Effect of screen size on multimedia vocabulary learning

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Abstract
The objective of this study was to investigate the effects of three different screen sizes (small, medium and large) and two types of multimedia instruction (text only and text with pictorial annotation) on vocabulary learning. One hundred thirty-five Korean middle school students learning English as a foreign language were randomly distributed into six groups and were given a pretest, a self-study multimedia instruction, a posttest and a retention test online. The pretest, posttest and retention test were identical and included 30 vocabulary questions. Results show that the large screen multimedia instruction helped the students to learn English vocabulary more effectively than the small screen instruction as demonstrated on both the posttest and retention test. However, there was little difference in vocabulary learning between the text-only and text-with-pictorial annotation instructions. Although visual perception can be influenced by each learner’s expectations and knowledge, using a smaller screen for instruction causes more challenges for learners to perceive and comprehend vocabulary learning.

Introduction
Two-year-old Jonah watches his favourite movie, Dinosaur, on an 80-gig iPod in his living room. It is not surprising to see young children using small portable devices and even electronic toys as learning tools. Older children often view their favourite digital content (e.g., movies, TV shows, news, books) on computers, iPods, e-book readers or cell phones. Students spend hours reading emails, blogs, text messages, news and reports. They even use various digital devices to complete school projects. Moreover, many newer portable devices enable their owners to view and create digital content online. Hearther (2008) notes that ‘reading doesn’t have to involve cover-to-cover, word-for-word activity’ (p. 34). This reading trend requires educators and instructional material developers to change the way they use electronic content to teach young students. Such content often embraces text and graphics but also makes use of multimodal features including multimedia and hyperlinks (Larson, 2008). Many educators believe that all of these features should be taken into consideration when working with technology-based education.

Literature review
In this era of digital devices, mental processes are strongly related to tool-mediated activity (Vygotsky, 1986). Visual text and graphics are already popular tools in distance learning environments, where graphics are often used to represent important information and support
traditional text (Newby, Stepich, Lehman & Russell, 1996). The properties of such tools are inseparable from the cognitive information processes of the uses of the tools (Rogoff, 1990). Some researchers (Paivio, 1986; Sadoski & Paivio, 2001) believe that verbal stimuli (ie, visual text) and non-verbal stimuli (ie, graphics) are processed by the sensory systems. Other researchers have shown that higher cognitive processes occur when learners interact with verbal and nonverbal information (Mayer & Moreno, 2002; Schnotz, 2001, 2005). For example, Kim and Gilman (2008) adopted the cognitive theory of multimedia learning (CTML) from Mayer and Moreno (2002) to show that visual text (verbal) and graphics (non-verbal) enhanced the vocabulary learning performance of English as a foreign language (EFL) students better than visual text (verbal) and audio (verbal) in web-based instruction. Kim and Gilman explained that because many EFL learners are familiar with memorising new English vocabulary without knowing how the word is pronounced, audio creates an unnecessary distraction and thus requires a heavier cognitive load, as suggested by Sweller (Schnott & Kürschner, 2007; Stiller, Freitag, Zinnbauer & Freitag, 2009; Sweller & Chandler, 1994; Sweller, van Merriënboer & Paas, 1998). However, adding graphics such as pictorial annotations in multimedia instruction is not always effective. For example, Schnott, Bannert and Seufert (2002) argued that some learners paid less attention to visual text when pictures were added. Acha (2009) also found that children’s vocabulary learning performance was better when they received verbal annotations than when they received either both verbal and pictorial annotations or pictorial annotations only. From the cognitive psychology perspective, most cognition involves a mixture of bottom-up processing (stimulus–attention–perception–thought processes–decision–response or action) and top-down processing, which is ‘influenced by the individual’s expectations and knowledge rather than simply by the stimulus itself’ (Eysenck, 2001, p. 2). Although visual perception depends on the information that is presented to the eye and involves bottom-up processing, constructivist theorists emphasise the top-down process (Eysenck, 2001).

The growth of new technologies also demands a broader view of learning. In technology-enriched environments, learning occurs not only through interactive learning activities with others but also through the procedures of internalisation with the use of digital devices. Instances of learning through internalisation are illustrated by learning experiences that are shaped by computer-assisted instruction. In computer-assisted language learning, for instance, vocabulary learning has been facilitated through portable devices, the Internet and multimedia technology. Researchers have recently begun to investigate the use of various mobile technologies such as mobile phones, MP3 players and personal digital assistants for learning (Stockwell, 2007). An extensive amount of research on vocabulary learning via mobile phones has been conducted (eg, Chen, Hsieh & Kinshuk, 2008; Lu, 2008; Motiwalla, 2007). The findings of these studies suggest that mobile learning (m-learning) by means of these technologies has great potential in providing EFL learners with rich learning experiences anytime and anywhere (Lu, 2008). Cavus and Ibrahim (2009) claimed that students expressed their satisfaction and enjoyment of learning new English words with short message service text messaging through their mobile phones. These mobile devices that enhance communication and social interactions can be potential learning tools for language learners.

Rationale for the current study
Although mobile technologies that utilise wireless Internet connection could potentially make a difference in m-learning, the characteristics of small screens (eg, resolution, display size and text/image density) certainly create problematic challenges for the development of multimedia instruction. Most previous studies, which emphasised the importance of multimedia in learning, were conducted without comparing different display sizes. A few studies focusing on comparing different screen sizes have been conducted (Chen et al, 2003; Maniar, Bennett, Hand & Allan
2008; Reeves, Lang, Kim & Tatar 1999). For instance, some of the previous studies emphasising
the importance of screen size were focused mainly on the effect of screen size on user attention.
Reeves et al (1999) found that people tend to pay more attention when they receive a media
message on a large screen. Chen et al (2003) raised a similar concern about screen size; that is, a
small screen size may create problems with attention and visual perception. In a related study,
Maniar et al (2008) stated that a small screen size may be problematic for learning paper folding
through video-based instruction because the small space often displays less data at a given time
and may create difficulties for users when they use the device for complex tasks. In spite of the
interdependence of screen size and learning, there has been little investigation of the effects of
screen size on students’ vocabulary learning.

Students live in a rapidly changing and increasingly technological society where they may be
exposed to numerous types of digital instruction. Because ‘the human mind is limited in the
amount of information it can process’ (Miller, 1956, as cited by Sorden, 2005, p. 264), it is very
important that educational researchers understand the effects of different screen sizes on multi-
media vocabulary learning to reduce redundant memory load and to increase the effectiveness of
instruction. The main focus of our study was to extend Kim and Gilman’s (2008) experimental
idea with three screen sizes (small, medium and large) and two types of multimedia instruction
(text-only and text-with-pictorial annotation mode).

Method

Research questions

Our interest in investigating the effectiveness of screen size and two different instructions on
students’ vocabulary learning led to the following research questions:

1. What are the differences in vocabulary learning among students who received the small, medium and large computer screen multimedia instructions?
2. Is there a difference in vocabulary learning between the text-only and text-with-pictorial annotation mode of instruction?

Participants and materials

Five middle school classes in South Korea were recruited, yielding a sample of 135 students to
participate voluntarily in the study during July 2009. Participants were randomly assigned to one
of the six experimental groups in the study as shown in Table 1. We randomly assigned the
numbers 1–6 to the participants in order to divide them into six groups. The retention test groups
were smaller than the posttest groups because only students who took both the pretest and
posttest were analysed for retention test results.

We adopted Kim and Gilman’s (2008) instructional design with three common screen sizes (or
screen resolutions): 320 × 240 pixels (small screen; eg, iPod), 480 × 320 pixels (medium screen;
eg, smart phone) and 600 × 800 pixels (large screen; eg, Kindle). For each screen size, two
representation modes were considered as the type of multimedia instruction: visual text only and visual text and pictorial annotation.

<table>
<thead>
<tr>
<th>Screen size</th>
<th>Group</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Retention test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (320 × 240)</td>
<td>Text only</td>
<td>n = 22</td>
<td>n = 20</td>
<td>n = 16</td>
</tr>
<tr>
<td></td>
<td>Text with pictorial annotation</td>
<td>n = 22</td>
<td>n = 19</td>
<td>n = 14</td>
</tr>
<tr>
<td>Medium (480 × 320)</td>
<td>Text only</td>
<td>n = 23</td>
<td>n = 20</td>
<td>n = 15</td>
</tr>
<tr>
<td></td>
<td>Text with pictorial annotation</td>
<td>n = 20</td>
<td>n = 23</td>
<td>n = 13</td>
</tr>
<tr>
<td>Large (600 × 800)</td>
<td>Text only</td>
<td>n = 21</td>
<td>n = 21</td>
<td>n = 16</td>
</tr>
<tr>
<td></td>
<td>Text with pictorial annotation</td>
<td>n = 27</td>
<td>n = 27</td>
<td>n = 23</td>
</tr>
</tbody>
</table>
The key design of the instruction was based on the following criteria:

- The items of English vocabulary were of appropriate difficulty level for Korean students.
- Pictorial annotations supported visual text.
- Pictorial annotations were available for cueing the meaning of vocabulary items from static or animated images.
- Example sentences were available for linguistic cues.

A web-based self-instruction programme was used for student vocabulary learning. The length of each lesson was a maximum of 30 minutes, and students controlled the amount of time they spent on each instruction.

**Procedures**

The experiment was conducted via the Internet. Students were required to take a pretest, participate in multimedia instruction, take a posttest and take a retention test for the study. The 30 vocabulary questions on the pretest, posttest and retention test were identical and were delivered in the same format. The pretest was administered to the participants approximately 1 week before they received the multimedia instruction. During the following week, the students received the self-study multimedia instruction based on their assigned groups. Items of vocabulary were projected on the computer screen through the multimedia instruction. Immediately after students finished the instruction, they were asked the same questions as in the pretest. Approximately 1 week after the posttest, the retention test, which contained the same questions as the posttest, was conducted.

**Results**

The analysis that follows is guided by the two research questions listed above.

**Question 1:** What are the differences in vocabulary learning among students who received the small, medium and large computer screen multimedia instructions?

The data were analysed to evaluate the difference of the small, medium and large screen sizes regardless of multimedia presentation modes as shown in Table 2. Analysis of variance (ANOVA) was conducted to determine if differences existed among the groups on the pretest, posttest and retention test. Scores on the pretest did not differ significantly across the screen size groups on a one-way ANOVA, $F(2, 132) = 0.61$ and $p = 0.544$. However, the comparison of the three groups showed a significant group difference, both in the posttest, $F(2, 127) = 11.34$, $p < 0.001$, and in the retention test, $F(2, 94) = 5.53$, $p < 0.01$. Eta squared ($\eta^2$) was also calculated as a measure of effect size. The resulting $\eta^2$ values in the posttest and retention test were 0.15 as a large effect and 0.11 as a medium effect respectively. Tukey’s Honestly Significant Difference (HSD) test indicated that students who received the medium and large screen multimedia instructions earned higher scores than students who received the small screen instruction on the posttest and retention test. In the retention test, however, scores of students who studied content on the medium screen ($M = 14.71$) were not significantly better than those of students who studied content on the small screen ($M = 12.27$).

<table>
<thead>
<tr>
<th>Test</th>
<th>Small (screen size)</th>
<th>Medium (screen size)</th>
<th>Large (screen size)</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest (mean score)</td>
<td>8.98</td>
<td>9.95</td>
<td>9.50</td>
<td>0.61</td>
<td>0.544</td>
</tr>
<tr>
<td>Posttest (mean score)</td>
<td>16.62</td>
<td>20.95</td>
<td>23.92</td>
<td>11.34</td>
<td>0.000*</td>
</tr>
<tr>
<td>Retention test (mean score)</td>
<td>12.27</td>
<td>14.71</td>
<td>18.87</td>
<td>5.53</td>
<td>0.005*</td>
</tr>
</tbody>
</table>

*The score difference is significant at the 0.01 level.*

Question 2: Is there a difference in vocabulary learning between the text-only and text-with-pictorial annotation mode of instruction?

In order to respond to the second research question, the data were separated into ‘text-only’ and ‘text-with-pictorial annotation’ groups. Table 3 shows that the overall difference between the two groups was also not significant. In other words, the performance of the visual text-only group and the text-with-pictorial annotation group was similar. In addition, each screen size group was separated into the text-only and text-with-pictorial annotation groups. The results of a t-test also revealed that there was no significant difference in the posttest between the two groups within the same screen size (small, medium and large).

Discussion
In this study, we sought to investigate the effects of three different screen sizes and two different modes of instruction on Korean EFL students’ vocabulary learning. In sum, we identified the effects of screen size on multimedia vocabulary learning. More specifically, the mean of students who studied English vocabulary on the large screen was significantly higher than that of students who studied English vocabulary on the small screen. This difference was observed in both the posttest and retention test. Our findings also indicated that there was little difference between the text-only and text-with-pictorial annotation instruction on the same screen size.

Screen size
Our study shows that small screen instruction can be less effective in assisting Korean EFL students to learn and retain English vocabulary than large screen instruction. Figure 1 shows the cognitive process of vocabulary learning, which is modified from Mayer’s CTML (Mayer 2001, p. 59). Although providing either text only or text and pictorial annotation allows learners to select relevant information (S), organise it into coherent representations (O) and integrate it with prior knowledge (I) as meaningful learning, showing the information on a small screen may lead to increased cognitive load.

Increased cognitive load (ie, extraneous cognitive load) may occur because the small screen (groups A and B) affects students’ attention and visual perception (Chen et al, 2003; Maniar et al, 2008). This small screen effect can appear in the transition from sensory memory to working memory. For example, the small screen often shows information with limitations (ie, distortions in brightness, colour, font, and spacing between characters, lines, and words) compared to the large screen. In the cognitive process of vocabulary learning, learners must read the information closely and carefully and then try to translate it in a manner that is meaningful to them. When students receive words in visual text or pictorial annotations that ‘gorge’ means ‘to eat greedily’ on the small screen, they are easily distracted because the information with limits of the viewing screen does not have sufficient saliency and meaning to hold their attention, which may lead to perceptual errors. Moreover, spending too much time manipulating the environment itself by closely reading words or graphics on the screen may distract them from the concepts to be learned (eg, spelling and definition). Although visual perception can be

<table>
<thead>
<tr>
<th>Test</th>
<th>Text only (mean score)</th>
<th>Text with graphics (mean score)</th>
<th>t-test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest (mean score)</td>
<td>9.09</td>
<td>9.84</td>
<td>1.60</td>
<td>0.208</td>
</tr>
<tr>
<td>Posttest (mean score)</td>
<td>19.57</td>
<td>21.78</td>
<td>0.12</td>
<td>0.729</td>
</tr>
<tr>
<td>Retention test (mean score)</td>
<td>14.68</td>
<td>16.52</td>
<td>0.48</td>
<td>0.490</td>
</tr>
</tbody>
</table>
influenced by each learner’s expectations and knowledge, working memory activities can be overloaded by the limitations of the small screen before the learner gets to a series of information processing systems (e.g., thinking process, decision and response or action) that enables meaningful retention of vocabulary.

Furthermore, the small screen may create obstacles in cognitive processes for users who are accustomed to learning on a bigger computer screen. For instance, some English definitions on the screen may not be translated correctly and their meanings may be distorted for students who are habituated to scanning information quickly rather than reading word by word on bigger computer screens. The scanning activity may make it difficult to perceive and comprehend vocabulary as students try to locate information rapidly by moving their eyes on the screen. Especially in the scanning process of an unrelated piece of information, students may often make careless mistakes and have difficulty in cognitive activities. One implication from our findings is that multimedia developers should consider perceptual errors and obstacles in cognitive processes in the use of small screens to reduce unnecessary memory load and increase the effectiveness of instruction.

Our findings suggest one more interesting consideration: that the limitations of small screen may have an effect on the nature of cognitive processes in working memory of vocabulary learning. According to Vygotsky (1986), ‘the word is a direct expression of the historical nature of human consciousness’ (p. 256). In other words, consciousness can be investigated in a word. In addition, thought and language in a word are inseparable. That is, the properties of language are inseparable from the thinking processes related to the word use (Rogoff, 1990). If one assumes that vocabulary learning is a tool-mediated activity, our findings can also indicate that screen size may affect not only language learning but also thinking processes and reasoning in language learning. In the domains of vocabulary learning, a bigger screen may effectively develop students’ thinking process and reasoning because of its smaller cognitive load. Future researchers should take all components of cognitive load into consideration in assessing the outcomes of multimedia vocabulary learning. At the same time, there is a need to study how we can deal with all components to ensure a sound foundation on which to investigate thinking processes and reasoning in vocabulary learning.
Adding pictorial annotations

Adding pictorial annotations (i.e., graphics) to visual text instruction has been recognised as an effective tool to represent information, but some researchers suggest that it does not easily generalise to all educational settings (e.g., Schnotz & Kürschner, 2008; Tabbers, Martens & Merrienboer, 2004). In this study, although adding pictorial annotations increased most students’ vocabulary learning on the medium and large screen sizes compared to the small screen, our findings suggest that there is no statistically significant difference between the visual text-only and visual text-and-pictorial annotation mode on the same screen size. Our results are closely related to the view of Chanlin (1997) that ‘students who limited domain knowledge may regard graphics as excess complexities and incomprehensible information’ (Stokes, 2002, p. 12). A definition of new vocabulary in text as a signifier may be directly signified to students, whereas a graphic is indirectly signified. For example, a graphic illustrating ‘gorge’ accompanying the definition of the word may overload cognitive processes for building its meaning (‘to eat greedily’) from both indirect graphic and direct word information. It seems that the added graphics for the Korean students led to extraneous load in the cognitive processes of multimedia vocabulary learning because visual attention is split between graphics (depictive representation) and visual text (descriptive representation), which have to be integrated mentally to achieve comprehension. Our study supports that adding pictures can have a negative effect on learning when the form of visualisation used affects mental model construction in an inappropriate way (Schnotz & Kürschner, 2008). From data on 135 Spanish EFL children, Acha (2009) also found that adding pictures may generate a higher cognitive load than presenting word-only instruction in a self-paced vocabulary learning multimedia programme. While EFL students are internalising meanings of new English words, adding pictorial annotations seems to create an excessive cognitive load.

Another possible reason for the insignificant difference between the two modes is Korean students’ learning preference for visual text. Korean learners often focus on English vocabulary learning based on visual text alone in printed materials such as word lists or paired associates in which new words are presented with their translations (Kim & Gilman, 2008). As a result, many Korean students may have a higher verbal ability and lower visual ability to process information in computer-based vocabulary learning. Providing too many pictorial annotations can lead to increased cognitive load when students do not have high verbal and visual abilities (Chen et al, 2008). Furthermore, because the items in this study did not require high-order thinking processes, providing text-only instruction may be just as useful as adding pictorial annotations. Therefore, multimedia instruction developers need to be aware of cultural contexts when they add pictorial annotations because different cultures use such representations in different ways.

Limitations of the study

There are a few limitations of this study. First, this study was designed to investigate the effectiveness of screen size on a computer monitor rather than on mobile devices. Thus, the findings from this work may not be generalised to more interactive mobile learning, which can promote rich vocabulary learning experiences. However, they do provide important hypotheses for subsequent work. In addition, there are some limitations in the test instrument. The data of this study were based on repeated measurements using the same test. The results in the measurements should be interpreted with caution because of the possible familiarity of some questions to the students in the study. For instance, the students’ familiarity and recognition of words in the repeated measures design may have affected test scores and even reduced the effectiveness of graphics in the results.

Conclusion

Although many researchers have found positive student attitudes towards vocabulary learning using small mobile devices, the findings of this study indicate that a small screen size can create...
a high extraneous cognitive load regardless of different representation modes. Our results suggest that screen size should be considered in order to increase the effectiveness of multimedia instruction. One implication for teaching practice is that the content designed for a large screen size cannot be reduced to a small screen size without a change in learning effectiveness. Classroom teachers should consider the limitations of small screen size when they develop or redesign multimedia instruction by transforming current multimedia contents from a large screen to a small screen device and modify their instructional strategies as required such as by reducing the length of instruction or breaking down contents into small units. The limitations of a small screen may have an impact not only on students’ perception of vocabulary learning, but also on other aspects of vocabulary learning such as thinking processes and reasoning—a fact that both researchers and practitioners of vocabulary learning should keep in mind.

References


Chapter 18
Building an Interactive Fully-Online Degree Program

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Saint Mary-of-the-Woods College, USA

ABSTRACT
Saint Mary-of-the-Woods College (SMWC) expects to launch an interactive fully-online undergraduate degree program in 2010. This program will fill a market need not currently met at SMWC. The program is designed for an online community of learners with a format and focus that appeals to net generation (millennial), neo-millennial, and computer savvy non-traditional students, including military personnel. The General Studies in the new program will focus on seven themes of Leadership for Environmental and Social Justice and will build upon a subset of the existing General Studies. This new program will complement the Woods External Degree (WED), an existing distance education program, established in 1973, that was built on the “correspondence model.” In the new program, students will not be required to come to campus, but will become a vibrant part of the SMWC community by being empowered to explore, discover, and interact through innovative technologies.

ORGANIZATION BACKGROUND
Saint Mary-of-the-Woods College (SMWC), the oldest Catholic liberal arts college for women in the United States is located on a 67-acre campus five miles northwest of Terre Haute, Indiana. Sponsored by the Sisters of Providence, the College was founded in 1840 by Saint Mother Theodore Guerin, who was canonized by the Roman Catholic Church on October 15, 2006. The College provides three distinct academic opportunities: 1) traditional campus-based undergraduate degree programs for women, 2) distance education undergraduate degree and teacher licensure programs (Woods External Degree) for women and men, and 3) distance education graduate degree and certificate programs for women and men.

The College serves a diverse community of learners in undergraduate and graduate programs. As of Fall 2008, 271 students were enrolled on campus.
Building an Interactive Fully-Online Degree Program

and 1097 men and women (89% of whom were over the age of 26) were enrolled in the Woods External Degree (WED) program. Students can earn degrees in 39 major areas. The College is best known for its undergraduate programs in Equine Studies, Education, Business, and Pre-professional Studies. The WED program has a 35-year history of serving non-traditional adult students, and was one of the first independent-study degree programs in the nation. Today, students can earn degrees in 27 major areas through the WED program. Four of the graduate programs, Art Therapy, Earth Literacy, Music Therapy, and Pastoral Theology, enroll 116 students. The Master of Leadership Development (MLD) program enrolled its third cohort of 23 students in February 2009, and 9 additional students in a special cohort. The Master of Education (M.Ed.) program enrolled its first two cohorts totaling 20 students in 2008, with expectations of exceeding 25 students in 2009.

In addition to regional accreditation by the North Central Association of Colleges and Schools, specific programs are accredited or approved by the National Association of Schools of Music, the American Music Therapy Association, the National Council for Accreditation of Teacher Education, and the Institute for the Certification of Computer Professionals. U. S. News and Woods Online Report ranks Saint Mary-of-the-Woods College among the top 25 comprehensive colleges in the Midwest in 2009.

Setting the Stage

The College started a correspondence distance program in 1973 and delivered its first online course in 1996. SMWC currently provides different distance formats (see Table 1) available to both women and men. There are more than 2,500 distance students that have graduated or completed their programs at the College through these programs.

The MLD and M.Ed. programs were designed to be completed in one year using a hybrid-course format, with on-site-face-to-face cohort group seminars at the beginning and end of each course, an interactive webinar experience in the middle of the course, and web-based assignments/ discussions throughout the course. The term, webinar, is a combination of the terms “seminar” and “web”. In effect, a webinar describes holding a synchronous seminar over the Web. It is often used to deliver a workshop, lecture, group discussion, question/answer, and presentations.
Saint Mary-of-the-Woods College is cognizant of the fact that degree programs that are offered electronically (via the Internet) support and broaden the functions of educational institutions. Thus the College desires to respond, in a proactive manner, to such trends in higher education by (a) developing and implementing a new totally-online interactive program, and (b) incorporating online components into the existing WED program. Since there will be no residency requirement for students in the new program, SMWC strongly believes that the program will attract students that our existing programs cannot - geographically distant adult learners and computer savvy non-traditional students, and people serving in the US Military.

According to a Spring 2008 survey of approximately 400 people, conducted by the College’s Program Development Team, there is strong interest among adult learners for such a program. Focus groups, conducted by Williams Randall, Inc. on behalf of the College, also indicate that there is strong interest among targeted groups in an interactive totally-online program. The focus group that expressed the most interest in a fully-online degree program was comprised of military personnel. According to the Department of Defense (DoD), as of October 31, 2007, the United States Military had 1,419,212 active members. Of that figure, 220,908 are officers and 1,143,399 are enlisted members. As of September 30, 2006, approximately 201,575 of those military members were female. Each service member is a potential student for WED and Woods Online. Throughout the years, the need for highly educated military service members has grown immensely as technology, both military technology and non-military technology has also grown at a very rapid rate. In addition, military service members are seeking college degrees as a means of earning promotions. For example, in August 2006, the Navy implemented a new rule that as of the year 2011, all sailors must have earned at least an associate degree in order to qualify for promotion in to senior enlisted ranks. Therefore, further need is constantly created for postsecondary education programs that are well-suited to the needs of military service members (Blumenstyk, 2006). The United States Military strongly desires service members who have either a knowledge base to build upon, or the ability to learn and educate themselves. It is a win-win situation for both the military and the service member (American Council on Education, 2007).

In addition, the College is confident that the proposed program will bring about a significant increase in enrollment, especially because the program will attract new student groups. The College emphasizes that the proposed online program and the current WED program are two distinct distance education models that complement, rather than compete, with one another. However, this should not cause any significant decrease in WED enrollment, because the individualized and flexible nature of the WED program is highly suitable for a majority of adult learners who prefer to complete their education part-time. The proposed inclusion of totally online and electronic components and the removal of the on-campus residency requirement in the WED program will appeal to a larger student market. The College expects students to take advantage of both programs.

The College strongly believes that the implementation of the proposed online program will have a significantly positive impact on our existing campus and WED programs. Many of the technology-components that the proposed program will feature will gradually percolate into and strengthen the existing programs as well.

Over eighty-five percent of WED students come from Indiana and Illinois. Based on the successful foundation of serving distance students through the WED program and graduate programs, the College intends to expand its reach geographically through a new fully-online program to untapped markets, such as millennial and neo-millennial students, computer savvy non-traditional students, and those serving in the US Military.
The College formed various task forces to get us ready for the new delivery formats in both the graduate programs and the anticipated launch of Woods Online. The authors, Dr. Jennie Mitchell (Professor & Director of the Woods Online Program) and Dr. Daesang Kim (Assistant Professor & Instructional Design Specialist) were part of every task force.

Case Description

In August, 2004, President Joan Lescinski, CSJ appointed a four-member faculty team which Dr. Mitchell chaired. This team was directed to “think outside the box” in helping the College to develop new programs, new markets, and new delivery systems that would generate new sources of revenue. During the fall of 2004, the team (now called the Program Development Team) visited other colleges, did lots of research, and lots of brainstorming. In 2005, the team met with the president with a list of “top ten ideas” for increasing revenue streams. One idea was to admit men into the Women’s External Degree program. This idea was fairly controversial for the College and was debated by faculty, staff, students, the Sisters of Providence, and alumnae. Later that year, the College did approve admitting men into the WED program, and by 2009, men made up about 10% of this program in the renamed “Woods External Degree” program. The campus remains all female.

A second idea supported by Lescinski was the development of a graduate degree program. According to the SMWC Institutional Plan (2005), New Product Development, the College should “implement at least one new academic program (degree, certification, delivery model) at least every two to three years” (p.8). Once given the authority to move forward, the Program Development Team (PDT) developed the Master of Leadership Development program (MLD) in 2007 and Master of Education (M.Ed.) in 2008. The development of the proposal considered a) initial market research to assess demand; b) analysis of survey results from students, alumnae, and external participants; c) formal and informal meetings with SMWC faculty; d) formal and informal meetings with Graduate Council; e) research of distance education technologies; f) feedback from an external Advisory Committee; g) focus groups; and h) consultations with the Chief Academic Officer and President of the College. The MLD was approved by Graduate Council on October 18, 2005, received approval from the Board of Trustees and the Higher Learning Commission in 2006. The first full cohort was admitted in February 2007, and the program was profitable the first year, something rare in the first year of new programs.

One of the most significant contributions of President Lescinski was to embrace the entrepreneurial approach taken by the PDT to develop the program. Every member of the PDT took ownership; in fact, PDT faculty members were so committed to the development of the MLD, that they worked without compensation for hundreds of hours in its development. The PDT identified their service on the PDT as a way to leave a legacy to The College. The entrepreneurial approach used a business plan with seven chapters to outline new programs: 1) description and rationale; 2) the planning process; 3) human resource requirements; 4) market potential and finances; 5) physical resource requirements; 6) instructional resource requirements; and 7) appendix of evidence. The same group used this business plan model to develop the Master of Education (M.Ed.) in 2007.

Now, the College expects to launch a new interactive fully-online undergraduate degree program, Woods Online, in 2010 that empower students to explore, discover, and interact (see Figure 1). SMWC adopted a constructivist model for teaching in the Woods Online program. As adopted, the faculty anticipate to “sets up problems and monitors student exploration, guides the direction of student inquiry and promotes new patterns of thinking” through innovative online
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Woods Online is an online Bachelor’s degree program that can attract a community of online learners that we currently do not serve. It is different from both the on-campus and WED undergraduate degree programs in that it:

- is a distance mode of delivery that is entirely online
- involves a specified General Studies (GS) curriculum, consistent with the existing GS objectives and learning outcomes, that is focused on Leadership for Environmental and Social Justice
- classes are accelerated, lasting only 8-weeks
- could provide an option for accelerated degree completion

The general studies in the new program focuses on seven themes of Leadership for Environmental and Social Justice. The themes were adapted from The Earth Charter, the Universal Declaration of Human Rights, and the Themes of Catholic Social Teaching. Originally, the Program Development Team reviewed the potential for a new major, social entrepreneurship for the new program. However, after meeting with the new President, Dr. David Behrs, the PDT investigated the possibility of using existing majors to start this program. According to Behrs, “The most benefit will be where majors share a common set of core courses” (personal communication, September 25, 2007). Since the College planned to use existing majors, President Behrs asked the PDT to move the launch date to January, 2010, instead of the proposed August, 2010.

The format of the new program’s academic year includes five sessions that are eight weeks in length. This allows for a total of twelve weeks off throughout the year. Students will generally take six hours per session with an occasional eight hours to complete the program in four years. Because of a specified General Studies and pre-established electives, students will be given a clear picture of their academic journey from start to finish. Students in this program will be eligible for full-time financial aid. Transfer students will be accepted as early as August, 2010. Any major compatible with this format could be offered in the Woods Online program.

In March, 2009, preliminary conversations from a focus visit from the Higher Learning Commission of North Central Association for Colleges and Schools (the accrediting body) indicated that the College had a thorough planning process and an excellent quality assurance process; however, a few challenges remained. Some of the challenges include: technologies that support an online learn-
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Table 2. Characteristics by generations

<table>
<thead>
<tr>
<th>Description</th>
<th>Matures</th>
<th>Baby Boomers</th>
<th>Generation X</th>
<th>Net Generation</th>
<th>Current Generation Predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>Greatest generation</td>
<td>Me generation</td>
<td>Latchkey generation</td>
<td>Millennials</td>
<td>Neo-millennials</td>
</tr>
<tr>
<td>Likes</td>
<td>Command and control, self-sacrifice</td>
<td>Optimistic Workaholic</td>
<td>Independent Skeptical</td>
<td>Hopeful, Determined</td>
<td>Connected Group problem solvers</td>
</tr>
<tr>
<td>Dislikes</td>
<td>Waste Technology</td>
<td>Laziness Turning 50</td>
<td>Red tape Hype</td>
<td>Anything slow, Negativity</td>
<td>Impersonalized experiences One-size fits all</td>
</tr>
</tbody>
</table>


According to Oblinger & Oblinger (2005), each generation has unique characteristics as shown in Table 2.

The program is designed for an online community of learners with a format and focus that appeals to net generation (millennial), neo-millennial, and computer savvy non-traditional students, including military personnel. Because the program targeted a new market for SMWC, research was conducted to determine the type of I.T. support needed to support the academic and service infrastructure for a totally online degree. The PDT compiled some of the requirements for this new format from faculty. Faculty wanted to emphasize personal touch and social connection through technology (Woods Interactive Online Degree Proposal, p7) and suggested the following components:

- four-day response times from faculty for graded assignments (later reduced to three days)
- combination of independent and group assignments so students are socially connected
- opportunities for online chat rooms, lectures, and synchronous meeting online experiences
- opportunities to conduct research with faculty members
- opportunities to participate in virtual poster shows, virtual art shows, campus publications, traditional ceremonies (e.g. ring ceremony, graduation)
- opportunities for participation in specific social interactive groups using an Avatar, Second Life, or other online social engagement activities
- opportunities to participate in campus and professional organizations (perhaps through a portal)
- use of SMWC email, not other accounts (e.g. Yahoo, Gmail)
In summary, the Woods Online was developed for technology savvy students, and unreliability of technology will be a critical concern. For example, if technology is down for one week, it’s like losing one eighth of the course.

Management and Organizational Concerns

Palloff and Pratt (2001) suggested that “Not all faculty are suited for the online environment” (p. 21). Teaching in a fully-online environment is more than uploading a syllabus and creating assignments online. It requires a new teaching paradigm and recognition that the millennium student or net generation students are different. Inexperience in structuring “the way” millennials and neo-millennials think, learn and communicate will be a major concern for the new program.

In 2007, a total of twenty-nine faculty (counting the PDT and Dr. Chris Bahr, Interim VPAA) attended a faculty meeting to gain input on a launch of a new program. Twenty-two faculty provided input on the 8-week format and it represented a fairly positive response. Not all courses would need to be adapted to an online 8-week format, only those chosen for Woods Online. Eleven faculty addressed concerns related to faculty development and time issues and included:

- Need faculty time. Training is one thing, but time is critical.
- Faculty resources – design, design, design
- Inexperience in structuring “the way” millennials and neo-millennials think, learn and communicate.

As mentioned in the previous session, the college hired a marketing firm to conduct three focus groups. One of the major points made by the participants of focus groups was the quality of online courses. Dr. Mitchell observed one of the focus group sessions, without the knowledge of the group members, and was very surprised that no one in the focus group knew that SMWC had an existing distance program. Clearly, much needed to be done to prepare for the new program as well as repackage the existing WED program.

Since the College intends to increase online course offerings for its existing WED program, a student seeking a distance program could be served concurrently by both WED and Woods Online if registration calendars were coordinated. Research by Palloff & Pratt (2003) state: “Issues such as ease of registration, integration of admission functions, access to library services, and access to advising all must be addressed by the institution in order to effectively retain online students in courses and programs. When their needs are not addressed, online students can become disgruntled and withdraw” (p. 60). This is especially important if WED students perceive that Woods Online students receive preferential treatment. The College removed the WED residency requirement for most majors in September, 2008 and 45% of the students chose a non-residency registration. For such students, inclusion of the online (non-residency) registration option in the WED program provided a convenient alternative to the face-to-face on-campus residences. The College realized that there were challenges beyond just having a solid academic technology. With the online option for WED and the launch of Woods Online, the College made a concerted effort to develop the institutional infrastructure, resources and culture required of online degree programs.

CURRENT CHALLENGES FACING THE ORGANIZATION

According to (Brown, 2005), it is possible to align net generation characteristics with learning principles, learning spaces and IT applications. However, the College has several hurdles to make this new program possible. For instance, when the WED program was established in 1973, it was classified as “independent study” by the accrediting body of the College. According to
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the Assurance Section of the Higher Learning Commission report conducted in 2004, “15% of all WED courses were online, 15% were offered in alternative format (weekend classes) and 68% were considered independent study” (Hanson, Clauson, Knowlton, & Gilliland, 2005). In 2004, the College used WebCT (course management system), for the online classes, but conducted most of the coursework using email one-on-one with each student.

The College appointed a task force to review a potential replacement for online learning environment including a course management system led by Dr. Joanne Golding, SP. WebCT had been bought out by Blackboard and a change was inevitable. The task force, comprised of several faculty (including authors, Dr. Mitchell with Dr. Kim joining later) and a member of IT, reviewed several content management systems including Moodle, Angel, Blackboard, Sakai, and Desire2Learn. Golding used EduTools for preliminary research to compare: a) communication tools; b) productivity tools; c) administrative tools; d) course delivery tools; e) curriculum design; f) hardware/software; and g) pricing. Edutools is a tool developed by WCET, “a membership cooperative of institutions and organizations dedicated to advancing access and excellence in higher education through the innovate use of technology” (WCET, 2006). After several months of review, the task force selected Desire2Learn. It was the most expensive of the products reviewed but it had several features that impressed the task force.

- First, Desire2Learn was the only product (at the time) that had a competency component. This component would allow the College to conduct assessment at the major level, the department level, and college-wide. In addition, it appeared that Desire2Learn might be able to replace LiveText (accreditation management system). Education faculty used LiveText as the assessment management system but discovered that it did not work well for WED students (WED students can take up to twelve years to complete their degree).
- Second, Desire2Learn personnel had an excellent track record in responding to questions, issues, and update support.
- Third, Desire2Learn had many products in development that the task force hoped to utilize including LiveRoom, Learning Object Repository, and e-Portfolio.

The College appointed Golding to serve as the Desire2Learn faculty administrator and a member of the I.T. staff was responsible for the technical administration and server requirements (updates, issue resolution, etc.). Golding was also responsible for teaching faculty how to use Desire2Learn and took on additional duties of adding students to the Desire2Learn database. Although Desire2Learn uses IMS enterprise specification for student data, the registration integration would not work with the College’s system, CampusAnyware™ (online registration and student information services). To this day, faculty enroll students manually in any Desire2Learn course.

SMWC faculty signed up for 2007 workshops and training as the College moved from WebCT to Desire2Learn. The first year was difficult for faculty as they migrated their courses from one environment to another. Although Desire2Learn indicated this would be easy, it was not. Faculty spent more time editing existing courses, than if they had started with a blank course. Basic workshops did not include technologies that would enhance content (e.g. multimedia) or promote interactive learning experiences. One of the authors, Dr. Daesang Kim, an instructional design specialist, was hired specifically to help launch the MLD program. He provided training for the MLD faculty, templates in Desire2Learn, and an introduction to technologies that supported online instruction. This contributed to the success of the MLD program; unfortunately, it only included faculty involved in the graduate program.
In 2007, SMWC hosted its first webinar for the new graduate program, Master of Leadership Development, using Convenos (web-based conferencing tool) and Gizmo5 (peer-to-peer Internet telephony and instant messaging software application). Although Convenos worked fairly well, Gizmo was often unreliable. The College kept Convenos and an 800 number using a conference call bridge. Although current graduate programs have a “webinar” as a requirement, many of the Woods Online instructors wanted to use this technology to connect to their students in a way that is more robust than just chat. In fact, additional I.T. support staff is necessary, specifically someone that understand online program requirements. The task force and the Program Development Team supported the hiring of an additional I.T. person. Additionally, the PDT suggested a late-afternoon to night shift to stretch the hours for helpdesk, and if they had the skills, to help with a portal, run backups, system updates, and monitor the infrastructures that support all programs.

Since there will be no residency requirement for students in this program (unlike the WED program in which students are encouraged to come to the SMWC campus for short residencies), the program requires building all resources online for all students from any part of the globe including those who serve in the US Military. First, online services and services must be supported by robust software that is integrated with the existing infrastructure. For example, the College has several legacy systems that do not integrate well. The College uses CampusAnywhere™ (online registration and student information services), PowerFAIDS® (financial aid software system), Desire2Learn (course management system), and Sage MIP (fund accounting software). None of the software packages work seamlessly with the other. Second, there is a need for some semblance of a portal to support a community of learners. A web portal was suggested to support the Master of Leadership Development program (MLD), using SharePoint Services. The portal system was never successfully implemented by I.T. As an alternative, the MLD program set up a “411” course that connected all students in the cohort to announcements, discussions, etc. This was a fix, but not an optimal solution. A portal system is an essential service for online students. And, third, web pages should be designed to appeal to various markets without confusing students looking for distance education. Students will have the option of only WED or only Woods Online, or some combination of both products.

Since the College has not pursued military markets, understanding this market was a huge undertaking for SMWC. Specifically, Coltharp and others, suggested that “military pages be created for each branch of the service” (Coltharp, 2008). Creating different web pages is not an issue, but developing content for these pages requires an understanding of this audience. Did SMWC understand the needs of military students? The Military Family Research Institute in The Higher Education Landscape identified issues relevant to challenges faced by Indiana colleges. Research conducted by the Military Research Institute asked a series of questions geared to determine an organization’s military friendliness. SMWC’s plan to make degrees more accessible to service members and veterans through the development of the Woods Online program is a worthy goal, but is SMWC really military friendly? SMWC has no staff dedicated to military student support and few institutional resources to support the critical needs of veterans and service members. Furthermore, many staff and faculty in key areas were not aware of current policies that benefit military personnel or, when aware, offered conflicting information.

SOLUTIONS AND RECOMMENDATIONS

Because the Woods Online students never meet, interaction between students is a key component to
developing a community of learners. The selection of the course management system, Desire2Learn was the foundation needed to build a fully-online program. It supports interaction as well as all the necessary features you would expect in a course management system. Woods Online faculty plan to use discussion forums for individual and groups, the paging function (somewhat like instant chat), chat break-out rooms, group drop-box folders, and group lockers (space to share files). The College expects to use the competency feature to assess programs by 2012. Furthermore, Woods Online faculty plan to empower students to explore, discover, and interact through the use of (or improvement) of innovative technology, professional development, the quality review process, and resources.

Acceptance to the Woods Online program will require students to take an online education readiness course, meet established college admissions standards, and have access to technologies to complete the program.

Innovative Technology

The College kept a task force to review existing technology to support the MLD, M.Ed., and the new Woods Online program. In 2009, the College adopted Adobe® Acrobat Connect Pro (web conferencing tool) to replace Convenos to support webinar activity in all programs. Adobe® Acrobat Connect Pro web conferencing tool allows SMWC to captivate students with interactive web meetings and virtual classroom experiences. For instance, this tool allows participants to share presentations including their desktops with their web browsers and Adobe® Flash Player. In particular, Adobe® technology enables the use of rich multimedia presentations and interactivity to create a personal touch and social connection through our existing technology including Desire2Learn. The Webinar actively will be used to deliver a workshop, lecture, group discussion, question/answer, and presentations for students-to-students and students-to-instructor. In anticipation of online community of learners, the College adopted Atomic Learning™ that provides web-based software training for more than 110 of the most commonly used applications.

Course development contracts were awarded for the first ten courses in May of 2008, a year before delivery. The College required Woods Online faculty to adopt or use interactive technologies that would appeal to the net generation (millennial), neo-millennial, and computer savvy non-traditional students, including military personnel. A list of suggested technologies was included (see Figure 2), but soon faculty expressed interest in additional Web 2.0 technologies. In May 2008, the task force presented a series of workshops,

Figure 2. Change of innovative technology.
Discover the Possibilities, that incorporated many Web 2.0 technologies. This is covered in more depth in the next section.

Professional Development

Faculty who plan to teach in the Woods Online program were asked to attend training that included technology and instructional design strategies that would appeal to an online learner. In May of 2008, the College provided a ten-topic training session, entitled Discover the Possibilities that was led by experienced Desire2Learn instructors. There were Desire2Learn (an online course management system), Captivate and Camtasia (interactive presentation software), Webinars, and Podcasting. More that 50% of the faculty attended these sessions. Through this discovery of what is possible, faculty looked for ways to combine multimedia and active learning techniques. Faculty were energized by this process and looked forward to the next training sessions. Some of the key issues discussed how the role of the teacher changes when moving from a traditional campus class to hybrid courses or fully-online courses. For example, faculty often transition from an “expert” role to “guide on the side” and sometimes even a “co-learner.” After the training session, the College developed an online resource site for all faculty including adjuncts. The site is to foster and support excellence in teaching and learning at the College, to promote the sharing of resources and ideas, to provide remote access of forms and documents, and to establish a dynamic and engaged learning community among all faculties.

In May of 2009, the College again provided ten-topic training sessions with the keyword, Web 2.0. The presentation was delivered in a lab-classroom to promote participation in hand-on activities by experienced Desire2Learn instructors. The key benefit of the training was to share real examples of how faculty can combine multimedia and active learning techniques to stimulate learning, and then practice through hands-on activities. These multimedia components get and hold learners’ interest, which many researchers believe is important when teaching the new generation (Jonassen, 2000, p. 208). Providing a rich multimedia instruction will help students to “select relevant information, organize it into coherent representations, and integrate it with other knowledge” (Mayer & Moreno, 2002, p. 111) as meaningful learning (Kim & Gilman, 2008). Furthermore, distance learning courses can benefit by enriching the student’s experience with relevant multimedia and opportunities to interact with their peers. In fact, these components can create “bridges between the students’ previous knowledge actively moving them towards more complex understanding…bringing alive the theory…” (Wiesen & Stacey, 2005, p. 393).

The Quality Review Process

In the fall of 2008, the process for quality review of online courses was established and ten courses from the fully-online undergraduate degree program were reviewed by the Quality Review Committee. The Quality Review Process used at SMWC is two-phased, and is modeled on many of the lessons learned in the Quality Matters™ program (Wells, 2007). The Quality Matters™ program was funded by the U.S. Department of Education. In the Quality Matters™ project, courses were assessed in forty specific rubric items in the following “categories: 1) course overview and introduction; 2) learning objectives; 3) assessment and measurement; 4) resources and materials; 5) learning engagement; 6) course technology; 7) learner support; and 8) accessibility” (MarylandOnline, 2006). The Quality Matters™ process uses a scoring rubric and a minimum total score with specific requirements.

At SMWC, the quality review process was researched by the Quality Review Committee consisting of the Program Development Team, the Instructional Design Specialist, and the Assistant Dean. Although, the Quality Matters™
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process was reviewed and considered, the group felt that a scored approach would send the wrong signal to faculty members that were developing online courses for the new program. In addition, the committee wanted to promote interaction, a rich use of multimedia, collaboration, eight-week model content, and various other components that related to a general studies theme. Both authors are members of the Quality Review Committee and believe that by combining multimedia and active learning techniques, students are empowered to discover, explore, and interact.

Consistent with the Saint Mary-of-the-Woods College Institutional Assessment Plan, the Woods Online program will have an assessment system that incorporates ongoing, performance-based assessment of student learning based on the mission and learning outcomes of the programs. In fact, Desire2Learn is particularly helpful in collecting competency data and rubric data by student, by instructor, by course, by program, and campus-wide. All courses in the new interactive online degree program will be housed in the College content management system, Desire2Learn, and will take advantage of the robust assessment component. Specifically, assignments used for assessment must be scored with applicable rubrics and competencies. This is one of the requirements listed in the course design contracts. The Measures of Academic Proficiency and Progress standardized exam will also give information about the general studies learning of the online degree program. This exam allows comparison of freshmen and senior scores and also between peer institutions.

Resources

There have been many changes in the I.T. Department over the spring and summer of 2008, partially as a result of a technology audit that was completed by an outside firm in 2008. The firm conducted extensive interviews, reviewed materials and processes, and made several recommendations. In the summer of 2008, Michael Sims was hired as the Executive Director of the Information Technology Department. Mr. Sims brings years of experience in the I.T. industry and has made several changes. He conducted extensive meetings with the I.T. Department and various groups on campus. Within the first six weeks, he requested and received approval to purchase a 24/7 helpdesk software system. Additionally, he requested and received approval to hire a full-time Technical Support Specialist to support the 24/7 helpdesk initiative. Under his leadership, a User’s Group made up of technology power users was for M.Ed. and the first meeting was held September 10, 2008. It is the purpose of this group to see that all constituents of the College are considered when technology decisions are made. This same group will work together to streamline all technology processes to minimize software conflicts and incompatibilities. The additional I.T. support provided to the MLD and M.Ed. programs (orientation, trouble-shooting, follow-up, etc) has been of tremendous value to both students and instructors. Although staffing can be eased by using student workers, they often require supervision. In anticipation of Woods Online, an additional I.T. person was hired July 1, 2009.

The College joined the Servicemembers Opportunities Colleges (SOC) consortium in August, 2008, and completed the paperwork to become a member of Concurrent Admissions Program (ConAP) in anticipation of understanding the needs of a military market. Since the military market is new for the College, representatives from financial aid, admission, and other offices attended the Servicemembers Opportunity Colleges (SOC) Consortium Workshop in November, 2008, or attended online webinars. In May, 2009, the College joined the Yellow Ribbon GI Education Enhancement Program (Yellow Ribbon program) which allows the VA to fund tuition expenses at the highest public in-state undergraduate tuition rate and match 50% of the difference (U.S. Department of Veterans Affairs, 2009). In May
2009, SMWC received the Ball Venture Grant to develop a Virtual Academic Support Team (V.A.S.T.) to support both WED students and Woods Online students. In addition, the College has written several grants that will help SMWC develop military friendly policies.

SMWC strongly believes that to attract as well as provide excellent educational opportunities to net generation (millennial), neo-millennial, and computer savvy non-traditional students, including military personnel, it has to develop and sustain a totally different program model that is completely online, structured, and interactive. With the advent of new computer technologies and electronic tools vis-à-vis rapid rise in computer literacy of the society, learning styles of students have changed substantially. Classical instructional methods that were once effective and relevant are quickly becoming ineffective and unsuitable to the present generation of students; these students learn better by visualization and interactive/hands-on activities rather than by listening and passive comprehension of concepts. The Internet and e-mail have revolutionized how we obtain and communicate information. The College has realized that a degree program that is fully interactive and online will be the most suitable solution to attract the student groups mentioned above.

Any institution that wants to develop an online program, should adopt the entrepreneurial model and require a business plan model to include all functions of the institution. This model supports faculty and staff buy-in. Faculty and staff must invest in the program and believe in its success. Most institutions do not have seed money to start a new program that will tap new markets. Understanding the needs of students in a new market is essential for the success of the program. Competition in the online market is intense, so the College needs to spend marketing dollars wisely. SMWC has built a quality product, now it needs to attract students to it. As you can see in Figure 3, SMWC's solutions for empowering students to explore, discover, and interact in their learning.

*Figure 3. SMWC’s solutions for empowering students to explore, discover, and interact in their learning. (note: logo undergoing approval)*
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3, SMWC has built a foundation for this program on innovative technology, professional development, quality review, and resources. For this case, resources range from I.T. resources to scholarship resources for military students. SMWC continues to learn about the military market, and has written various grants in the last month to support students in a totally online environment and continues to look for resources to support faculty development including adjunct faculty.

REFERENCES


**FURTHER READING**


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KEY TERMS AND DEFINITIONS

Constructivist Model: The model of learning that concentrates on what happens during the process of learning. It identifies the central role of concepts and understandings that learners bring to new and learning and the way in which new and old ideas interact. It begins with learners using their existing frameworks of understanding to interpret what is being taught, and that these existing ideas influence the speed and effectiveness with which new ideas are learned i.e. generating knowledge and meaning from experience.

Entrepreneurial Approach: This refers to an organization being business like, forward thinking, well organized and responsive to change.

Millennial Students: These students are the largest and most diverse generation in the college or university and they are not like those students of earlier years. They have unique collective personality, thought processes, and educational tendencies. They are characterized by having lack of professional boundaries which is influenced by socialization, want to have immediate feedback, lack of critical thinking skills, unrealistic expectations, and an expected “how to” guide to succeed in and out of the classroom. They spend less time on work and have a desire for success with little effort.

Neo-Millennial Students: These are the new generation students who are online automatically and use a web that is an even more interactive, social place where they talk using programs. For example, they are familiar with Skype, software that gives them free calls around the world; with Wikis, server software that allows them to edit a web page; with Web 2.0 which is all about social interaction. They will also want to control their teaching agenda to whatever extent possible and create knowledge clusters without interacting with anyone.

Web 2.0 Technologies: These technologies refer to web development and web design that facilitates interaction information sharing, interoperability, user centered design and collaboration on the World Wide Web. Examples include web-based communities, hosted services, web applications, social networking, wikis, blog, etc.

Webinar: It is a combination of the terms “seminar” and “web” that describes holding a synchronous seminar over the Web and is often used to deliver a workshop, lecture, group discussion, question/answer, and presentations.
Effects of Text, Audio, and Graphic Aids in Multimedia Instruction for Vocabulary Learning

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ABSTRACT
This study is an investigation of the use of multimedia components such as visual text, spoken text, and graphics in a Web-based self-instruction program to increase learners’ English vocabulary learning at Myungin Middle School in Seoul, South Korea. A total of 172 middle school students (14 years of age) in five classes participated in the study. Each individual was required to complete several testing instruments such as a pretest, posttest, retention test, and attitude inventory. Participants learned better when they received “visual text and added graphics” or “visual text, added spoken text, and added graphics” instruction. Although the added multimedia components required learners to spend more time on the instruction, the extra time was not significant. The results lead one to conclude that an effective way to improve learning of English vocabulary is to offer graphics that illustrate what the vocabulary means.

Keywords
Multimedia Learning, Web-based Self-Instruction, Admissible Probability Measurement Procedures, English as a Foreign Language Vocabulary Learning

Introduction
With computer technology, Web-based learning has become a common choice in education institutions (Bauer, 2002, p. 31). Furthermore, the variety of media such as text, graphics, audio, and video for delivering content has attracted many instructors and students to use the Internet for distance education (Ali, 2003). These multimedia components get and hold learners’ interest, which many researchers believe is important when teaching the video generation (Jonassen, 2000, p. 208). Visual text and graphics are some of the most popular tools in on-line learning. In many cases, graphics can be used to represent important information and are often used for supporting text (Newby, Stepich, Lehman, & Russell, 1996, p. 103). Using these techniques, the most widely used asynchronous on-line learning tool is courses primarily posted in visual text and static graphics (Liles, 2004).

English as a Foreign Language (EFL) learners often adopt various strategies to memorize vocabulary words. For instance, vocabulary learning is often used with strategies such as word lists or paired associations in which new words are presented with their translations. These strategies often require learners to memorize pair associations directly (Sun & Dong, 2004). Meara (1996) found that many researchers in vocabulary learning studies have explored various methods of vocabulary presentation and their corresponding effectiveness in retention. Some earlier studies found the following:

• There is a limit to the number of words that can be learned at one time (Crothers & Suppes, 1967, chap. 4).
• Rote repetition appears less efficient than using spaced recall and structured review (Atkinson, 1972).
• Silent repetition and silent writing are less effective than repeating the words aloud (Meara, 1996).

Brown and Payne (Hatch & Brown, 1995, p. 383) have identified five steps to vocabulary acquisition: (a) having sources for encountering new words; (b) getting a clear image, either visual or auditory or both, of the forms of the new words; (c) learning the meaning of the words; (d) making a strong memory connection between the forms and the meanings of the words; and (e) using the words.

Recently, a number of researchers have discussed the benefits of presenting information using multimedia components such as visual text, spoken text, graphics, and videos on language learning (Al-Seghayer, 2001; Chun & Plass, 1997; Duquette & Painchaud, 1996; Ehsani & Knodt, 1998). In their studies, information presented in text,
spoken words, graphics, and video formats can be integrated to create an authentic, attractive, and multi-sensory language context for EFL learners (Sun & Dong, 2004). Kost, Foss, and Lenzini (1999) found that EFL learners performed better on both production and recognition vocabulary tests when they were allowed to use a combination of visual text and graphics.

Designing pedagogically effective multimedia instruction in language learning based on theories has been an important issue (Chapelle, 1998; Hoven, 1999; Liu, Moore, Graham, & Lee, 2002; Watts, 1997). Mayer and Moreno (2002) focused on a cognitive theory of multimedia learning which combines dual coding theory (Paivio, 1986, chap. 4; Sadoski & Paivio, 2001, chap. 3), cognitive load theory (Sweller, Van Merrienboer, & Paas, 1998), and constructivist learning theory (Novak, 1998, chap. 3; Vygotsky, 1978, chap. 6). From dual coding theory they adopted the idea that verbal stimuli and nonverbal stimuli detected by our sensory systems are processed in different systems of the brain (verbal system and nonverbal system). From cognitive load theory they adopted the idea that “humans are limited in the amount of information that they can process in each channel at one time” (Mayer, 2001, p. 44). Sweller et al. explained that redundant memory load is caused by “the presentation format of instructions extraneous load” (Tabbers, Martens, & Merrienboer, 2004, p. 72). Mayer and Moreno (2002) finally concluded that “presenting too many elements to be processed in visual or verbal working can lead to overload” (p. 111). They also took the idea from constructivist learning theory that “meaningful learning occurs when learners actively select relevant information, organize it into coherent representations, and integrate it with other knowledge” (p. 111).

Mayer and Moreno (2002) found the following interesting results:  
• Providing words with narration and animation helped learners’ performance more than words alone.  
• Reducing the number of unneeded words and sounds helped learners’ performance.  
• Providing words with narration helped learners’ performance more than on-screen text.  
• Providing words as narration and animation helped learners’ performance more than narration, animation, and on-screen text.

Reducing the amount of on-screen text makes more area available for graphics and labeled illustrations, which are necessary tools for teaching certain types of concepts. Some studies indicated that including the visual text in the illustration and labeling the illustrations improved learning (Koroghlanian & Klein, 2004).

However, as Mayer (2001) states, “all multimedia messages are not equally effective” (p. 79). For example, Mayer concluded “Schnotz, Bannert, and Seufert (in press) reported situations in which some learners reduced the amount of attention they paid to text when pictures were added” (p. 79). Tabbers et al. (2004) concluded that replacing visual text with spoken text and added graphics to the visual text both do not easily generalize to non-laboratory settings.

By better understanding the effect of individual components of multimedia, language educators will be able to design effective instruction for EFL learners. This study is an investigation of the effect of multimedia components such as visual text, spoken text, and graphics on increasing learning or decreasing redundant memory load in English vocabulary learning.

**Method**

The primary objective of this research is to study the effects of six methods of instruction in a Web-based self-instruction program: visual text (Group A), visual text and added spoken text (Group B), visual text, and added graphics (Group C), visual text, added graphics, and added spoken text (Group D), reduced visual text and added spoken text (Group E), and reduced visual text, added graphics, and added spoken text (Group F). The researchers investigated the use of multimedia components such as visual text, spoken text, and graphics in a Web-based self-instruction program to increase English vocabulary learning at Myungin Middle School (MMS) in Seoul, South Korea.

Multiple choice questions are usually used to test a student’s ability to recall information, to interpret data or diagrams, and to analyze and evaluate material. In this study, Shuford’s Admissible Probability Measurement (APM) procedure was used to reduce guessing scores on the multiple choice tests (Gilman, 1967, p. 27). Shuford claimed that APM procedures operate scoring systems with a very unique property that guarantees that any student can maximize his expected score if and only if the student honestly reflects his or her degree of belief probabilities. The
formula depends only on the probability assigned to the correct answer and not on probabilities assigned to the other incorrect alternatives (Gilman, 1967, p. 27). The score obtained from an expressed probability to a correct response (rk) is expressed as a function gk (rk) such that

\[
g_k(r_k) = \begin{cases} 
1 + \log r_k & \text{for } 0.01 < r_k \leq 1 \\
-1 & \text{for } 0.00 \leq r_k < 0.01
\end{cases}
\]

The possible scores range from minus one to plus one and are fairly related to the practice of giving the student one point for each correct answer and subtracting one point for each incorrect answer in order to discourage guessing in multiple choice testing. In other words, a value of 1 indicates that the student’s response is correct for a question and a value of -1 indicates that the student’s response is incorrect for a question. For instance, a student whose responses are all correct on a 30-item multiple choice test will receive 30 points. A student whose responses are all wrong for a 30-item multiple choice test will receive -30 points for the test.

There were two forms of response for each multiple-choice question. The first was for the response to each question (a, b, c, or d). The second required the learner to write a number from 0 to 100 to indicate how sure the student was that his or her response was correct. For instance, a student who was 100% sure that the response was correct would put “100” in the second space. If he or she was not completely sure, the second space should contain a smaller number. This number constitutes the degree of certainty score. From there, the admissible probability score is obtained by applying the formula listed above. For instance, if the student was 100% sure and his or her response was correct for a question, the admissible probability score would be 1 for the question; if the student was 0% sure that his or her response was correct for a question, the admissible probability score would be -1 for the question. If the student’s response was wrong for a question, the admissible probability score would be -1 for the question.

Research Questions

The research questions for this study were:
1. What are the differences in original learning among students who are taught under the six methods of instruction conditions as measured by raw score, mean degree of certainty estimate, and an admissible probability scoring procedure?
2. What are the differences in time to complete instruction among students who are taught under the six methods of instruction?
3. What are the differences in students’ attitude toward instruction among students who are taught under the six methods of instruction conditions as measured by their scores on the attitude inventory?

Participants

A total of 172 middle school students (14 years of age) in five classes participated in the study. The students had no previous experience with computer-assisted instruction in English vocabulary learning. All sampling procedures were random. All participants were separated into six groups, 43 students (Group A), 22 students (Group B), 34 students (Group C), 24 students (Group D), 24 students (Group E), and 25 students (Group F). The groups that used spoken text format (Group B, D, E, and F) were smaller than the non-spoken text groups (Group A and C) because many computers in the classroom did not have sound systems with headsets or speakers.

Materials

The topic of the Web-based self-instruction was English vocabulary learning. The design of the English vocabulary instruction was based on the following criteria:
1. The items of English vocabulary were of appropriate difficulty level for Korean middle school students.
2. Graphics supported visual text.
3. Graphics were available for cueing meaning of the word from static or animated images.
4. Spoken text was used as narration to support visual text.
5. Reduced the amount of visual text on a screen left more area available for graphics and spoken text.
The illustration of the criterion 3, 4, and 5 are shown in Figure 1 with one example.

The items of English vocabulary to be learned by students on the Web-based self-instruction program were: 1) tether, 2) wither, 3) tumble, 4) separate, 5) gorge, 6) fetter, 7) beacon, 8) crest, 9) awl, 10) ditch, 11) entice, 12) taut, 13) quench, 14) wizen, and 15) waylay. The length of each lesson was a maximum of 30 minutes and the time was controlled by computer. The six groups of Web-based self-instruction program are shown in Figure 2.

**Procedures**

Each participant was required to complete a pretest, posttest, retention test, and attitude inventory for the study. A pretest was administered to the participants one week prior to the study. All students among the six different groups were required to respond to 30 questions regarding the vocabulary with a number from 0 to 100 to indicate their degree of certainty on the pretest. One week later, all students among the six different groups received multimedia instruction through a Web-based self-instruction program. Items of vocabulary were projected on the computer screen through the program. Then, all students among the six different groups were required to respond to 30
questions regarding the vocabulary with a number from 0 to 100 to indicate their degree of certainty on the posttest. Approximately one week later, all participants were required to again respond to 30 questions regarding the vocabulary with a number from 0 to 100 to indicate their degree of certainty on the retention test. In addition, all students were required to complete the 40 items of the attitude inventory.

Figure 2: An example showing frames of Groups (Translation into English)
Results

Data were analyzed using two analyses - mixed factorial design (the split-plot analysis of variance) and one-way ANOVA - to evaluate the results from the study with regard to the following variables:

1. Student’s raw scores on
   - Pretest
   - Posttest
   - Retention test

2. Student’s mean degree of certainty estimates on
   - Pretest
   - Posttest
   - Retention test

3. Shuford Admissible Probability Scores on
   - Pretest
   - Posttest
   - Retention test

4. Time required to complete multimedia instruction

5. Student attitude inventory

Table 1 presents the results of analyses of all variances with mean scores and standard deviation for each group on the pretest, posttest, and retention test.

<table>
<thead>
<tr>
<th>Table 1. Mean scores and standard deviations for each group</th>
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<tbody>
<tr>
<td>Group A (n = 43)</td>
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<tr>
<td>------------------</td>
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<tr>
<td><strong>Raw Scores</strong></td>
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<tr>
<td>Pretest</td>
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<tr>
<td></td>
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<tr>
<td>Posttest</td>
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<td>Retention Test</td>
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<tr>
<td><strong>Degree of Certainty Estimates</strong></td>
</tr>
<tr>
<td>Pretest</td>
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<td>Posttest</td>
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<td>Retention Test</td>
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<td><strong>Admissible Probability Scores</strong></td>
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<td><strong>Time (sec)</strong></td>
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<tr>
<td><strong>Attitude Inventory</strong></td>
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Students’ Raw Scores

The mixed factorial design (the split-plot analysis of variance) was used to analyze data from mixed designs – one within-subjects factor (“test”) and one between-subjects factor (“group”). There were three levels of factor in the
within-subjects design in which subjects took all three tests (“pretest”, “posttest”, and “retention test”) and there were 6 levels of factor in the between-subjects design corresponding to the six groups of participants.

The repeated factor, “test,” was a statistically significant main effect for students’ raw score, Wilks’ Lambda = .174, $F_{(2,165)} = 390.784, p = .000$, effect size = .826. The interaction between factors “test” and “group” was also a significant main effect for students’ raw scores, Wilks’ Lambda = .848, $F_{(10,330)} = 2.831, p = .002$, effect size = .079. For a follow-up analysis on a significant interaction between the factors “test” and “group”, the ANOVA was used to test for the “group” factor on the levels of the “test” factor.

The ANOVA performed on the pretest data indicated that there was no significant difference in students’ raw scores between the groups, $F_{(5,166)} = 0.570, p = .723$, effect size = .017. However, the ANOVA performed on the posttest data revealed that there was significant difference between the groups, $F_{(5,166)} = 4.220, p = .001$, effect size = .113. A follow-up post-hoc test, Tukey’s Honestly Significant Difference (HSD) test was conducted to evaluate pair-wise differences among the means. The results of the Tukey’s HSD test indicated that there was a significant difference between the groups (Group B & C and C & E). These results demonstrate that Group C students who received “visual text and added graphics” ($M = 27.44, SD = 3.90$) earned significantly higher raw scores than Group B students who received “visual text and added spoken text” ($M = 21.95, SD = 7.31$) and Group E students who received “reduced visual text and added spoken text”, ($M = 21.08, SD = 6.85$) on the posttest.

From the retention test, the ANOVA data also revealed that there was a statistically significant difference between the groups, $F_{(5,166)} = 3.487, p = .005$, effect size = .095. Tukey’s HSD post-hoc test indicated that there was a significant difference between the groups (Group B & D and D & E). These results indicate that Group D students who received “visual text, added spoken text, and added graphics” ($M = 25.42, SD = 4.85$) earned significantly higher raw scores than Group B students who received “visual text and added spoken text” ($M = 17.82, SD = 9.53$) and Group E students who received “reduced visual text and added spoken text” ($M = 18.42, SD = 8.77$) on the retention test.

These results indicate that the students in Group C (“visual text and added graphics”) and Group D (“visual text, added graphics, and added spoken text”) learned and retained English vocabulary more effectively than students who received the other types of instruction as shown in Figure 3.

![Figure 3. Group’s means for students’ raw scores](image)

**Students’ Mean Degree of Certainty Estimates**

The mixed factorial design was used to analyze the mean degree of certainty estimates. The repeated factor, “test,” was a statistically significant main effect for students’ mean degree of certainty estimates, Wilks’ Lambda = .236,
$F_{(2,165)} = 267.809, p = .000, \text{ effect size } = .764$. However, the interaction between the factors “test” and “group” was not a significant main effect for students’ mean degree of certainty estimates, Wilks’ Lambda $= .908, F_{(10,330)} = 1.630, p = .098, \text{ effect size } = .047$.

The ANOVA performed on the pretest ($F_{(5,166)} = 1.286, p = .272, \text{ effect size } = .037$) and the retention test ($F_{(5,166)} = 1.953, p = .088, \text{ effect size } = .056$) data indicated that there were not statistically significant differences in mean degree of certainty estimates between the groups. However, from the posttest, the results of the ANOVA were statistically significant, $F_{(5,166)} = 2.910, p = .015, \text{ effect size } = .081$. The results of Tukey’s HSD test also indicated that there was a significant difference in means between the groups (Group C & E). In other words, Group C students who received “visual text and added graphics” ($M = .91, SD = .17$) earned significantly higher mean degree of certainty scores than Group E students who received “reduced visual text and added spoken text” ($M = .69, SD = .31$).

Therefore, the results indicate that students in all groups earned higher scores in general, indicating that their degree of belief probabilities increased when they received multimedia instruction as shown in Figure 4.

![Figure 4. Group’s means for students’ mean degree of certainty estimates](image)

**Shuford Admissible Probability Scores**

The mixed factorial design was also used to analyze the students’ admissible probability scores. The repeated factor, “test,” was a statistically significant main effect for students’ admissible probability scores, Wilks’ Lambda $= .186, F_{(2,165)} = 360.841, p = .000, \text{ effect size } = .814$. The interaction between the factors “test” and “group” was also a statistically significant main effect, Wilks’ Lambda $= .845, F_{(10,330)} = 2.9.4, p = .002, \text{ effect size } = .081$.

The ANOVA performed on the pretest data indicated that there was no significant difference in admissible probability scores between the groups, $F_{(5,166)} = 1.222, p = .301, \text{ effect size } = .036$. However, from the posttest, the ANOVA was statistically significant, $F_{(5,166)} = 4.789, p = .000, \text{ effect size } = .126$. Tukey’s HSD test indicated that there was a significant difference in the means between the groups (Group B & C, C & E, and D & E). These results indicate that Group C students who received “visual text and added graphics” ($M = 23.72, SD = 9.49$) earned significantly higher scores than Group B students who received “visual text and added spoken text” ($M = 10.43, SD = 17.37$) and Group E students who received “reduced visual text and added spoken text” ($M = 6.34, SD = 17.41$). It also shows that Group D students who received “visual text, added graphics, and added spoken text” ($M = 21.28, SD = 13.22$) earned significantly higher scores than Group E students who received “reduced visual text and added spoken text” ($M = 6.34, SD = 17.41$).
For the retention test, the ANOVA was also statistically significant, $F_{(5,166)} = 3.378$, $p = .006$, effect size = .092. Tukey’s HSD test indicated that there was a significant difference in means between groups (Group B & D) on the retention test. The result indicates that Group D students who received “visual text, added graphics, and added spoken text” ($M = 17.70, SD = 13.31$) earned significantly higher scores than Group B students who received “visual text and added spoken text” ($M = -1.58, SD = 24.03$).

These results lead to the conclusion that there was a significant difference in students’ admissible probability scores between the groups when students received multimedia instruction as shown in Figure 5.

![Figure 5. Group’s means for students’ Shuford Admissible Probability Scores](image)

**Time Required to Complete Instruction & Student Attitude Inventory**

The ANOVA showed that there was no significant difference among students who were taught under the six methods of multimedia instruction conditions either in the time required to complete the instruction ($F_{(5, 161)} = 1.070$, $p = .379$, effect size = .032) or in the student attitude inventory ($F_{(5, 163)} = .175$, $p = .972$, effect size = .005).

**Discussion**

*Hypothesis 1: There are no differences in original learning among students who are taught under the six methods of multimedia instruction conditions as measured by raw score, mean degree of certainty estimate, and the Shuford Admissible Probability Scoring Procedure.*

The mixed factorial design (the split-plot analysis of variance) on data obtained from the scores of students who were taught under the six methods of multimedia instruction conditions as measured by the student’s raw scores and the Shuford Admissible Probability Scores on the posttest and retention test showed differences between the six methods of multimedia instruction at the .05 level of significance.

No significant differences were found among treatment groups on data of the students’ mean degree of certainty estimates on the pretest and retention test. Thus, this result leads one to conclude that there were no significant differences among the treatment groups with respect to the degree of certainty of knowledge on the pretest and retention test. However, the results show that, in general, students earned a higher score which indicates that they increased their degrees of belief probabilities when they received multimedia instruction.
The students received higher scores in general, which indicates that they learned better when they received “visual text and added graphics” or “visual text, added graphics, and added spoken text” in their instruction than did students who received other types of instruction (“visual text”, “visual text and added spoken text”, “reduced text and added spoken text”, or “reduced text, added graphics, and added spoken text”). In other words, when visual text was presented with graphics, students may be more motivated to success and achievement in vocabulary learning.

Hypothesis 2: There are no differences in time to complete instruction among students who are taught under the six methods of multimedia instruction conditions.

Results of the ANOVA on data obtained from the students who were taught under the six methods of multimedia instruction conditions as measured by the time required to complete instruction showed no differences between the six methods of multimedia instruction at the .05 level of significance.

Although providing multimedia components required individuals to spend more time to complete the instruction, the amount of time spent was not significant. This result leads one to conclude that there were no significant differences among the six methods of instruction with respect to time needed to complete instruction.

Hypothesis 3: There are no differences in students’ attitude toward instruction among students who are taught under the six methods of multimedia instruction conditions as measured by their score on the student attitude inventory.

Results of the ANOVA on data obtained from the students who were taught under the six methods of multimedia instruction conditions as measured by score on the student attitude inventory showed no differences in attitude toward instruction among students who were taught under the six methods of multimedia instruction conditions. This result leads one to conclude that there were no significant differences among the treatment groups with respect to student attitude.

Based on visual text. The instruction based on visual text (Group A), in general, helped students to learn and retain English vocabulary more effectively than the instruction based on visual text and added spoken text (Group B) and the instruction based on reduced visual text and added spoken text (Group E).

From Mayer and Moreno’s research (2002), the results should have indicated that providing words as narration (spoken text) helped students’ performance more than on-screen text (visual text). However, the results show that written words alone may help students to learn and retain English vocabulary. A possible reason for this is that EFL learners often adopt various strategies to memorize vocabulary words such as word lists or paired associations in which new words are presented with their translations. These strategies often require learners to memorize pair associations directly. Vocabulary learning studies in South Korea have often focused on learning based on visual text alone in printed materials. In other words, written words alone may be better than text and added spoken text because Korean students are more accustomed to memorizing lists.

Added spoken text. The instruction based on visual text and added spoken text (Group B) and based on reduced visual text and added graphics (Group E) reduced students’ ability to learn and retain English vocabulary. According to cognitive load theory (Mayer, 2001; Sweller et al., 1998; Tabbers et al., 2004), the results should have indicated that students could reduce memory load with instruction based on reduced text with added spoken text (Group E). However, in fact, this aid did not help students to learn and retain English vocabulary. This result indicates that neither replacing visual text with spoken text nor adding graphics to the visual text easily generalize to all educational settings.

The lower scores for Groups B (visual text and added spoken text) and E (reduced visual text and added spoken text) may indicate problems in phonetic learning. Students may have difficulty in knowing exactly how the words are pronounced. Because many EFL learners in Korea are accustomed to memorizing new words without knowing exactly how they are pronounced, spoken text in the instruction created an unnecessary distraction.

Another possible reason for this is that the test was designed to measure only students’ understanding of a word’s meaning and did not measure their knowledge of the word’s pronunciation. The spoken text seemed to be a
distraction to students who are accustomed to learning a foreign language mainly in the current written test format. Thus, this result leads one to conclude that an effective way to improve learning of new English vocabulary is to avoid the addition of spoken text when explaining what the vocabulary means in Korean.

Added graphics. The instruction based on visual text and added graphics (Group C), based on visual text, added graphics, and added spoken text (Group D), and based on reduced text, added spoken text, and added graphics (Group F) helped students to learn and retain English vocabulary more effectively than the other types of instruction as demonstrated on the pretest and retention test. The results show that in general, students earned a higher score, which indicates that they learned better when they received graphics or graphics and spoken text in their instruction than did students who received other types of instruction (Group A, B, and E). In other words, when visual text is presented with graphics, students may be motivated to success and achievement in vocabulary learning.

The likely reason is that text does not usually translate in a manner that is meaningful to the student, while a graphic allows the student to visualize the definition in a more meaningful way. Some words cannot be translated directly and retain meaning for middle school students. When students received the instruction based on visual text only, for example, showing that “taut” means “pulled or stretched tight” may not allow learners to explain what that definition means in ways that make sense to them. The results supported the conclusion that students performed better on vocabulary tests when they were allowed to use a combination of visual text and graphics (Kost et al., 1999).

The results support the concept from dual coding theory (Paivio, 1986, chap. 4; Sadoski & Paivio, 2001, chap 3) that students are likely to build connections between verbal (visual text) and nonverbal (graphics) representations. As Mayer (2001) concluded, we assume that processing of visual text takes place initially in the nonverbal channel and then moves to the verbal channel of the brain. The results appear to indicate that providing both visual text and graphics helped students to “select relevant information, organize it into coherent representations, and integrate it with other knowledge” (Mayer & Moreno, 2002, p. 111) as meaningful learning.

The results appear to indicate that replacing visual text with spoken text and adding graphics to the visual text both do not easily generalize to all educational settings (Tabbers et al., 2004). A possible reason for this is that reduced text was not sufficient to explain the definitions in Korean.

In addition, learning new vocabulary within the context of the instruction based on visual text and added graphics may indicate that

“...students have to make informed guesses as to the meaning of a new word in light of available linguistic cues in the context as well as the relevant knowledge in the learner’s mind, including general knowledge of the world, awareness of the situation, and relevant linguistic knowledge.” (Sun & Dong, 2004, p. 132)

Conclusion

This study was an investigation of the use of multimedia components such as visual text, spoken text, and graphics in a Web-based self-instruction program to increase students’ English vocabulary learning at Myungin Middle School in Seoul, South Korea. The findings of the study support the idea that the use of visual media supports vocabulary acquisition and helps increase achievement scores. In particular the results lead one to conclude that an effective way to improve the learning of English vocabulary is to offer graphics to illustrate the definition. Students were likely motivated to success and achievement in vocabulary learning when visual text was presented with graphics because text alone did not usually translate in a manner that is meaningful to the learners, while graphics allowed them to visualize the definition in a more meaningful way.

Vocabulary learning is often used with strategies such as word lists or paired associations in which new words are presented with their translations. These strategies with visual text alone may be outdated and irrelevant to students who are accustomed to visual stimuli and have shorter attention spans. The findings of this study indicate that developers of vocabulary learning instruction and curriculum should reconsider their use of multimedia within their presentations. For example, because presenting too many elements in visual or verbal form can lead to reduced ability to learn and retain vocabulary, visual text, spoken text and graphics must be carefully planned and utilized in the instruction. Replacing text and graphics with spoken text can create an unnecessary distraction for EFL learners
who are accustomed to memorizing new words without knowing exactly how they are pronounced. Reduced text or graphics sometimes does not sufficiently explain the definitions of new words, while spoken text helps developers to save space or time to present messages in the instruction. Developers should select relevant graphics to illustrate the meanings of words with appropriately sized images in multimedia instruction. Integrating text and graphics can allow learners to visualize definitions of the words in a way that fosters meaningful learning outcomes. It can help students to have meaningful learning through the cognitive process, or in other words, “selecting relevant words and images, organizing them into coherent verbal and visual representations, and integrating corresponding verbal and visual representations” (Mayer & Moreno, 2002, p. 111). This has ramifications beyond the world of computer-based learning. Printed instructions and in-class lessons should also be designed to improve learner retention through the implementation of graphics alongside current uses of media.

Future research could focus on measuring students’ knowledge of a word’s pronunciation as well as its meaning. In a test that measures students’ knowledge of the word’s pronunciation, the spoken text may not be a distraction to English vocabulary learning. Other future studies could replicate our methods to discover whether the results would be similar for vocabulary learning for languages other than English and with students from countries other than Korea. Although “all multimedia messages are not equally effective” for EFL students (Mayer, 2001, p. 79), it is hoped these findings can be replicated and expanded for the use of vocabulary learning in other languages and cultures.

References


Public Project Webpage

- Project Webpage URL:
  [http://www.smwc.edu/grants/hp_tablet/](http://www.smwc.edu/grants/hp_tablet/) (Bottom: image of first page of the project website)

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HP Tablet Grant - ELEVATE Program

Saint Mary-of-the-Woods College was selected as one of 39 two- and four-year colleges and universities in the United States and Puerto Rico to receive a 2008 HP Technology for Teaching grant, which is designed to transform teaching and improve learning in the classroom through innovative uses of technology.

SMWC received an award package of HP products and a faculty cash award valued at more than $177,000. Each of the HP Technology for Teaching grant recipients will use wireless HP Tablet PCs to enhance learning in engineering, math, science, or computer science. At SMWC, the tablets are currently used in three courses: Introduction to Computer Software, Business Finance, and Chemistry.

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The Enhanced Learning Experience via Advanced Tablet-PC Environment (ELEVATE) program was made possible by a generous award by HP. Thank you HP!
In Project ELEVATE, HP Tablet PCs were introduced in three courses: Business Finance, Introduction to Computers, and General Chemistry, in 2008-2009 at SMWC. Using the tablet PCs, students took digital class-notes, created poster designs, integrated webpage-clippings, carried out virtual experiments/simulations, and performed molecular drawing, modeling and visualization. The instructors used the tablets for real-time annotations in their lectures as well as for annotating student work such as quizzes, exams, and papers. The tablet-PC technology facilitated a collaborative and interactive classroom atmosphere, thereby enhancing students’ critical thinking and problem solving skills, and, to some extent, seemed to alleviate their math phobia.
Other faculty (contact information, such as email or phone, is optional)

**Jennie Mitchell, Ph. D., CPA., CMA.**  
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Department of Business, Art, and Media  
Role on project: Co-Investigator  
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- **Impact on Student Learning** – Please describe your project’s goals relative to student learning outcomes. Then describe any emerging evidence, quantitative and qualitative, you have collected that demonstrates how the project has changed student academic success. Be sure to include baseline data to which you can compare your results. For suggestions on creating a compelling evaluation story, please refer to the assessment resources by Gloria Rogers at ABET and the Research and Evaluation resources at the International Society for Technology in Education.

<table>
<thead>
<tr>
<th>Goal 1: Reduce math and science phobia in female students</th>
<th>Activities</th>
<th>Outcomes</th>
<th>Data</th>
<th>Analysis</th>
</tr>
</thead>
</table>
| Objective 1: For students to take math-intense and science courses at appropriate academic levels (not postpone or avoid such courses) | Establish tablet-PC classroom(s).  
Provide faculty training/workshops in tablet-PC technology.  
Provide resources to faculty (survey questions, preliminary survey results, tutorials, etc.)  
Review course redesigns to facilitate collaborative problem-solving activities. | Increase in the number of students enrolling in math-intense and science courses at appropriate academic levels.  
Reduction in the number of absences or drops in such courses.  
Increase in the number of students who are comfortable learning with technology in a collaborative environment. | Registrar report – Completed hours, to determine when students take math and science classes.  
Absentee report (compare no-Tablet class to Tablet PC class)  
Student success in solving complex problems  
Faculty feedback, student surveys, interviews  
Scheduled for 2009/2010: Fennema-Sherman Attitude Survey (both math and science) | Frequency analysis of absences in classes; content and statistical analysis of survey comments and scales, statistical analysis of test/project/lab scores. |
<table>
<thead>
<tr>
<th>Objective: Students are able to solve complex problems with more confidence</th>
<th>Activities</th>
<th>Outcomes</th>
<th>Data</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Establish tablet-PC classroom(s).</td>
<td>Increase the confidence of students to solve complex problems using tablet PCs</td>
<td>E student success in solving complex problems</td>
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<td></td>
<td>Provide faculty training/workshops in tablet-PC technology.</td>
<td>Increase in the number of students who are comfortable learning with technology in a collaborative environment.</td>
<td>Faculty feedback, student surveys, interviews</td>
<td>Interviews analyzed using qualitative methods to determine increased comfort in using critical thinking skills.</td>
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<tr>
<td></td>
<td>Provide resources to faculty (survey questions, preliminary survey results, tutorials, etc.)</td>
<td>Review course redesigns to facilitate critical-thinking problem-solving activities.</td>
<td>Comparison of course grades</td>
<td></td>
</tr>
<tr>
<td>Objective: Students demonstrate confidence in using critical thinking skills in math and science</td>
<td>Scheduled for 2009/2010: Fennema-Sherman Attitude Survey (both math and science)</td>
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</table>

Considering the small sizes of classes, we do not have much quantitative data to support our findings, but we do have qualitative evidence to support the following general findings:

- More complex problems were completed in the Business Finance Tablet-PC class than in classes that did not use Tablet PCs; yet there was no degradation in students’ grades
- Increased attendance rate in CS101 – Computer Science Tablet-PC section when compared to CS101 non-Tablet-PC section offered by the same professor in the same semester
- Increased confidence among students in organizing class-notes effectively for study (BU381)
- Increased number of students that are comfortable learning with technology (across all classes)
- Increased enjoyment and excitement in conducting chemistry experiments and molecular model building; thereby contributing to reduced science phobia in students
- Better feedback provided to students through digital annotations on their work and by digital pen-based email messages
• **Impact on Teaching** - describe specific examples of how this project has influenced your instructional practices. What were you able to accomplish in your teaching that would not have been possible without the technology?

In chemistry courses students used two molecular modeling programs, ChemPad and Chemskech, to build molecules and to explore their three-dimensional geometries. Students also performed virtual experiments, simulations (*LabVIEW*, National Instruments) and lab experiments (*LoggerPro*, Vernier) developed by the instructor, Dr. Ramachandran. Ramachandran also used the Tablet PCs to annotate student work such as exams and to send digital pen-based email to students (e.g., molecular structures, chemical equations, figures and diagrams, and detailed solutions to problems, all drawn/written directly in email messages. Such tasks would not have been possible without the Tablet-PC/Digital Pen technology.

Dr. Mitchell (BU381) reflected, *"Using the Tablet PCs has fundamentally changed the way I teach. I look at ways to incorporate note-taking, Excel functions, charting and analysis. Instead of looking at graphs in the book that relate to problems, we just draw them in with our notes. We use color to highlight problems and OneNote templates that help us organize lecture notes"* (HP Technology Grant Open House, 2008).

In CS 101 courses, using the Tablet PCs allowed the instructor to move students from a computer lab to a more relaxed classroom. In a traditional computer lab, the teacher would be at the front of the classroom at one computer station looking out on the rows of computers where students sat. In the tablet-PC classroom, on the other hand, the students can sit where they can see each other and work together on projects and concepts while Dr. Kim projects his notes and slides for them to see (See the picture). "They can write on the screen so they can make a journal and save the file and email it to themselves," he said (by Elaine Yaw, Adviser of the Woods newspaper, issue date: 10/01/08).
Technology Integration - describe how technology is being used to support teaching and learning. What are the faculty & students doing with the technology? What software is being used/developed?

- Tablets in CH115/116 and CH222/322:
  - At present, our tablet-PC project is still in its very initial stage. We are currently using the tablet PCs in our chemistry courses only to a modest extent. Students of organic chemistry use ChemPad and Chemsketch (tablet-PC-compatible structure drawing software applications) to draw chemical structures for building molecules and studying their three-dimensional geometries.
  - General chemistry students use the tablet PCs to perform virtual experiments (developed by the Principal Investigator using LabVIEW, a graphical programming language), to view and explore animations (developed by the PI or accessed from the Internet), and to perform calculations using Microsoft Excel.
  - The PI also used Tablet PCs to annotate student work such as exams and to send digitally-annotated email to students (for example, molecular structures, chemical equations, figures and diagrams, and detailed solutions to problems all drawn/written directly in email messages could be sent which is very difficult to do without the tablet technology).

- Tablets in BU381:
  - Students used OneNote 2007 to take notes, integrated screen-clippings, and could even add audio or video clips within their notes. Because students had access to OneNote on the college server, they could access their notes from any campus computer that had OneNote. Students were given OneNote for their personal computers as well.
  - With digital notes, it is easy to upload the notes to Desire 2 Learn (the course management platform that the College subscribes to) for students. For example, finance problems can be printed to OneNote and students can work from the typed problem. In general, the Tablet PC allows the instructor to have more direct interaction with students during a presentation. The instructor can annotate answers quickly and easily with "digital ink" directly in an application such as Microsoft Excel.
  - Students used a new form of presentation through Captivate. Instead of using class time to demonstrate a problem in Excel, students recorded the screen and voice and the demonstrations were shared with the entire class through Desire 2 Learn.

- Tablets in CS 101:
  - The major use of the Tablet PC in the class was to replace writing/drawing on paper with using the digital pen of the Tablet PC. Although writing on the screen of the Tablet PC often takes more time than typing with a keyboard, students could complete all class activities easily.
  - In general, the Tablet PC allows the instructor to have more direct interaction with students during a presentation. For example, the instructor could write answers quickly and easily with the pen on MS Excel application when students asked questions.
  - In addition, the professor included additional technology features not available in the current computing lab, such as Skype, Captivate, and podcasting.
We are currently evaluating various Classroom Management Systems (CMS), e.g., Net Support School, Classroom Presenter, DyKnow, and Synchroneyes, to select a suitable system for our tablet PCs. The CMS will facilitate student-student and instructor-student interaction in the classroom and thus create a highly collaborative learning atmosphere for students. Also, the monitoring and instant polling capabilities of the CMS will enable the instructors to keep track of student learning progress in real-time.

- { additional elements, such as embedded videos, publication links, research citations, and helpful references, etc. are highly recommended so that your webpage attracts attention and is useful to other educators}

  ✓ Tablets in BU381: [http://www.smwc.edu/grants/hp_tablet/bu381.php](http://www.smwc.edu/grants/hp_tablet/bu381.php)
  ✓ Tablet Videos: [http://www.smwc.edu/grants/hp_tablet/tablet_video.php](http://www.smwc.edu/grants/hp_tablet/tablet_video.php)

### Additional Project Results for HP

Additional feedback that may not already be on your public webpage is also requested. These additional items are listed below:

- **Impact on Instruction** - What level of impact has your grant experience had on the instructional practice in your classrooms? Have your original project goals relative to student learning outcomes been met? Indicate how you rate the impact by highlighting or bolding one of the following:
  - Very Positive
  - Positive
  - Neutral / not sure yet
  - Negative
  - Very Negative

- **Impact on Student Learning** - Based on the evidence that you have collected, what level of impact has this project had on student learning? Indicate how you rate the impact by highlighting or bolding one of the following:
  - Very Positive
  - Positive
  - Neutral / not sure
  - Negative
  - Very Negative
• **Other Outcomes** - Please describe any other expected or unexpected outcomes/benefits that have arisen from this project (positive or negative). How has the technology facilitated these outcomes/benefits?

  ✓ Primary outcome: The collaborative learning environment (facilitated by the tablet-PC and associated technologies) seems to help students in overcoming their phobia toward quantitative subjects. Instructors use the tablet-PC technology to provide students with step-by-step instructions, digital annotations, and graphical illustrations/animations. Challenging, and yet supportive, learning atmosphere in our pilot courses definitely seem to raise the confidence levels of students.

  ✓ Resolving hardware and software problems and logistic hurdles, especially during the first year of the project. We faced (and are still facing) several technology issues, but slowly we are resolving those problems.

  ✓ Training students in the tablet PC technology and related software applications takes time, and achieving this without compromising on the content and rigor of the course was an important issue in our pilot courses. Students were comfortable with the Tablet PCs after the first few classes.

  ✓ Learning new technology is not always fun because it often takes effort and time.

  ✓ We had to depend on our Information Technology personnel on hardware issues. Limited manpower in the IT department translates into limitations in timely help received by the instructors.

• **Project Visibility**: How have you communicated the project and its results of this project to others? Include presentations about the project conducted on campus, at conferences, and/or any publications. Please be sure to describe any recognition that your project has received or ways in which your team and/or students have shown the grant-related work to others on your campus, in your community, or beyond.


  ✓ HP Tablet Grant Open-house, Nov 24, 2008: [http://www.smwc.edu/news/blog/item/photos-hp-technology-grant-open-house](http://www.smwc.edu/news/blog/item/photos-hp-technology-grant-open-house). The event was open to the public and media. The local newspaper and a television station covered the event. Besides our faculty members and students, visitors from other educational institutions, e.g., Indiana State University, attended the function as well. Our team and student volunteers conducted demonstrations and provided hands-on activities to the visitors on the tablet PC and digital pen technologies.


  ✓ “Tablet PC and Digital Inking Technology in Classroom Instruction”, Saint Mary-of-the-Woods College, May 21, 2009; a Faculty Development Workshop conducted by Dr. B. R. Ramachandran, Dr. Jennie Mitchell, and Dr. Daesang Kim
• **Personal Highlights**: If you had only one minute to explain your experience, what aspect of your project are you most enthusiastic about?

Using the tablet PCs, students took digital class-notes, created poster designs, integrated webpage-clippings, notes and Excel worksheets, carried out virtual experiments/simulations, and performed molecular modeling and visualization. The tablet-PCs created a collaborative and interactive classroom atmosphere, thereby enhancing students’ critical thinking and problem solving skills, and, to some extent, seemed to alleviate their math phobia.

• **Project Challenges**: What stumbling blocks or challenges did you encounter and how did you overcome them? What “words of wisdom” would you share with other educators who would like to replicate your project?
  - Redesigning courses to incorporate tablet and inking technologies.
  - Developing interactive learning-objects that focus on complex quantitative problems.
  - Encouraging and motivating more faculty to use the tablet PCs in their courses.

The project team dedicated immense amounts of time in becoming conversant with the tablet PCs, in identifying tablet-PC capable software (freeware as well as those involving cost), and in learning to use them before incorporating those technologies in their courses.

The project team also identified tablet PC compatible software in other disciplines (e.g., art, music) in order to motivate faculty in other disciplines to explore the use of tablet PCs in their courses.

Furthermore, the project team conducted faculty development workshops on the tablet PC technology and software applications to encourage others to use the technology.

• **Administrator’s Reflections** - (To be answered by a department head or other key administrator who is familiar with the project) Please review the team’s final reflections on the impact of the grant as requested above and describe any significant outcomes of the team’s work from your perspective. Describe the commitment of the institution/department to continue and expand these efforts. In the conclusion of the statement please include your name, title, and contact information.

As the leader of the faculty at SMWC, I am very interested in innovative teaching that engages our students more fully in the teaching/learning process. Use of the tablet technology has accomplished this goal. The arrival of the Tablet PCs was accompanied with excitement among the faculty who worked directly with the grant. During the recent academic year, their enthusiasm has spread to other faculty members and there is much interest in learning how the tablet technology could be used in other courses and disciplines. The students in the pilot classes have become proficient at using the applications specific to the tablet computers. We believe that these students have been more engaged with their learning than they would have been without the computers and we look forward to tracking the long-term improvements in persistence and student retention in science, mathematics, and technology fields – Dr. Dottie King, Vice President for Academic Affairs, Saint Mary-of-the-Woods College.
• **Student Quotes** – If possible, please ask your students to describe the impact that the project had on their learning. Include some of your favorite student quotes (Reference first names only, and what course they attended).

  ✓ “Wow this is different but I like it!!! (Brandianne, CS 101)”
  ✓ “This is an amazing technology and I can’t wait to learn more about it!”
  ✓ “We use OneNote in class...it makes my notes much more organized and personal...I use these notes when doing my homework. (Ashley, BU381)”
  ✓ “I can take screen captures of Excel as a screen capture...it puts all the pieces together in OneNote...it is even environmentally friendly. (Ashley, BU381)”
  ✓ “I’m scared to death of computers!!!! I hope that this class will help me become a lot more familiar and comfortable with computer technology.”
  ✓ “I feel that this is going to be an interesting year.”

• **Publishing the Results**: HP has received feedback from several projects around the world indicating an interest in publishing a book about these projects. Would you be interested participating in this project? If yes, please indicate how you would like to contribute (write a chapter, peer review, steering committee, or...?)

• We like to collaborate with past-recipients of the HP Technology Grant (e.g., Rose-Hulman Institute of Technology) for comparing experiences, and joint publications and presentations.

• **Speaking Opportunities**: We frequently get requests for speakers/experts in education technology, and we look for opportunities to raise the visibility of successful projects. Would you be interested in speaking in person or online about your project success?
  Yes

**Optional: Program Feedback/Suggestions (anonymous)**


We are always looking for ways to enhance and improve our philanthropy programs. If you would like to give us some anonymous feedback and suggestions, please take this brief survey (about 5 minutes). We would like you to rate the following experiences, and provide any suggestions that would enhance our grant programs:

• Applying for a grant
• Communications with HP
• Receiving the grant (cash and equipment)
• Technical Support
  • Overall Rating of your experience in collaborating with HP