of the results.

Outcomes and Benefits

A Web-based resource has the potential to be influential in knowledge gains of preservice general educators. Regardless of condition, the scores on the posttest indicate that preservice general education teachers do not have simple knowledge of AT. These preservice educators had very little knowledge of AT; moreover, the majority of the participants were in their senior year. Information about AT and other needs concerning teaching students with disabilities will help prepare professionals who teach *all* children and prepare them for the realities they will face in classrooms when they

graduate. A Web-based resource could potentially be an efficient and effective way to prepare these teachers for diverse classrooms in the 21st century. However, based on the results of this study, a simple stand-alone Web-based resource is not an effective way to educate preservice general educators. It appears that when the intervention includes a component that will affect students' grades, such as an assignment, then the Web-based tool is just as effective as a traditional lecture.

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Appendix A - Web-based Resource: Resources In Special Education

Classroom Tools

Technology and Assistive Technology

- Michigan Assistive Technology Resources
- Assistive Technology of Michigan
- Assistive Technology Resource Guide
- Abledata
- AbilityHub
- Assistive Technology Training Online
- Assistive Technology devices by student needs

Examples of Assistive Technology Devices

- AlphaSmart
- WatchMinder
- Hal Screen Reader
- Jaws Screen Reader
- Wynn Reader
- Kurzweil
- Dragon Naturally (Comerical Voice Recognition Software)
- Windows Speech Recognition (Comerical Voice Recognition Software)
- IBM's Via Voice (Comerical Voice Recognition Software)
- Mobile Spellcheckers and Thesauruses
- Inspiration

Assistive Technology Website Resources

- Center for Applied Assistive Technology
- Project Intersect
- Assistive Technology Basics

Assistive Technology Videos

- Demonstration of a screen reader for students with visual impairments
- Demonstration of screen magnifiers
- Demonstration of electronic documents and scanners

Assistive Technology Articles

- A family's guide to assistive technology, assistive technology defined, and how to make assistive technology decisions
- Excellent article for future teachers - Assistive Technology: A Handout for Teachers How assistive technology can be applied in the classroom for students with disabilities

Appendix-B: Knowledge Test

1) Assistive Technology is defined as

a) improving capabilities of individuals with disabilities.
b) helping people stay alive or function outside of hospitals.
c) employing a combination of human and nonhuman resources to bring about more effective instruction.
d) instructional approaches systemically designed and applied in precise ways.

2) Which statement about assistive technology is <u>not</u> true?

a) The use of assistive technology is part of the student's IEP
b) With assistive technology a student can learn at their own pace.
c) An alpha smart is an expensive option for students with disabilities.
d) The district is required to pay for the AT device if it is required in an IEP for a student meeting FAPE

3) _____is a device or a program allowing a student to access print.

a) large print keyboard
b) hypermedia
c) voice recognition software
d) screen reader

4) An example of a low tech assistive technology could be

a) pencil grip
b) braile reader
c) voice recognition
d) co:writer program

5) Assistive technology also includes assistive technology services such as

a) evaluation of functional needs
b) purchase, lease, other provision for AT
c) coordination with other therapies
d) all of the above
e) none of the above

6) Which of the following is not considered assistive technology?

a) speech to text software
b) pencil grip
c) eyeglasses
d) none of the above are considered assistive technology
e) all of the above are considered assistive technology

7) Which of the follow statements is true?

a) As a teacher you have the right to decide when your student uses his/her assistive technology
b) All assistive technology is computer based.
c) As a teacher you have right to know how technology works for the student.
d) Assistive Technology is so advanced that it can replace good teaching.

8) Screen Readers or E-Readers are good for students who…

a) have low listening comprehension
b) only speak English
c) have good vision
d) have a hearing impairment
e) need to access information above their level

9) Name two of the activities in which a WatchMinder helps a student

1_____
2_____

10) What type of student could use a WatchMinder?

1_____
2_____

11) What are the benefits of an Alpha Smart?

1)_____
2)_____
3)_____

12) Which of the following is NOT a true statement about AT use by students with disabilities:

A) It is the school district's responsibility (as a public agency) to evaluate, select, acquire and train students and significant personnel in the use of AT devices
B) AT devices needed by a student in multiple environments in order to receive a free and appropriate public education (FAPE) must be provided
C) AT must be identified on a case-by-case basis
D) AT must be provided at no cost to student's parents
E) All the above are true

13) The most appropriate location for training and instruction in use of an assistive technology (AT) device is

A) A quiet area with few distracters
B) The student's home environment
C) The environment in which the device will be used
D) A training center where several therapists are available

14) What would type of assistive technology would you suggest for the following students and why?

Tory-Is a 5th grader who has been diagnosed with a mild learning disability in the area of writing. Tory is unable to spell non phonetic (irregular) words. This impedes his written expression fluency. He reads at about a whole grade level lower then his peers and has trouble with specialized vocabulary. What assistive technology would you suggest for him and why?

Danny is a 2nd grader, is a student who is considered a risk but, not yet received a special education label. He reads at grade level and he can spell well when he doesn't have to write out the words. His handwriting is illegible. His grip on the pencil is tight. What AT device would you suggest for him and why?

Approximately how many times did you access the RISE Web site? 0, 1-2, 3-5, 6-8, 9+