The Resonance Factor: Probing the Impact of Video on Student Retention in Distance Learning

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Abstract

Teaching and instructing is one of the challenging manifestations of informing, within which distance learning is considered harder than face-to-face instruction. Student retention is one of the major challenges of distance learning. Current innovative technologies enable widespread use of video lectures that may ease the loneliness of the distance learner and increase retention. This study explores the impact of video lectures on relatively senior students in a distance-learning environment. The study compares the retention and achievements of overseas students enrolled in a financial theory compulsory course, which is considered difficult. Students tend to study this course only after successfully completing other courses. The results indicate that before the introduction of video most of the students who failed the course dropped out immediately after failing, whereas afterwards nearly all the students who failed the course continued their studies. The main findings suggest that video lectures may increase senior students' retention, although their achievements were not found significantly better than those of distance learners that did not have video lectures available. This paper contributes to the informing science transdiscipline by demonstrating the importance of resonance for effective informing.

Keywords: online video lectures, effectiveness of instructional technologies, student retention, distance learning, social aspects of online learning, continued use of information systems, attention economy.

Introduction

The informing science transdiscipline (Cohen, 1999, 2009; Gill, 2010; Gill & Cohen, 2009) studies all issues concerned with informing clients. The classic definition of the purpose of informing science is providing clients with information "in a form, format, and schedule that maximizes its effectiveness" (Cohen, 1999). The term *client* that refers to the recipient of the information is somewhat misleading because it may implicitly imply that the client is a customer of the information sender. However, practically, informing science uses the term clients to describe all sorts of recipients, such as machines (e.g., computers), customers, patients, students, employees, the general public, business associates, and soldiers who take orders from their commanders.

Teaching and instructing is one of the most challenging manifestations of informing because it involves imparting new knowledge or skills to a learner. The immediate association that comes to

mind is teachers teaching pupils in schools or students in universities and other higher education institutes. However, business corporations, governmental services, and diverse sorts of other organizations, all need to train their employees and keep them up-to-date with relevant knowledge and skills. Furthermore, lifelong learning is an evolving trend and people seek frameworks of study that will be compatible with their other commitments, such as work and family.

Distance learning enables flexibility of time, place, and pace of learning. Contemporary technologies, particularly instant worldwide connectivity through the internet, provide organizations and individuals with convenient opportunities for deploying distance learning. However, studying, as well as instructing, in a distance-learning environment is considered harder than that conducted in face-to-face frameworks. In educational contexts, student retention has always been one of the major challenges of distance learning (Levy, 2007; Simpson, 2003; Tinto, 1998; Woodley, 2004). Much is attributed to the lack of social interaction, especially the "loneliness of the long-distance learner" (Eastmond, 1995). Current innovative technologies enable widespread use of video lectures (Copley, 2007) that may ease the loneliness of the distance learner, and increase retention.

From the informing science perspective, video lectures may enhance resonance by supporting the social aspects of learning and satisfying the students' need for social interaction. Gill (2008) developed the concept of resonance, based on Cohen's observation that in order to achieve effective informing, the sender must understand not only the task, but also the client's psychology (Cohen, 1999). Following this observation, Gill & Bhattacherjee (2007, 2009) argued, in the context of academic research, that besides rigor (i.e., research quality from a discipline's perspective) and relevance (i.e., the potential utility of the research to client activities), resonance is necessary for effective informing. Resonance is defined by Gill (2008) as the ability to impact client mental models. Gill (2008) indicates several filters that can interfere with resonance, and the type of filters that is most relevant in the context of this study is visceral filters, such as emotions and moods. The relatively rich medium of video lectures as opposed to written text may help to overcome such filters.

This study contributes to the informing science transdiscipline by demonstrating the importance of resonance for effective informing in distance learning environments. The study explores the impact of video lectures on relatively senior students in a distance-learning environment. Student dropout in distance learning frameworks is a multifaceted issue (Woodley, 2004). However, as students progress in their studies their tendency to quit decreases (Geri & Gefen, 2007; Simpson, 2003). Therefore, this study examined relatively senior students who have already proven their ability to learn in a distance learning mode and successfully completed on average about 7-8 courses. The research compared the retention and achievements of overseas students enrolled in a financial theory compulsory course, which is considered difficult. The results indicated that before the introduction of video most of the students who failed the course dropped out immediately after failing, whereas afterwards nearly all the overseas students who failed the course continued their studies.

The following section provides the theoretical context of this study and reviews various e-learning methods that attempt to deal with the social needs of students in distance learning environments. Subsequently, the research methodology and results are presented, followed by discussion of the theoretical and practical implications of the findings. This paper concludes with the observation that although the availability of video lectures has not significantly affected overseas students' achievements, by attending to their need for social interaction, it might have increased resonance (Gill, 2008) and improved student retention.

Theoretical Context: Social Interaction in Distance Learning

The importance of social interaction in distance learning is well recognized (e.g., Salmon, 2004), and has been widely studied. The concept of distance learning is not new. Distance education has been around at least since the late years of the 19th century and was based on correspondence via mail (Moore & Kearsley, 2011). As more communication channels and technologies, such as radio and television, were developed and became ubiquitous, they have also been used for distance education. However, the internet has provided distance education with much more powerful communication channels and increased its potential use. Online learning has grown considerably in recent years, and it is used in many academic institutions, at least partially, instead of face-to-face instruction (Hiltz & Turoff, 2005). Nevertheless, not enough thought has been given to the implications of this fundamental change (Hirschheim, 2005), particularly to high dropout rates, which is a primary challenge of distance learning (Simpson, 2003; Tinto, 1998; Woodley, 2004).

An online submission assignment system is a relatively simple tool that improves communication between distance learning students and instructors. However, some instructors may not encourage the use of such online submission assignment systems because it may not be convenient to read the assignments, or write comments, online (Geri & Naor-Elaiza, 2008).

Social interaction is considered as one of the main ways to increase student retention in distance learning (Guri-Rosenblit, 2005). Discussion boards are regarded as a principal means of e-learning (Harman & Koohang, 2005), since they enable various sorts of communication between tutors and their students, as well as among students, and seemingly replace regular class discussions. Unfortunately, students tend not to participate in a threaded discussion unless they are obliged to do so (Wishart & Guy, 2009). Notwithstanding, students like to read other students' posts, so the number of views is much larger than the extent of posts (Saade & Huang, 2009).

Another important trend, which is aimed at increasing social interaction among students, is collaborative tasks. These tasks require much more effort from both the students and the instructors. The main collaborative online tools are wikis (Wheeler, Yeomans, & Wheeler, 2008), blogs (Blau, Mor, & Neuthal, 2009), and GoogleDocs (Caspi & Blau, 2011; Rimor, Rosen, & Naser, 2010).

Finally, there are video lectures, which can be synchronous or asynchronous. Whereas participation in synchronous video sessions seems to be more interactive, asynchronous video sessions provide the learners with the opportunity to select the time, place, and pace of learning that fit their individual needs. Current technologies render video use readily available at low production and consumption costs (Copley, 2007), and these factors are anticipated to increase their use for both distance learning and supplementing regular in-class learning.

Although video lectures usually offer students a rich learning experience, such as in regular face-to-face classes, prior studies show that most students prefer traditional in-class studying, even when they are offered a rich e-learning environment that includes video lectures, exercises, and personal online tutoring (Guri-Rosenblit, 2005). It seems that the essential human need to socialize has a major influence on student preferences. However, for those students who cannot attend class, video lectures may be very helpful (Wieling & Hofman, 2010). Few studies investigate the use of video for learning. There are two studies, one by Whatley and Ahmad (2007) and the second by Brecht and Ogilby (2008), which examine the use of video lectures to support a traditional classroom course. In both studies, the videos helped the students to successfully complete the course.

Table 1 summarizes major levels of social interaction in distance learning. It describes types of interaction, maps the participants in the communication process of each type, indicates the mode

of interaction (personal versus group), publicity (personal versus public content available to all the students in the group), and lists comments.

Table 1: Levels of social interaction in distance learning

Types of interaction	Participants in the communication	Mode of interaction	Publicity	Comments
Student submits an assignment and gets personal feedback from the tutor (via mail, e-mail, or designated system)	Tutor and student	Personal	Personal	The main type of student-tutor interaction prior to the arrival of course websites.
Student submits an assignment and gets personal feedback from the tutor; the assignment is posted at the course website	Tutor and student	Personal	Public	Improves quality of students' work, and their learning. They try harder, since their work is published.
Student posts a question on a course discussion board, and the tutor answers it	Student and tutor (generally, most postings are answered by the tutor)	Personal	Public	Most students read the posts, thus passive participants also gain benefits.
Threaded discussions (as a course assignment)	Students (tutor usually moderates the discussions)	Group	Public	Considered as the main tool of social interaction in distance e-learning. Students tend not to participate in a threaded discussion unless they are obliged.
Collaborative task – students are assigned to small groups	Students (tutor usually moderates the activity)	Small group	Public	Requires much effort. Main tools: Wiki, blogs, Google Docs.
Asynchronous video lectures	Tutor provides content	Impersonal	Public	Student watches alone, flexibility of time, space, and pace.
Synchronous video sessions or other tools that enable group communication, e.g., Elluminate	Tutor and students	Group	Public	Many students prefer to watch the videos asynchronously, if they are available.

Another important aspect that should be kept in mind is the essentiality of active learning Zhang, Zhou, Briggs, and Nunamaker (2006). The students should be discouraged from just passively watching the videos, because is not cognitively captivating and challenging, and therefore it is less effective for learning (Cherrett, Wills, Price, Maynard, & Dror, 2009). These learning activities, which are intended to challenge the viewers and make them cognitively effective, may not necessarily involve the tutor who recorded the video (Dror, Schmidt, & O'connor, 2011). Such activities may include taking notes, answering online quizzes, or preparing assignments. Zhang et al. (2006) compared three e-learning environments and one traditional classroom setting, and found that the effectiveness of video learning was contingent upon providing the students with interactive video sessions.

Methodology

The purpose of this study is to contribute to the informing science transdiscipline by empirically demonstrating the importance of resonance (Gill, 2008), specifically social interaction through asynchronous video lectures, for effective informing in distance learning environments. In order to achieve this aim, the study analyzed the impact of video lectures on the retention and achievements of relatively senior overseas students in a distance-learning environment. Since there is very little prior research on this matter, the nature of this study is exploratory.

The study took place at the Open University of Israel, which is a distance-learning institute with about 43,000 undergraduate students and 3,500 graduate students (Open University President's report, 2010). The Open University's credo is open admission and academic excellence. Every year, the university recruits 11,000-12,000 new students. However, many of them drop out at the beginning of their studies because they are unable to meet the academic requirements. As mentioned above, many factors influence student retention in distance learning frameworks (Simpson, 2003; Woodley, 2004). Nonetheless, it is known that as students progress in their studies their tendency to quit decreases (Geri & Gefen, 2007). In order to reduce the possible influence of other effects that may cause student dropout, this study examined relatively senior students who have already proven their ability to learn in a distance learning mode and have successfully completed on average about 7-8 courses.

A prior exploratory study (Geri, 2011), which was conducted at the Open University of Israel, examined the adoption of interactive online video-based distance learning in two introductory courses during the first six semesters in which this option was offered. Only7% of the actual 19,000 student enrollment decisions were to enroll to the interactive video-based study group. Although the video lectures were perceived excellent, these results demonstrated that students preferred face-to-face learning. Further examination of the video lectures' impact on the achievements and perseverance of overseas students did not reveal statistically significant improvement in their performance. Geri (2011) suggested that these findings might be attributed to the introductory nature of the examined courses, and they might not be applicable to more advanced courses, or to more experienced students. Therefore, as already mentioned above, the current study investigates overseas senior students.

The Open University offers its students the choice of a full distance-learning model or a blended learning model. Students who choose the blended model combine face-to-face meetings with online support through course websites, which supplement traditional means of distance education, such as books and study guides. During the last three years, video lectures were gradually introduced in some of the courses. The videos were uploaded to the course websites and were available to all the students enrolled on these courses. Overseas students were chosen for this study, and not the overall population of the students enrolled in a certain course, because they were unable to attend traditional class meetings. Local students, who were enrolled to traditional classes, may have watched the videos as well as attending face-to-face class meetings, or may

have chosen after the fact, to abandon their class and study just from the videos. Some local students, as well as overseas students, may have chosen not to watch the videos at all.

Generally, all the students were expected to have a positive attitude with regard to the video lectures, as suggested by a study of general attitudes of students toward video lectures in ten courses, which was conducted at the Open University of Israel (Steimberg et al., 2010). The study indicated that 93.6% of the students thought that watching the videos might improve their understanding of the learning materials. However, Steimberg et al. (2010) measured perceptions and their study was based on a sample of students who answered a survey, whereas this study measures actual individual students' grades and their retention records.

The research population of this study was comprised of overseas students enrolled in a financial theory compulsory course. Although it is a regular course, it is considered difficult. Most students tend to study this course only after successfully completing several other courses. The course is offered by the department of management and economics, and, in accordance with the open admission and academic excellence policy of the Open University, there are no prerequisites to this undergraduate course (anybody may enroll). However, students are advised to take this financial theory course only after studying four introductory courses: two introductions to economics and two introductions to statistics.

During the years 2010 and 2011, the course was offered twice each year, and in each semester, 1,000 to 1,200 students have studied it. The course was not offered during the shorter summer semester. About two thirds of those who take the course eventually complete it successfully. Some of them fail the first time they take the exam and pass on the second time. Others have to take the course twice. Those who do not succeed either change their program of studies or quit.

Interactive video conference lectures were introduced in the financial theory course in semester 2010A. The video lectures were given by the course coordinator, who is responsible for organizing and managing the instruction process and is an excellent as well as experienced tutor. The video lectures were complete class sessions, so the overseas students could see the instructor, as well as some students who attended the video sessions, and hear the interaction that took place in the class. Other available options for communication and social interaction that overseas students could use included the discussion board on the course website, as well as chat, e-mail connection with the instructor, and written feedback on their assignments.

The analysis compared data of 32 overseas students who were enrolled in the financial theory course during the first four semesters in which the video lectures were offered (i.e., semesters 2010A, 2010B, 2011A, 2011B) with data of 32 overseas students who took the course previously (during semesters 2006A, 2006B, 2007A, 2007B, 2008A, 2008B). The students who took the course in 2009 were excluded since in this year there were exogenous circumstances that might have affected the students' achievements. The total of 64 students is all the overseas students who were enrolled in the financial theory course during the years 2006-2011 (excluding 2009). None of these students took the course twice, but some of them dropped out, as reported in the results section.

Students who were enrolled in an interactive video group and overseas students were entitled to participate in a live video session. They could watch the session anywhere via the internet on their personal computer screen, communicate (e.g., ask questions) in real time with the instructor mainly through chat or phone, and get their answers during the same video session. The students could also choose just to watch the recording, which was posted on the course website about a day after the session took place. Most of the overseas students probably watched the recordings, due to being in different time zones or for other reasons. The proportion of students who participated in the interactive video sessions, out of those who were entitled to do so, varied, and usually was around 30% in regular sessions during the semester. It should be pointed out that many of the

Open University's students work, and one of their reasons for choosing to study at this university is that they are not obliged to attend class meetings. Their only obligation to physical presence is when taking the course final exam at the end of the semester.

It was impractical to compare the achievements and retention of all the thousands of students who took this course in a blended learning environment with those of overseas students. Furthermore, the population of students who take this course in a blended learning environment is heterogeneous and differs in many aspects from the population of overseas students. Nevertheless, two face-to-face study groups were sampled, one group before the introduction of video lectures, and one afterwards. Both control groups were instructed by the same tutor as the one who taught the video lectures. The group from semester 2007A had 29 students, and the group from semester 2010B had 35 enrolled students. Two aspects were examined: the proportion of students who failed the course and their retention.

Results

Table 2 presents the overseas students' demographics and descriptive data regarding their general achievements, as well as their achievements in the financial theory course. It is evident that the two groups of students, those who took the course before the introduction of video lectures and those who took it afterwards, are very similar in all the analyzed aspects, except for one - student retention. As shown on the last row of Table 2, out of seven students who failed the final exam before the availability of video lectures, six students dropped out immediately and did not enroll in other courses at the Open University. Further probing of the data revealed that although the two other students who dropped out passed the financial theory course, their grades in this course were very low (just under 60%), whereas their average grade in all their other courses was almost 80%. Thus, eight overseas students dropped out of their studies at the Open University due to their unsuccessful experience in studying the financial theory course before the availability of video lectures. On the contrary, after the introduction of video lectures, although there were eight students who had not passed the course, none of them dropped out.

The overseas students were compared with two sample local groups of students who had chosen the blended learning option and were instructed face-to-face by the same tutor of the video lectures. The results are presented in Table 3. Interestingly, all the seven students who took the face-to-face course in 2007A and failed continued their studies immediately after the failure. Five of them withdrew several semesters afterwards but it may be due to other reasons, including failure in other courses. The other two students continued their studies, but so far, they have not attempted to repeat this course. One other student who passed the course, dropped out immediately afterwards probably due to other reasons. When comparing this group to the overseas students group before the introduction of video lectures, it is evident that those who failed reacted differently: most of those abroad dropped out immediately, while the locals continued their studies, at least for the short run.

However, when comparing the data in Table 3 of the local 2010B blended group with the overseas students group after the introduction of video lectures, the picture looks a bit different. Of the local group with 35 students, 14 (40%) had failed the course, and four of them (11.4% of the total enrolled, or 28.5% of those who failed) withdrew immediately. As already mentioned, none of the overseas students withdrew. This issue is discussed further in the following section.

Table 2: Overseas students' demographics and achievements in a compulsory undergraduate financial theory course			
	Before introduction of video lectures	**After introduction of video lectures**	**Comments**
Semesters	2006A, 2006B, 2007A, 2007B, 2008A, 2008B	2010A, 2010B, 2011A, 2011B	
Number of students	32	32	
Gender	15 Men (46.9%) 17 Women (53.1%)	12 Men (37.5%) 20 Women (62.5%)	
Average age when taking the course	31 years old (SD=4.8)	30 years old (SD=4.4)	
Average credit points earned before enrolling to the course	44.3 points (SD=23.8)	51.4 points (SD=28.8)	Excluding accreditation for prior studies that was negligible.
Average current credit points earned (as of 2011C)	81.4 points (SD=34.0)	67.2 points (SD=34.7)	Those who studied the course before the introduction of video lectures started their studies earlier.
Average current grade (as of 2011C)	79.1 (SD=6.0)	78.2 (SD=6.8)	
Average exercise points earned	15.2 (SD=5.6)	15.8 (SD=6.3)	
Average number of final exams taken	1.1 (SD=0.6)	1.0 (SD=0.6)	Students may take up to two final exams in each course. Some students are still entitled to take another exam.
Average final exam grade	70.6 (SD=10.1)	71.1 (SD=13.1)	Only of those who passed the course.
Average final course grade	72.2 (SD=8.9)	74.0 (SD=12.3)	Only of those who passed the course.
Success: Students who passed the course	25 students (78.1%)	24 students (75%)[1]	[1] Some of the students are still entitled to take the exam, so the actual success rate may increase.
Failure: Students who did not pass the course	7 students (21.9%)	8 students (25%)[1]	
Dropout[2]	8 students (25%)[3]	No students (0%)	[2] Refers to students who dropped out immediately after taking the course. [3] Out of 7 who failed, 6 students dropped out immediately.

Table 3: Comparison of overseas students and local students in a compulsory undergraduate financial theory course				
	Before introduction of video lectures		**After introduction of video lectures**	
	Overseas	**Local**	**Overseas**	**Local**
Semesters	2006A, 2006B, 2007A, 2007B, 2008A, 2008B	2007A	2010A, 2010B, 2011A, 2011B	2010B
Number of students	32	29	32	35
Success: Students who passed the course	25 students (78.1%)	22 students (75.8%)	24 students (75%)	21 students (60.0%)
Failure: Students who did not pass the course	7 students (21.9%)	7 students (34.1%)	8 students (25%)	14 students (40.0%)
Immediate dropout	8 students (25%)	1 student (3.4%)	No students (0%)	4 students (11.4%)
Total known dropout	8 students (25%)	6 students (20.7%)	No students (0%)	5 students (14.3%)

Discussion

Theoretical Implications, Limitations, and Further Research

The theoretical purpose of this exploratory study was to empirically demonstrate the necessity of resonance (Gill, 2008) for effective informing. In order to do so, this study investigated the impact of video lectures on relatively senior students in a distance-learning environment. These students had already proven their ability for academic studies, as well as their perseverance by successfully completing on average at least seven courses. Therefore, it was surprising to find out that before the introduction of video lectures, most of these overseas students who failed the compulsory financial theory course, dropped out immediately after failing. Undergraduate students are entitled to two attempts to pass the final exam of each course. As shown in Table 2, the average number of final exams taken by all the students included in the sample was 1.1 (SD=0.6). Further examination of the data revealed that none of those who failed the course took two exams. Actually, only three of them took one exam, and the others did not even try it once.

The obvious limitation of this study is the small sample size: two groups with 32 overseas students in each one of them. The sample included all the overseas students who were enrolled in this course during the years 2006-2011 (excluding 2009). Replication of this study in other courses, schools, and learning environments is required to corroborate its findings. Nevertheless, the fact that before the introduction of video lectures practically all of those who failed dropped out, while afterwards none of those who failed withdrew, suggests that video lectures may enhance student retention in distance learning environments.

Even more interesting is the finding that the video lectures did not have much influence on the overseas students' achievements. The proportion of the failures was similar in both groups, about 25%. The average final exam grade was practically the same: 70.6 (SD=10.1) before, and 71.1 (SD=13.1) after. The students' proclivity to submit assignments was similar. The combination of the strong effect of the video lectures on retention and the virtually no effect on students' achievements suggests that the videos enhanced resonance. Many questions require further research, such as:

- Why apparently the videos did not affect learning?
- How did the videos increase resonance? Was it the social presence of the tutor? Was it due to a sense that the university tries to provide the students with more helpful means of learning?

The comparison with the two control groups of local students, who studied in a blended mode, raises further questions. It seems that the availability of videos on the course website might have had a negative effect on the local students. There are anecdotal reports that local students tend to skip more face-to-face sessions because they rely on the videos. From an attention economy perspective (Davenport & Beck, 2000, 2001; Geri, Neumann, Schocken, & Tobin, 2008), it may be harder to concentrate while watching the videos. It might be even harder to find the time to watch them, thus, causing students to procrastinate this task until the end of the semester (Ariely & Wertenbroch, 2002; Gafni & Geri, 2010), and then become overloaded. These issues are important directions for further study.

Practical Implications

The findings of this study suggest that video lectures may be a helpful means for increasing student retention in a full distance-learning environment. However, the effective deployment of this tool requires further experimenting, as well as academic research and practical evaluations.

According to prior research (Guri-Rosenblit, 2005, 2009A, 2009B), most students prefer the hybrid types of courses that combine new technologies, such as video, with conventional learning methods, and only those who cannot attend face-to-face class meetings choose distance-learning modes. The observations of the two local control groups suggest that further work is required to ensure effective integration of video lectures in blended learning settings.

Conclusion

Instructing in a full distance-learning framework is a considerable informing challenge. Although this mode of learning has been around for more than a century, student retention is a major problem, and the search for effective distance learning methods continues. Video lectures seem to be a promising tool for improving distance learning, especially by catering to the social aspects of the learning process.

This exploratory paper demonstrates the importance of resonance (Gill, 2008) for effective informing. It also suggests some directions for further research of this emerging topic. The study compares the retention and achievements of overseas students enrolled in a financial theory compulsory course, before and after the introduction of video lectures. The main findings indicate that before the use of video lectures most of those who failed the course withdrew their studies immediately after failing, whereas afterwards nearly all the students who failed the course continued their studies. Although the availability of video lectures has not significantly affected the achievements of overseas students, it might have improved their retention. Apparently, this was achieved by attending to their need for social interaction, even though they did not actively participate in the interaction and might have mainly just watched the instructor, it increased resonance, and thus improved their retention.

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Biography

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Assessing the Effectiveness of Web-Based Tutorials Using Pre- and Post-Test Measurements

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Abstract

Computer technology in general and the Internet in particular have facilitated as well as motivated the development of Web-based tutorials (MacKinnon & Williams, 2006). The current research study describes a pedagogical approach that exploits the use of self-paced, Web-based tutorials for assisting students with reviewing grammar and mechanics in a business communications course. The adopted tutorial consists of (1) grammatical and mechanical rules, (2) sentence reinforcement exercises, and (3) interactive diagnostic testing, all with immediate feedback and explanations.

The purpose of the study was to determine if the use of Web-based tutorials significantly improved student performance using pre- and post-test measurements. A quasi-experimental design was used to compare learning outcomes. The results indicate that the use of Web-based tutorials to review grammar and mechanics significantly impacted students' scores from pre-test to final post-test.

Keywords: Web-based tutorials, interactive tutorials, grammar and mechanics, tutorials, pre- and post-test

Introduction

The effectiveness of traditional teaching methods has been questioned as educators search for alternative ways of presenting material, engaging students, and improving academic performance (Jain, 2006). As a result of such enquiry, the use of computers and the Internet have become integral parts of student learning in today's classroom (Seal, Przasnyski, and Leon, 2010). Additionally, computers and the Internet have facilitated the development of Web-based tutorials for student learning and assessment across various disciplines (MacKinnon & Williams, 2006). Bliwise (2005) defines Web-based tutorials as "computerized demonstrations that are used for active learning exercises."

The use of Web-based tutorials has become acceptable as a complement to lectures as it improves students' level of understanding of materials (T. Mitchell, Chen, & Macredie, 2005) and allows learners to control the sequence and pace of the instructional materials (Bolliger & Supanakor, 2011). During the development stages of Web-based tutorials, Dawson (1998) argued that, "while the lectures provide content to make learning possible, tutorials are the major avenue to activate the learning process through preparatory reading and

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subsequent discussion." Other proponents suggest Web-based tutorials:

- provide students with interactive learning environments that appeal to different learning styles;
- allow students to have greater control over their learning;
- afford students the opportunity to learn at their convenience; and
- offer students the opportunity to gain knowledge through the use of audio, visual, and hands-on applications (Birch & Sankey, 2008; MacKinnon & Williams, 2006).

On the other hand, opponents argue that drawbacks to using Web-based tutorial include:

- lack of direct feedback;
- lack of discussion;
- lack of evidence to support learning; and
- lack of academic integrity among students (Garfield, 1995; Sweeney, O'Donoghue, & Whitehead, 2004).

Study Purpose

Despite considerable research on the outcomes of various teaching approaches at the tertiary level, there have been few investigations assessing student performance using Web-based tutorials. The current study addresses this deficit.

The current research study describes a pedagogical approach that exploits the use of self-paced, Web-based tutorials for assisting students with reviewing grammar and mechanics in a business communications course. The purpose of this study is to determine if the use of Web-based tutorials are beneficial to student learning. Specifically, the research examines the use of Web-based tutorials using pre- and post-test measurements. The following research questions guided this study:

1. Are there significant differences in pre-test and mid-term post-test scores for students using Web-based tutorials?
2. Are there significant differences in pre-test and final post-test scores for students using Web-based tutorials?
3. Are there significant differences in mid-term and final post-test scores for students using Web-based tutorials?

Literature Review

Experts in the field of performance assessment are actively debating whether students using Web-based tutorials perform equal to or better than students using more traditional methods of instruction. A review of literature reports on a number of primary research studies that have provided comparable data on student performance as well as student perception of Web-based tutorials. Despite the fact that the use of Web-based tutorials has gained momentum in recent years, a discussion examining the relationship between learning styles and instructional methods is warranted.

Relationship between Learning Styles and Web-Based Systems

Clark (1983) argued that the media (e.g., video, computer, or oral tradition) are merely vehicles that deliver instruction but do not influence student learning. Additionally, Alexander (1995) suggests that we focus on the way in which students learn using the technology rather than the media.

Parson (1998) stressed the importance of understanding how technology can affect learning when used by different types of learners. Thus, identifying learning styles becomes an important factor in understanding how students perceive and process information in different ways (Ching-Chun & Gamon, 2002) and how the strategies of learning affect student attitudes toward Web-based systems (Tawei & Chang, 2011).

According to Keefe (1979), learning styles are generally considered as "characteristic, cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to a learning environment"(p.4). Studies have shown a direct correlation exists between student performance and the method of instruction matched to the preferred learning style.

In examining the association between students' learning style and instructional methods, Benham (2002) compared the effectiveness of Web-based and traditional instructor-based training in a computer literacy course using the Kolb learning Style Inventory. The study results suggest that learning styles influenced performance and the study concludes that students who favor instructional methods that include convergers (i.e., thinking and doing) and assimilators (i.e., thinking and watching) were less effective in the Web-based training. Yet, in a similar study, Terrell (2002) found that students with a preference for convergers and assimilators were more effective in the Web-based method of instruction. With similar results, Manochehr (2006) also compared Web-based versus traditional instructor-based training and discovered that students with a preference for convergers and assimilators performed better in the Web-based training while those with a preference for accommodators (i.e., feeling and doing) and divergers (i.e., feeing and watching) performed better in the traditional instructor-based training.

While a number of studies showed that learning style determines preference for Web-based instruction (Aragon, Johnson, & Shaik, 2002; Terrell, 2002), the majority of research studies show no significant difference in student performance and learning styles relative to Web-based versus traditional instructor-based method of instruction (Brittan-Power, Legum, & Taylor, 2008; Buerck, Malmstrom, & Peppers, 2003; McNeal & Dwyer, 1999). Therefore, Diaz and Cartnal (1999) suggest that if there are no differences in learning styles, then the same learning activities should be effective for both Web-based and traditional instructor-based training and any differences in student performance may be due to other factors.

Student Performance Using Web-Based Tutorials

Proponents of Web-based tutorials assert that such systems offer opportunities to increase student engagement and understanding of material; thereby, students have the opportunity to complete assignments and receive immediate feedback at any time (Cheng & Swanson, 2011). The results of various studies conducted across the country indicate the following:

1. Students spend more time studying outside of class and have favorable opinions about using Web-based tutorials (Allain and Williams, 2006; Butler and Zerr, 2005; Lee, Courtney, & Balassi, 2010; Sagarra & Zapata, 2008; Smolira, 2008; Zerr, 2007).
2. Students are better prepared for class and are more likely to complete homework and other assignments when Web-based tutorials are used (Lenz, 2010; Zerr, 2007).
3. Students report having a greater understanding of course content when using Web-based tutorials (Lee, et al., 2010; Smolira, 2008).

Early studies have shown that simple and complex material can be learned well in a computerized format such as Web-based tutorials. Worthington, Welsh, Archer, Mindes, and Forsyth (1996) found that students who used computer-based exercises in an introductory psychology class had higher scores on the final exam than students in a lecture-only section of the course. Likewise, M.

Mitchell and Jolley (1999) found significant positive correlation between students who used a self-guided, Web-based tutorial and exam performance. Additionally, Koch and Gobell (1999) found that Web-based tutorials led to improved accuracy regarding decisions about design issues and the correct choice of statistics in an advanced course on research methods and statistics.

Desrochers, House, and Seth (2001) reported higher scores among students who used Web-based tutorials to apply knowledge of assessment and intervention to a novel clinical situation compared to students who learned the material in a lecture-only format. Similarly, Wilson and Harris (2002) evaluated the use of interactive tutorials in an introductory psychology class and found that students who learned from the Web-based tutorial scored better on exams than students who learned only from classroom lectures.

Varnhagen and Digdon (2002) found that high levels of access and participation in a Web-based interactive learning module were associated with higher exam scores for students learning to understand and critically evaluate published research articles in a research methods course.

Bliwise (2005) conducted a quasi-experimental study in which she compared learning outcomes of students who were enrolled in (1) a class that offered tutorials to students as an extra-credit course option and (2) a lecture-only class. The study consisted of 248 students enrolled in either the control group (no tutorial) or the experimental group (tutorial). The author taught each class maintaining comparable lecture and computer lab structures. Students who completed Web-based tutorials on selected statistical concepts performed better than those who did not use the tutorial on critical items on 4 of the 5 course exams. The findings suggest that Web-based tutorials can be an effective supplement to class lectures for enhancing student learning.

More recently, Tallmadge and Chitester (2010) examined the effectiveness of tutorial use in a physiological chemistry course using pre- and post-test measurements. The pre-test assessed general principles of the topic assumed to be covered in high school. The average score for the pre-test was 12 correct responses out of 30 questions (40%) with a range of 7 to 23. The median score for correct responses was 13. The average score for the post-test improved significantly as compared to the pre-test to 22 out of 30 (73%) with a range of 11 to 27 and a median of 22. The average score increased 33%, with a minimum increase of 13% and a maximum increase of 57% (see table 1). The authors concluded that "using Web-based tutorials assisted students in compensating for insufficient background in chemical principles, allowing the class to progress faster into the biological chemistry" (p. 6).

Table 1: Pre- and Post-Test Correct Responses (as cited in Tallmadge and Chitester, 2010)

	Pre-Test marks out of 30	Post-Test
Average Number of Correct Responses	12	22
Median	13	22
Range	7 to 23	11 to 27

Singh and Haileselassie (2010) developed self-paced interactive problem-solving tutorials for an introductory physics course with the purpose of comparing the performance of students who used the tutorials with those who learned similar content by other means. Students were randomly assigned to one of the following three groups:

- Group 1 consisted of students who used the Web-based tutorials;
- Group 2 consisted of students who used the solutions for the Web-based tutorial problems; and
- Group 3 consisted of students who used the adopted textbook.

The average performance for groups 1, 2 and 3 was 86%, 58%, and 11%, respectively. The researchers concluded that the Web-based tutorials significantly impacted student learning.

Don Osborn (2010) compared student learning using a Web-based tutorial versus a print-based tutorial. During a five-year period, a total of 325 students participated in the study and were enrolled in multiple 28 to 35 student sections of an introductory psychology class at a small, historically Catholic liberal arts college in the South. The performance evaluation assessed how well students solve the final exam items. The results showed that students who only had the print-based tutorial available scored lower on the final exam. Overall, students who used the Web-based tutorial became more skillful in analyzing experimental design problems; as a result, the author suggests that the Web-based hypertext tutorial approach is an effective instructional tool when compared to a print-based tutorial.

While the previously mentioned studies found Web-based tutorials to be more effective than classroom lectures and other traditional and non-traditional instructional methods, the following researchers found no significant difference between the use of Web-based tutorials and other instructional formats.

Hurlburt (2001) found that students who learned statistics using a Web-based tutorial performed as well as students in a traditional lecture class on course exams. Likewise, Aberson, Berger, Healy, and Romero (2003) compared test performance of students learning either about the sampling distribution of the mean or hypothesis testing from Web-based interactive tutorials to those exposed to the concepts in a lecture with class demonstrations or standard laboratory sessions. Knowledge significantly increased from pre-tests to post-test; however, improvements were comparable across both learning formats.

Keller, Finkelstein, Perkins, & Pollock (2006) assessed the effectiveness of a Web-based tutorial in an introductory physics course. The purpose of the study was to determine whether the use of computer-simulated tutorials is as effective as real laboratory equipment. The authors observed no lasting or repeatable significant differences in conceptual understanding between students who used either a computer simulation or real laboratory equipment, suggesting that in the appropriate contexts, simulations can be just as productive as real equipment.

Researchers and instructional designers argue the need to consider both the educational and social aspects of learning rather than solely the technological, and cite the psychosocial environment of classrooms of equal importance with regard to student learning and knowledge creation (Sweeney et al., 2004). Opponents of Web-based tutorials suggest that many colleges and universities have rushed to adopt technology-based methodology without considering ideological, pedagogical, and psychosocial issues (Sweeney & Ingram, 2001; Thomas, 1999). Opponents also argue that lectures and seminars are economically more feasible and should continue to serve as the main and time-honored means for disseminating knowledge and maintaining interactions between and among faculty and students.

It is against the technology-based classroom culture that the following studies have found lower student performance when using, specifically, Web-based tutorials. For instance, de Jong and van Joolingen (1998) used Web-based tutorials to review conceptual domains and found no general outcome in favor of such tutorials. The inability to deal with expected results and the under-use of features by students who did not successfully use the tutorials were cited as some of the factors that hindered student use of Web-based tutorials. Similarly, Cracolice and Abraham (1996) concluded that, as the difficulty of the problems in a chemistry class increased, students assigned to the printed workbook condition outperformed students assigned to the Web-based tutorial condition. An inference from the research conducted by Elicker, O'Malle, and Williams (2008) showed that the Web-based instructional tools made available to students were ineffective in increasing their performance compared to the easier communication with the instructor.

Seal, Przasnyski, and Leon (2010) set out to study the impact of Web-based interactive tutorials in order to improve students' learning. The subject pool for the study consisted of 40 College of Business Administration students. Low interactivity tutorials were used to demonstrate modeling concepts, keystrokes, and the mechanics of performing a particular task. Medium interactivity tutorials increased both the range of choices and the frequency of interaction as students were asked to take part in a concept-oriented exercise and were provided feedback about their responses. Specifically, the purpose of this experiment was to see if interactive tutorials improved students' understanding of the spreadsheet modeling of the transportation problem and if increasing levels of interactivity provide a commensurate increase in students' understanding of the modeling process. The researchers found that the low interactivity tutorials significantly improved students' ability to model and solve the transportation problem. However, the medium interactivity tutorials did not show a significant improvement in the students' learning and therefore failed to support the claim that increasing interactivity in Web-based tutorials will help students better learn spreadsheet modeling of the transportation problem.

Student Perception of Web-Based Tutorials

The literature review revealed both positive and negative responses regarding students' perceptions of Web-based tutorials. Turpen, Finkelstein, and Pollock (2009) present analyses of students' perceptions of Web-based tutorials used in a calculus-based introductory physics course. A survey was used to determine students' perceived utility and enjoyment of tutorials. Students were asked to rank (from 1--no help to 5--very much help) how much the tutorials helped their learning in the course. After a five-year study period, the authors and professors at University of Colorado determined that the students generally did not like the tutorials.

To evaluate the students' perceptions of Web-based tutorial, Jain (2006) developed and administered a questionnaire to 110 students enrolled in her introductory macroeconomic tutorial groups. The survey results indicate that a high percentage of study respondents perceive tutorials to be at least as important as lectures, if not more. A similar study conducted by Bolliger and Supanakorn (2011) revealed that the majority of the study participants thought the tutorials were useful in learning and reviewing the material. The majority of the participants thought the tutorials helped them spend less time in learning the material and completing the assignment.

Retna, Chong, and Cavana (2009) assessed students' perceptions of tutorials and the factors that contribute to their learning in a New Zealand university. Survey questionnaires were administered to management students at the end of their course, to gather information on their perceptions of tutorial effectiveness and to reflect on their overall experiences. Quantitative and qualitative analyses supported the initial hypothesis that the learning environment, positive and constructive feedback, and stimulating tutorials improved student learning and led to higher levels of student satisfaction with their learning experiences. The authors conclude that it is perceived that tutorials help create an environment conducive for learning.

Sweeney et al. (2004) compared students' perspectives on traditional face-to-face tutorials and Web-based tutorials. Their research found that the tutorial approach, despite representing an unknown to students, offered several benefits such as a greater number of participating students, reduced hierarchical divides, reduced race and gender-based inhibitions, and encouragement of collaborative learning. Overall, some students viewed the face-to-face tutorials as relatively easy and the Web-based tutorial as hard work, requiring reflective thinking and a substantial time commitment. Others viewed the Web-based tutorial as enabling a certain freedom of speech and offering a deeper learning approach.

Methodology

Business communication classes have a great deal of material to cover. As a result, it's almost impossible to teach grammar, punctuation, and usage skills in addition to teaching business communication writing skills; therefore, it is important to make students responsible for learning or reviewing grammar/punctuation/mechanics—with a minimum of class time devoted to this review. To accomplish this objective, a digitized, interactive, Web-based tutorial was employed as an online study assistant that features self-teaching of grammar and mechanics.

The current study encompasses students from the College of Business at Tennessee State University, a historically Black land-grant institution located in Nashville, Tennessee. Founded in 1912, this comprehensive urban university serves a student population of 9,165 where 74% are African American, 22% are Caucasian, and 4% are reported as other. TSU received accreditation from the Association to Advance Collegiate Schools of Business (AACSB International) a distinguished accrediting institution for business programs in higher education.

Subjects

Study participants included 198 students who self-enrolled in Business Communications (BISE 3150) during a study period of two years beginning fall 2008 through to spring 2010. The demographics of the sample population included a large percentage of African Americans (74%), a balance of males (45%) and females (55%), and a mixture of traditional (73%) and non-traditional (27%) students.

Procedure

The business communications course is a requisite for all business majors toward graduation with further requirements to maintain at least a grade point average of 2.0 in all core courses. All course sections used in this study were run consecutively and were facilitated by the same professor.

A quasi-experimental design was used to compare learning outcomes of student performance using pre- and post-test measurements of grammar and mechanics. Web-based tutorials, rather than class time, were used to address the prerequisite knowledge. This approach was chosen to minimize the in-class time required to review pre-requisite material.

At the beginning of the course, students were given proficiency test form A as a pretest (see Appendix A). Based on the results of the pre-test, students were required to review grammar and mechanics using Web-based tutorials. The assignment was worth 100 points and was not due until the end of the semester (week 16); however, students were aware that they needed to complete the review prior to mid-term in an attempt to improve grammar and mechanics pre-test scores. To access the Web-based tutorials, students had to either purchase the adopted textbook which included an access code or simply purchase an access code.

A second proficiency test form B, referred to as mid-term post-test (see Appendix B) was administered during mid-term (week 8). If students wanted to take another test to improve their scores, proficiency test form C, referred to as final post-test (see Appendix C) was administered during final exam.

Web-Based Tutorial

The adopted tutorial enabled students to review an entire business English course—including grammar, punctuation, capitalization, and number style—at their own pace. The "Your Personal Language Trainer" provided hundreds of sentence reinforcement exercises, all with immediate feedback and explanations for the best comprehension and retention. The trainer content included

the following 11 sections: nouns, pronouns, verbs, adjectives and adverbs, prepositions, commas, semicolons and colons, apostrophes, other punctuation, capitalization, and number usage. An interactive diagnostic test preceded the 11 learning workouts in "Your Personal Language Trainer." This online test included 66 questions that systematically covered all 11 learning workouts. Student performance was assessed based on the following scale:

95 to 100%	You have excellent skills in this category, but you should complete the workouts to be sure you understand and can explain the rules.
85 to 94%	You need a light review. The workouts can help!
75 to 84%	You need to refresh your memory of the rules by completing the workouts.
65 to 74%	You require careful study of the rules in the workouts.
0 to 64%	You need serious study and follow-up reinforcement in the workouts and your textbook. Consider buying and studying a reference manual.

Finally, students were then required to complete the three-step trainer workouts. These workouts provided rules plus exercises to reinforce learning.

Step 1 involved a warm up that reviewed specific grammar rules. Students read the synopsis followed by a quiz.

Step 2 provided special sentences that focused on the target grammar area.

Step 3 provided a quiz that measured how well students improved their language skills.

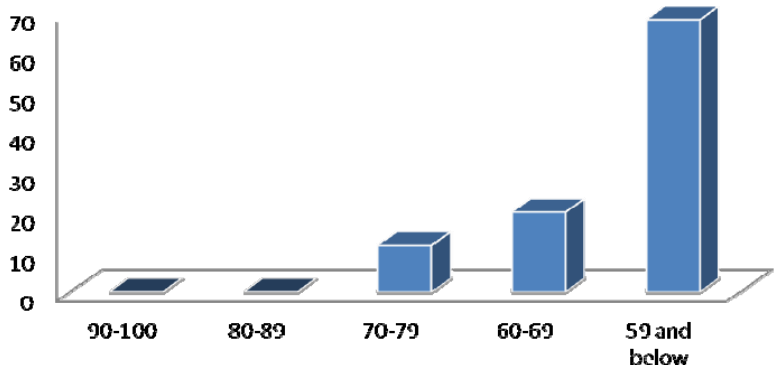
Findings

The performance of 198 students, who were self-enrolled in business communication courses, was assessed using pre- and post-test measurements. The data was analyzed using descriptive and inferential statistics for which Statistical Package for Social Sciences (SPSS) was used with the significance level set at a=0.05.

Data analysis in this study consisted of two phases. In Phase 1, frequencies were used to provide summaries about the sample population and the measures.

Within one week of the start of the semester, a pre-test was administered to the students. The pre-test examined some of the general principles assumed to be covered in a high school course. The pre-test scores, as presented in Figure 1, shows that the majority of the students (68.3%) fell below passing with scores 59 and lower, 20% earned scores ranging from 60-69 and 11.7% earned scores between 70-79. The low scores indicated that students did need a review of grammar and mechanics.

Figure 1: Pre-test Grade Averages



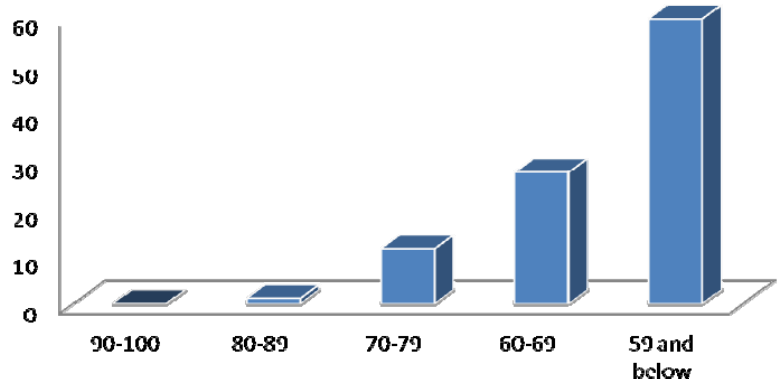
A one-way frequency table was computed to determine the rate of recurrence for each pre-test score, revealing that 18 students earned a score of 58%, 17 students earned 50%, and 15 students earned 52% while only 4 students earned a the highest score of 78% (see Table 2).

Table 2: Pre-Test Frequency Count

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	28	1	.5	.6	.6
	32	1	.5	.6	1.1
	34	2	1.0	1.1	2.2
	36	1	.5	.6	2.8
	40	9	4.5	5.0	7.8
	42	7	3.5	3.9	11.7
	44	8	4.0	4.4	16.1
	46	9	4.5	5.0	21.1
	48	11	5.6	6.1	27.2
	50	17	8.6	9.4	36.7
	52	15	7.6	8.3	45.0
	54	11	5.6	6.1	51.1
	56	13	6.6	7.2	58.3
	58	18	9.1	10.0	68.3
	60	8	4.0	4.4	72.8
	62	10	5.1	5.6	78.3
	64	6	3.0	3.3	81.7
	66	4	2.0	2.2	83.9
	68	8	4.0	4.4	88.3
	70	6	3.0	3.3	91.7
	72	8	4.0	4.4	96.1
	76	3	1.5	1.7	97.8
	78	4	2.0	2.2	100.0
	Total	180	90.9	100.0	
Missing	System	18	9.1		
Total		198	100.0		

Similarly to the pre-test, the post-test mid-term scores, as illustrated in Figure 2, reveal that the majority of the students (59.8%) fell below passing, 27.6% earned scores ranging from 60-69, 11.5% earned scores between 70-79, while only 1.1% earned scores between 80-89. The low scores at mid-term represent the low percentage of students who had not completed the Web-based tutorials for grammar and mechanics.

Figure 2: Post-test Mid-Term Grade Averages



Frequencies were used to obtain counts for post-test mid-term scores as exhibited in Table 3. Similarly to the pre-test, 19 students earned 58%, 15 students earned 62%, and 14 students earned 60% while only 1 student earned the highest score of 84%.

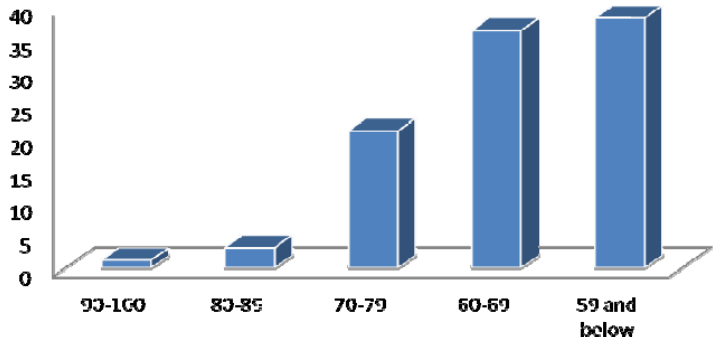
Table 3: Test Mid-Term Frequency Count

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	24	1	.5	.6	.6
	38	1	.5	.6	1.1
	40	6	3.0	3.4	4.6
	42	5	2.5	2.9	7.5
	44	9	4.5	5.2	12.6
	46	10	5.1	5.7	18.4
	48	9	4.5	5.2	23.6
	50	10	5.1	5.7	29.3
	52	11	5.6	6.3	35.6
	54	13	6.6	7.5	43.1
	56	11	5.6	6.3	49.4
	58	19	9.6	10.9	60.3
	60	14	7.1	8.0	68.4
	62	15	7.6	8.6	77.0
	64	7	3.5	4.0	81.0
	66	5	2.5	2.9	83.9
	68	6	3.0	3.4	87.4
	70	3	1.5	1.7	89.1
	72	7	3.5	4.0	93.1
	74	3	1.5	1.7	94.8
	76	4	2.0	2.3	97.1

		Frequency	Percent	Valid Percent	Cumulative Percent
	78	3	1.5	1.7	98.9
	80	1	.5	.6	99.4
	84	1	.5	.6	100.0
	Total	174	87.9	100.0	
Missing	System	24	12.1		
Total		198	100.0		

The post-test final scores as illustrated in Figure 3, shows that more than one-third of the sample population (38.3%) fell below passing, 36.4% earned scores ranging from 60-69, 21.0% earned scores between 70-79, while only 3.1% earned scores between 80-89 and 1.2% earned scores between 90-100.

Figure 3: Post-test Final Grade Averages



Frequency Table 4 provides the rate of occurrence for post-test final scores exposing a high rate of low marks with 13 students scoring 60%, 62% and 64%, uniformly. Quite the reverse was found at the other end of the grading scale revealing 1 student scoring 94%, 90%, and 86%, uniformly.

Table 4: Post-Test Final Frequency Count

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30	1	.5	.6	.6
	34	1	.5	.6	1.2
	38	1	.5	.6	1.9
	40	2	1.0	1.2	3.1
	42	2	1.0	1.2	4.3
	44	2	1.0	1.2	5.6
	46	1	.5	.6	6.2
	48	7	3.5	4.3	10.5
	50	1	.5	.6	11.1
	52	12	6.1	7.4	18.5
	54	11	5.6	6.8	25.3
	56	9	4.5	5.6	30.9
	58	12	6.1	7.4	38.3

		Frequency	Percent	Valid Percent	Cumulative Percent
	60	13	6.6	8.0	46.3
	62	13	6.6	8.0	54.3
	64	13	6.6	8.0	62.3
	66	12	6.1	7.4	69.8
	68	8	4.0	4.9	74.7
	70	8	4.0	4.9	79.6
	72	11	5.6	6.8	86.4
	74	8	4.0	4.9	91.4
	76	2	1.0	1.2	92.6
	78	5	2.5	3.1	95.7
	80	1	.5	.6	96.3
	82	1	.5	.6	96.9
	84	2	1.0	1.2	98.1
	86	1	.5	.6	98.8
	90	1	.5	.6	99.4
	94	1	.5	.6	100.0
	Total	162	81.8	100.0	
Missing	System	36	18.2		
Total		198	100.0		

Table 5 displays measures of central tendency and dispersion used to describe and compare scores of the pre-test, mid-term post-test, and final post-test. From these measures, it is evident that the final post-test scores were slightly higher than both the pre-test and mid-term post-test.

Table 5 Pre-Test, Mid-Term and Final Post-Test Statistics

		Pre-Test	Mid-Term Post-Test	Final Post-Test
N	Valid	180	174	162
	Missing	18	24	36
Mean		55.20	56.82	62.00
Median		54.00	58.00	62.00
Mode		58	58	60(a)
Std. Deviation		10.247	10.093	10.599
Minimum		28	24	30
Maximum		78	84	94

(a) Multiple modes exist. The smallest value is shown.

In the second phase of the data analysis, a series of pair-sample t-test were run to compare the average performance between the pre- and post-test measurements.

The first paired-sample analysis was run to determine whether the mean score for the pretest differs significantly from the mean score for the mid-term post-test. As revealed in Tables 6 and 6.1, the results indicate that the mean score on the mid-term post-test (M=56.76) was slightly higher than the mean score on the pre-test (55.46). Additionally, the results indicate that a significant positive correlation exists between the pre-test and the mid-term post-test ($r=.656$, $p<.05$), suggesting that students who score high on one of the exams tend to score high on the other. Likewise, students who score low on one exam also tend to score low on the other.

Table 6: Pre-Test and Mid-Term Post-Test Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	55.46	156	10.659	.853
Mid-Term Post-Test	56.76	156	9.804	.785

Table 6.1: Pre-Test and Mid-Term Post-Test Paired Samples Correlations

	N	Correlation	Sig.
Pretest and Mid-Term Post-	156	.656	.000

The second paired-sample analysis was run to determine whether the mean score for the pretest differs significantly from the mean score for the final post-test. As revealed in Tables 7 and 7.1, the results indicate that the mean score on the final post-test (M=61.93) was significantly higher than the mean score on the pre-test (54.74). Additionally, the results indicate that a significant positive correlation exists between the pre-test and the final post-test ($r=.543$, $p<.05$), suggesting that students who score high on one of the exams tend to score high on the other. Likewise, students who score low on one exam also tend to score low on the other.

Table 7: Pre-Test and Final Post-Test Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	54.74	144	10.508	.876
Final Post-Test	61.93	144	10.325	.860

Table 7.1: Pre-Test and Final Post-Test Paired Samples Correlations

	N	Correlation	Sig.
Pre-Test and Final Post-Test	144	.543	.000

Finally, the third paired-sample analysis was run to determine whether the mean score for the mid-term post-test differs significantly from the mean score for the final post-test. As revealed in Tables 8 and 8.1, the results indicate that the mean score on the final post-test (M=62.20) was slightly higher than the mean score on the mid-term post-test (56.20). Additionally, the results indicate that a significant positive correlation exists between the mid-term post-test and the final post-test ($r=.674$, $p<.05$), suggesting that students who score high on one of the exams tend to score high on the other. Likewise, students who score low on one exam also tend to score low on the other.

Table 8: Mid-Term and Final Post-Tests Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Mid-Term Post-Test	56.53	160	10.065	.796
Final Post-Test	62.20	160	10.474	.828

Table 8.1 Mid-Term and Final Post-Tests Paired Samples Correlations

	N	Correlation	Sig.
Mid-Term and Final Post-Test	160	.674	.000

Study Limitations

As with any research, there are a number of limitations that may impact this study; accordingly, caution is necessary when interpreting the findings.

While this study provides research on a population that is underrepresented in the literature, it also gives way to the first limitation in focusing solely on participants attending a minority-serving institution with no comparative data from a majority-serving institution. The second limitation pertains to missing data that was excluded from the analysis. The differences in the frequency count for exam completions of the pre-test and post-tests scores were due to students enrolling in the course after the pre-test was administered and students withdrawing from the course after mid-term and before the final exam. Missing data can be problematic because the means of the larger study participants is estimated with less error than the means of the smaller study participants. Thus, the missing data in this study is classified as "missing at random" because of the probability that missing pretest scores is unrelated to the value of other tests scores.

The course used for this study was business related which addresses the third limitation that frames the assumption not all disciplines have courses that are compatible with the use of Web-based tutorials.

Conclusion

Computer technology in general and the Internet in particular have facilitated as well as motivated the development of Web-based tutorials (MacKinnon & Williams, 2006). As a computer-based learning resource, Web-based tutorials support active learning environments and are designed to complement class lectures.

From the prevailing research, we can conclude that the use of Web-based tutorials as a means to (a) review prerequisite material, (b) foster knowledge and skill acquisition, (c) transfer knowledge to new situations, and (d) support a variety of problem-solving techniques enhances both student performance and the quality of the course (Bliwise, 2005; Osborn, 2010; Singh & Haileselassie, 2010; Tallmadge & Chitester, 2010).

The current study may serve to further affirm the findings of Tallmadge and Chitester (2010) who propose that Web-based tutorials assist students in compensating for insufficient background in any subject. Additionally, the results of the current study are consistent with others (Tallmadge and Chitester, 2010; Singh and Haileselassie, 2010; and Osborn, 2010) suggesting that Web-based tutorials are highly effective for student learning. Specifically, the use of Web-based tutorials to review grammar and mechanics significantly impacted students' scores from pre-test to final post-test.

Although Web-based training is becoming a phenomenon in education today because of its flexibility and convenience, it is vitally important to address those issues that adversely impact retention and success in this environment. Therefore, future research should more aggressively investigate instructional design and learning styles relative to Web-based environments.

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Proficiency Test -- Appendix A

Grammar: In the space provided, write the letter indicating the word that correctly completes each sentence. Use only one answer for each question.

___ 1. If I (a) was (b) were you, I would take the job.
___ 2. She dropped off her report when she (a) come (b) came over last week.
___ 3. A list showing all the documents prepared for the attorneys (a) was (b) were missing.
___ 4. An executive's time and energy (a) has (b) have to remain focused on achieving corporate goals.
___ 5. How important (a) is (b) are salary, benefits, and job security to you?
___ 6. Please order supplies for (a) her and me (b) her and I (c) she and I.
___ 7. All the new equipment (a) seem (b) seems to be working satisfactorily.
___ 8. (a) Anyone (b) Any one of the computers may need to be replaced shortly.
___ 9. I would appreciate (a) you (b) your (c) you're sending the application immediately.
___ 10. The group of players, coaches, and fans (a) is (b) are booking a charter flight.
___ 11. Sixty days (a) is (b) are the period of the loan.
___ 12. Special reports must be written by (a) whoever (b) whomever has a sales problem.
___ 13. One of the men left (a) his (b) their tennis shoes in the locker room.
___ 14. The boss told Maria not to take the criticism (a) personal (b) personally.
___ 15. Every employee may have (a) their (b) his or her (c) his (d) her tuition reimbursed.

Mechanics*:* For each of the following sentences, select one letter to identify faults in
(a) Commas or semicolons
(b) Punctuation other than commas or semicolons (including hyphens and apostrophes)
(c) Symbols (including dollar and percent signs)
(d) Number expression (word or figure form)
(e) Capitalization

___ 16. The newly-passed legislation will affect taxes in Texas, California, and Michigan.
___ 17. Erics report, which was entitled "Living in a Digital World," caused a stir.
___ 18. Stockholders for IBM could attend the meeting or they could return their proxies.
___ 19. We are earning 42 dollars on every item; however, total sales are slow.
___ 20. The President of DataTech met with the Vice President to discuss the 9 percent dip in sales.
___ 21. If we receive all the figures we will sign the contract July 1 in our headquarters.
___ 22. The memo from our Human Resources Department is quite clear don't you think?
___ 23. All three collectors, by the way, specialized in antique german and dutch coins.
___ 24. When Alicia is absent, we have only 3 operators in our Customer Service Department.
___ 25. We ordered 15 Pentax Cameras to be awarded as prizes.
___ 26. Our interviewing team consists of these people: Ann Simms, Accounting, Tom Burns, Human Resources, and Carlos Santana, Operations.
___ 27. My graduating class is having it's ten-year reunion June 10.
___ 28. The stockholders' meeting was heavily advertised, however, attendance was light.
___ 29. To improve their english, many Japanese students purchased the book entitled <u>The Power of Language is Yours</u>.
___ 30. Would you please send two copies of Invoice No. 39-5001?

Form A

Page 2

Confusing Words: In the space provided, write the letter of the word that best completes each sentence.

___ 31. Her (a) principal (b) principle concern was investment safety.
___ 32. The recent decline in prices will surely (a) effect (b) affect the entire market.
___ 33. Fidelity's brochure (a) assured (b) insured (c) ensured prospective investors that their money would be in good hands.
___ 34. Every new investor was given (a) complementary (b) complimentary concert tickets.
___ 35. Good researchers (a) sight (b) site (c) cite the sources of all references.
___ 36. After the theft everyone became more (a) conscience (b) conscious of equipment security.

Spelling: For each line of words, indicate the letter of any misspelled word. If no word is misspelled, write (e). For each numbered item provide only one answer.

	(a)	(b)	(c)	(d)
___ 37.	accommodate	existence	excellent	feasable
___ 38.	neccessary	practical	sincerely	volume
___ 39.	efficient	independent	seperate	usable
___ 40.	argument	convenient	government	definitly
___ 41.	miscelaneous	occurred	receive	sufficient
___ 42.	budget	accross	consecutive	immediate
___ 43.	congratulate	committee	analyse	restaurant
___ 44.	similar	priviledge	offered	license
___ 45.	consistent	incidentally	equipped	becomming

Sentence Structure: In the space provided, identify any sentence fault by selecting one of the following letters. If the sentence is correct, select (d).

(a) Faulty pronoun reference

(b) Sentence fragment

(c) Comma splice (comma joining clauses inappropriately)

(d) Sentence is correct.

___ 46. We've added fax machines and modems, consequently we must install two new telephone lines.
___ 47. Our office recycles paper and conserves energy because it helps save the environment.
___ 48. A number of stockholders who attended the meeting and expected to voice their opinions.
___ 49. Membership in the organization is voluntary; contributions and grants are the only means of support. This makes it difficult to continue a high level of support.
___ 50. Sales are increasing slowly, profits will respond soon.

Proficiency Test -- Appendix B

Grammar: In the space provided, write the letter indicating the word that correctly completes each sentence. Use only one answer for each question.

___ 1. Kevin found it difficult to (a) chose (b) choose a color for his new truck.
___ 2. If Laura had (a) saw (b) seen the report, she might have caught the error.
___ 3. The company's full range of products and services (a) is (b) are offered locally.
___ 4. Only the production cost and the markup of each item (a) was (b) were known.
___ 5. Lying on the table (a) is (b) are the newspaper, two magazines, and airline tickets.
___ 6. Send updated contracts to (a) he and I (b) him and I (c) him and me (d) he and me.
___ 7. Most of the new equipment (a) appear (b) appears to be working well.
___ 8. (a) Everyone (b) Every one of the applicants presented a laser-printed résumé.
___ 9. Bill would appreciate (a) you (b) your answering his telephone when he is away.
___ 10. A record of all dividends, rents, royalties, and pensions (a) was (b) were requested.
___ 11. Before you may rent a tandem bicycle, $50 (a) is (b) are required as a deposit.
___ 12. Dr. Lee will see (a) whoever (b) whomever is next in line.
___ 13. The committee submitted (a) it's (b) its (c) their report yesterday.
___ 14. To reduce costs, management pushed for a settlement (a) quick (b) quickly.
___ 15. Every new employee should receive (a) his (b) her (c) his or her (d) their orientation packet.

Mechanics: For each of the following sentences, select one letter to identify faults in

(a) Commas or semicolons
(b) Punctuation other than commas or semicolons (including hyphens and apostrophes)
(c) Symbols (including dollar and percent signs)
(d) Number expression (word or figure form)
(e) Capitalization

___ 16. Our newly-hired supervisor was scheduled to see representatives from Hewlett-Packard, Xerox, and Canon.
___ 17. Jennifers presentation, which was entitled "How to Make Computer Graphics," was excellent.
___ 18. Employees at the Minneapolis-based plant could earn 5 percent interest or they could withdraw their funds for deposit elsewhere.
___ 19. Each office chair lists for 98 dollars; however, we expect to pay less.
___ 20. The Vice President and Marketing Director were called to the President's office.
___ 21. If both sides are in agreement the contract will be signed Monday, April 2.
___ 22. The positions in our Marketing Department were advertised last week weren't they?
___ 23. All nine investors, nevertheless, purchased European and latin American stocks.
___ 24. If I remember correctly, I sent only 4 e-mail messages in the morning.
___ 25. Our two-year-old Canon Copier is still running well.
___ 26. The committee selected three potential convention cities; Atlanta, Georgia; San Antonio, Texas; and Anaheim, California.
___ 27. TechTronics will move it's headquarters to Purchase, New York, within eight months.
___ 28. All customers' addresses must be accurate, therefore, we must check the list again.
___ 29. Because they spoke little spanish, many visitors purchased the book entitled <u>Speak Like a Native in Just Ten Days</u>.
___ 30. Would you please send two copies of IRS Form No. 1099?

Form B

Page 2

Confusing Words: In the space provided, write the letter of the word that best completes each sentence.

___ 31. Although it was only a (a) miner (b) minor event, management took notice.
___ 32. His (a) principle (b) principal problem was written communication.
___ 33. New taxation laws will (a) effect (b) affect all corporations.
___ 34. Each property owner must sign a (a) waiver (b) waver before construction can begin.
___ 35. Because security takes (a) precedence (b) precedents over all other factors, we're seeking safe investments.
___ 36. Each new customer was given 1,000 (a) complementary (b) complimentary checks.

Spelling: For each line of words, indicate the letter of any misspelled word. If no word is misspelled, write (e). For each numbered item provide only one answer.

	(a)	(b)	(c)	(d)
___ 37.	absence	calender	convenient	interrupt
___ 38.	embarrass	dissatisfied	irrelavant	immediate
___ 39.	knowledgeable	ommission	prominent	questionnaire
___ 40.	recommendation	receive	volumn	writing
___ 41.	column	consecutive	familar	definitely
___ 42.	imediate	referred	separate	omitted
___ 43.	prevalent	noticeable	ninth	undoubtedly
___ 44.	business	acommodate	height	guarantee
___ 45.	February	usually	unecessarily	surprise

Sentence Structure: In the space provided, identify any sentence fault by selecting one of the following letters. If the sentence is correct, select (d).

(a) Faulty pronoun reference

(b) Sentence fragment

(c) Comma splice (comma joining clauses inappropriately)

(d) Sentence is correct.

___ 46. Our deadline is June 1, however we may receive an extension.
___ 47. Our specialists are trained in retirement planning, investment strategies, and working capital management. This explains our strength.
___ 48. Any number of investors who are looking for flexible leasing arrangements for new equipment.
___ 49. Rick suggested flexible work schedules for all who requested them and an extensive revamping of medical benefits. That was a big hit with all employees.
___ 50. The bond market is advancing slowly, the stock market is moving forward rapidly.

Proficiency Test -- Appendix C

Grammar: In the space provided, write the letter indicating the word that correctly completes each sentence. Use only one answer for each question.

___ 1. If you (a) was (b) were in my position, I'm sure you would do the same thing.
___ 2. Computer chips were (a) stolen (b) stole last weekend from two warehouses.
___ 3. Here (a) is (b) are the complete list of names and addresses.
___ 4. Considerable time and money (a) was (b) were spent on publicity for the event.
___ 5. The president told Jeffrey and (a) I (b) me (c) myself that we would start Monday.
___ 6. Each of the classifications (a) contain (b) contains four parts.
___ 7. (a) Any one (b) Anyone of our 200 employees is eligible to win the prize trip to Hawaii.
___ 8. Although some checks were delayed, (a) yours (b) your's was delivered on time.
___ 9. One hundred dollars (a) is (b) are too much to pay for one parking ticket!
___ 10. A long line of applicants (a) is (b) are waiting to apply for the advertised jobs.
___ 11. The first new computer goes to (a) whoever (b) whomever is at the top of the list.
___ 12. I certainly appreciate (a) you (b) your responding to my e-mail messages so promptly.
___ 13. Someone on the women's team left (a) her (b) their purse in the locker room.
___ 14. All student learners were instructed to drive (a) careful (b) carefully near the school.
___ 15. Every graduate may pick up (a) their (b) his or her (c) his (d) her diploma today.

Mechanics: For each of the following sentences, select one letter to identify faults in

(a) Commas or semicolons
(b) Punctuation other than commas or semicolons (including hyphens and apostrophes)
(c) Symbols (including dollar and percent signs)
(d) Number expression (word or figure form)
(e) Capitalization

___ 16. The highly-regarded engineer was hired to work on water projects in Utah, Colorado, and California.
___ 17. Erika may compile the list of names and addresses of customers or Steven may do it.
___ 18. Tim Roths screenplay, which was entitled "Tattooed Teenage Aliens," made the rounds of Hollywood producers.
___ 19. We were offered fifty-three dollars a share; however, we are not ready to sell.
___ 20. If you return the entry form by June 15 you will be eligible to win $50,000.
___ 21. Both our President and Sales Manager were unhappy with the 2 percent sales dip.
___ 22. If the manager agrees, we will try to hire 2 temporary employees.
___ 23. Regulators feel, nevertheless, that the japanese yen and the european euro will remain strong in the currency market.
___ 24. Will you please send me a copy of Invoice No. 20-4991?
___ 25. All customers' addresses were checked, however, some still have incorrect zip codes.
___ 26. The need for Spanish-speaking teachers is discussed in the Board of Education's booklet entitled "Closing the gap: Language Skills across the Curriculum."
___ 27. President Bush returned from Europe, and immediately addressed Congress.
___ 28. On May 5th my boat and its trailer will be repainted.
___ 29. When we went fishing we caught a 20-pound Atlantic salmon at the privately owned lake.
___ 30. We brought some Ziploc Bags; however, we did not have enough to package all the items.

Form C

Page 2

Confusing Words: In the space provided, write the letter of the word that best completes each sentence.

___ 31. Our realtor promised to (a) apprise (b) appraise each prospective buyer of the unusual contract terms.
___ 32. Homeowners are (a) liable (b) libel for "attractive nuisances" on their property.
___ 33. If you (a) altar (b) alter any wording in the contract, you must initial the changes.
___ 34. Stacy had to consult her (a) conscious (b) conscience before resigning her position.
___ 35. Restaurant patrons receive a (a) complimentary (b) complementary glass of wine with their meals on Wednesday evenings.
___ 36. Dr. Myers considered himself a person of high (a) principals (b) principles.

Spelling: For each line of words indicate the letter of any misspelled word. If no word is misspelled, write (e). For each numbered item provide only one answer.

	(a)	(b)	(c)	(d)
___ 37.	seperate	miscellaneous	truly	valuable
___ 38.	accommodate	consistent	milage	occasionally
___ 39.	column	convenint	mortgage	necessary
___ 40.	apointment	committee	immediate	irrelevant
___ 41.	occurred	opportunity	pamphlet	permenant
___ 42.	automatically	Febuary	fourth	genuine
___ 43.	criticize	definitely	desirable	serprise
___ 44.	courteous	efficient	goverment	prominent
___ 45.	libary	emphasize	ninety	therefore

Sentence Structure: In the space provided, identify any sentence fault by selecting one of the following letters. If the sentence is correct, select (d).

(a) Faulty pronoun reference

(b) Sentence fragment

(c) Comma splice (comma joining clauses inappropriately)

(d) Sentence is correct .

___ 46. Employers usually have stacks of résumés from talented applicants, therefore your résumé must be flawless.
___ 47. A vehicle apparently ran off Kelton Road and struck the mail box as it attempted to get back on the roadway.
___ 48. Although few applicants among the most recent candidates had the proper qualifications for the opening in our Customer Service Department.
___ 49. Many students are completing internships, then they are more employable.
___ 50. Antiwar protesters released live cockroaches inside the White House on Friday, and they were arrested when they left and blocked a security gate.

Biographies

Dr. Retta Guy has an Ed.D. in Curriculum and Instruction with emphasis in Instructional Systems Design from the University of Kentucky. Currently, she is an Associate Professor in the Department of Business Information Systems at Tennessee State University in Nashville. As an active author, Dr. Guy's scholarly publications include an authored book entitled "The Digitally Disinterested," two edited books entitled "The Evolution of Mobile Teaching and Learning" and "Mobile Learning: Pilot Projects and Initiatives," 6 book chapters, 25+ articles, and 10 refereed proceedings to date. Dr. Guy's intellectual interests include the use of digital technologies to augment teaching and learning, instructional design and assessment, as well as distance learning with specific emphasis in hybrid, online and mobile teaching and learning.

Dr. Millicent Lownes-Jackson is the Interim Provost and Executive Vice President for Academic Affairs at Tennessee State University. She is a small business specialist, author of 15 books, an entrepreneur, newspaper columnist, researcher, certified small business coach, and a tenured Professor of Management. Dr. Lownes-Jackson's educational background includes a Bachelor of Business Administration Degree from Fisk University. She also has a Master of Business Administration Degree and a Doctor of Philosophy Degree, both of which were conferred by Vanderbilt University. Dr. Lownes-Jackson has many research articles, publications and talk show appearances to her credit. She has been featured in numerous stories including articles appearing in Black Enterprise magazine, Contempora magazine, the Tennessee Tribune and the Urban Journal.

Has Distance Learning Become More Flexible? Reflections of a Distance Learning Student

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Abstract

This paper provides insight into the way in which distance learning had changed over the past 30 years from the perspective of the author as a distance learning student. The question is then asked as to whether current practice is reducing flexibility for distance learning students? The paper starts with a discussion of flexible learning and the different factors that need to be considered when making distance learning flexible for students. The paper then describes the author's experiences as a distance learning student in the early 1980s and compares it to her experiences as a student in 2006-2008. The experiences were compared using various dimensions of flexibility. The main dimensions used were flexibility of content, assessment, instructional approach, course delivery, time, and learning styles. While flexibility had improved in some areas, improving the pedagogical design by engaging students on an ongoing basis had also decreased flexibility in others. The paper concludes with a look to the future and factors that online designers might consider in balancing different types of flexible learning activities.

Keywords: distance education, flexible learning

Introduction

The constructivist theory of learning proposes that learners need to be actively involved in and responsible for their own learning in order to make the cognitive links between the new material and their prior understanding (Ardito, Costabile, de Marsico, Lanzilotti, Levialdi Roselli, & Rossano, 2006). Using a constructivist approach to learning would require an e-learning environment with appropriate levels of learner control and flexibility.

The need for flexibility in distance learning was recognised in the early 1980s (Baath, 1982; Marland, & Store, 1982), but the technologies were not there to enable flexibility in the same way that they are today. In a recent editorial in the journal Distance Education, Bennet, Agostinho, Lockyer, and Harper (2009, p. 175) state that "online technologies have transformed traditional print-and-post distance education and enabled campus-based institutions to offer flexible study options." While the author would not disagree with this statement, her recent experiences as a student have led her to wonder how flexible distance education has become since she first became a distance education student in the early 1980s. Hagel and Shaw (2006) say that it is often assumed that online study modes supported by Information and Communication Technologies (ICT) provide students with better flexibility and convenience, but do they really accomplish that?

Editor: Janice Whatley

This paper provides insight into the way in which distance learning has changed over the past 30 years from the perspective of the author as a distance learning student. The question is then asked as to whether current practice is reducing flexibility for distance learning students. The paper starts with a look at the literature on flexible learning and what it entails. The paper then describes the author's experiences as a distance learning student in the early 1980s and compares it to her experiences as a student in 2006-2008. Various dimensions of flexibility of distance learning are used for the comparison. The paper concludes with a look to the future and factors that online designers might consider in balancing different types of flexible learning activities.

What is Flexible Learning?

There are many ways of looking at flexible learning. Many students want their studies to be flexible so that they can fit their studies around family or work commitments, study with a disability, or study in a remote area (Willems, 2005). Students want to be able to study at their own pace and in a variety of locations.

There is more to flexible learning than just considerations around where and when students study, however. As Bowles (2004) says the hallmark of flexible learning is that it should be able to adapt to individual learner's needs and circumstances. To be truly flexible, online designers also need to consider flexibility in how learning takes place, instructional methods, content, and ways in which students interact with the lecturer and fellow students. In 1993, Van den Brande (p.2) defined flexible learning as "enabling learners to learn when they want (frequency, timing, duration), how they want (modes of learning), and what they want (that is learners can define what constitutes learning to them)." Sadler-Smith and Smith (2004) take these concepts further and suggest that to be truly flexible, the learner needs to be the centre of our design and that flexible systems will cater for students with different cognitive styles, learning styles, and instructional preferences. This is supported by Willems (2005) who relates flexible learning to student-centred learning. Students learn in different ways, for example, some are visual while others prefer textual, some are self-directed, independent learners while others are dependent, some prefer collaborative learning and others to work individually. To be truly flexible instructional design needs to cater for all of these (Sadler-Smith & Smith, 2004).

Distance education technologies have become more cost-effective over the years, and that means that teachers and students have access to a broad range of methods to help overcome any obstacles of time, place, and pace as well as helping students and staff to engage with one another in various ways (Baggaley, 2008). In the past five years technology has progressed to allow many options for student-student interaction and student-lecturer interaction, thereby ostensibly increasing the flexibility for course offerings. Tools like chat, video, discussion threads, application sharing, and group facilitation tools facilitate interaction between students and promote the use of group work (Trembaly, 2006). Willems (2005) questions whether these new technologies can constrain students and cause them undue frustration. Some of this frustration was experienced by the author and led to her investigating this topic.

There are various dimensions to flexible learning. Nikolova and Collis (1998) mention 5 categories of flexible learning, namely, time, content, instructional approaches, course delivery methods, and entry requirements. They expand time to cater for the dimensions of time when the course beings, times for participation within the course, the learner's pace through the course, and timing of assessment. They take the category of content and divide into it the flexibility dimensions of flexibility of topic, sequence, amount of learning activities, level of difficulty, and assessment standards. They suggest that entry requirements and prerequisites for a course can also be flexible in allowing various pathways into the course. The dimensions of instruction approaches and learning materials are given as social organisation (individual or group), language of communication, flexible formats for learning materials, and the pedagogy and role that the in-

structor plays. Course delivery can be flexible along the times and places for support, methods of obtaining support, types of support, place where students can study, and flexible delivery channels.

Nikolova and Collis' (1998) and Sadler-Smith and Smith's (2004) work have been used as a basis for the comparison provided later in the document. Entry requirements were not considered relevant to the discussion. The six main dimensions of flexibility addressed are content, assessment, instructional approach, course delivery, time, and learning styles.

A discussion of how technology has changed over the past thirty years is outside of the scope of this paper. When discussing the advantages of using technology for learning, the ability to be flexible with time and space and the ability to adapt to the individual student are often listed at the top of the list (Dalsgaard, 2005). Most people would agree that current technologies offer many options for the lecturer to offer the students an engaging, flexible experience. The question raised here is whether the use of these technologies increases or reduces flexibility of the learner's experience?

The following sections briefly describe my experience as a student in 1982-1983 and again in 2006-2008. As this is my story, I have chosen to write it in the first person. In order to understand my experiences as a student it is important to understand my learning styles. I will explain my situation at the time of studying with the two different descriptions. I consider myself an independent, self-directed learner rather than one that is dependent. I am able to look at data from both a holistic and an analytical perspective. While I enjoy interacting with others, I prefer to study and do assessment individually. I tend to prefer written materials to visual. This study was a voyage of discovery for me as I started to "prove" that distance learning had become inflexible and ended by realising that while one aspect of the study might have become more inflexible overall I had been given a wide variety of flexible experiences in my later studies.

My Distance Learning Story 1982 – 1983

In 1982, I decided that I needed to upgrade my Bachelor of Science degree to a Bachelor of Science (Honours) degree in the discipline of Information Systems. If I had been able to do this full time, it would have been a one year program, but I was working full time so I decided to do it in two years, part time. I enrolled by distance at a distance education university.

I enrolled for my Bachelor of Science (Honours) degree in December of 1981 and received the study materials for the course within a couple of weeks of enrolling. I was studying five subjects per year for two years. Along with the study materials, I received my assignments for the year. Each subject had 3 to 4 assessments and an examination. The University required satisfactory completion of assignments in order to write examinations.

I knew it was going to be a tough year and set to studying right away. Each subject had a paper-based study guide, and we were expected to use our textbook and additional reading when answering assignments and studying the various topics. We would order copies of articles and books from the university library when we needed them.

As I had received my study materials in December, I was able to put together a study program for the entire year. I knew when the pressure times were at work and gave myself some slack during those times. At other times, I would ensure that assignments were due on time or early.

All materials were paper-based and I would do most of my reading on the bus on the way to and from work. I would work on the assignments at night and over the weekend. I found a friend who was undertaking some of the same subjects as I was, and we would discuss some of the work and help each other when we got stuck. When we had a problem we would contact the lecturer who would help us over the phone.

With five subjects, some assignments were due at the same time as others, but I was able to plan my studies to ensure that I completed some of the assignments in advance so that I did not end up trying to finish them all at once. This left me with time at the end of the year to review old examination papers and review the materials before exams in November.

My Distance Learning Story 2006 – 2008

I decided to enrol in a Graduate Certificate in Higher Education. This Certificate was offered online, and we were expected to do two subjects per year (one each semester.) The first subject was offered from October 2006 to December 2006 over a 12 week period.

Online materials were usually made available to us one week prior to the start of the semester. In some cases we were able to get some information about the textbook prior to the semester. Each semester was 12 weeks. We had access to journals and articles through the library's electronic resources. The first three subjects were basically run in the same way with the fourth subject being a research project. I will discuss my experiences with the first three subjects here.

As the subjects were not run concurrently, I did not have to worry about multiple assignments being due at the same time. The first three subjects all included written assignments and an assignment based on our discussion groups and reflections. In some cases there was a discussion every week and in others every two weeks. In one of the subjects, we undertook a group assignment. There were no examinations.

Comparing My Experience with Respect to Flexibility

Many articles have been written about evaluating e-learning systems and approaches to e-learning (Ardito et al., 2006; Ozkan & Koseler, 2009). This study did not attempt to evaluate the whole experience or to evaluate the use of the technology itself. The methodology used for this research was a personal journey of exploration. The author's own experience led her to investigate what the term flexibility of learning meant and to then undertake the comparison.

The literature study identified seven dimensions of learning, namely, entry requirements, content, assessment, instructional approach, course delivery, time, and learning styles (Bowls, 2004; Nikolova & Collis, 1998; Sadler-Smith & Smith, 2004). The issue of entry requirements was not considered as it is not affected by the use of a technology environment. The other six dimensions were investigated further and Table 1 gives an overview of the dimensions and sub-dimensions used.

Table 1: Dimensions of flexibility	
Dimension	**Sub-dimensions**
Content	Topics covered Sequencing of topics Expectations regarding number and types of learning experiences
Assessment	Assessment methods fixed or choice Types of assessment Assessment criteria fixed or negotiated Individual / Group assignments
Instructional Approach	Social organisation of learning Formats of learning materials Role of the instructor Feedback methods from instructor
Course Delivery	Communication with the lecturer Types of support available Place for study
Time	Starting time of subject Times for participation within the subject Learners pace themselves Timing of assessment
Learning Styles	Autonomy (dependent vs. independent learner) Mode preference (verbal vs. visual) Collaborative vs. Individual

After identifying the categories for the evaluation of flexibility I evaluated my experiences as a student for the years 1982-1983 compared to the years 2007-2008. These are based on my personal experience and do not necessarily reflect the experiences of all students.

Content

When evaluating my experience regarding the flexibility of content, I found that the content was much more flexible in recent years than it was in the 1980s with regard to what was taught and being able to choose between different options regarding content. Table 2 compares my experiences.

Table 2: Comparison of flexibility for content category		
Flexibility Dimension	**1982-1983 experience**	**2007-2008 experience**
Topics covered	Fixed	Mostly fixed but some ability to adapt the content to our own experience. Choice of modules in some subjects.
Sequencing of topics	Largely fixed	Fixed as participation meant you had to do what was required in a particular week.
Expectations regarding number and types of learning experiences	Besides assignments student chose how much to study and how to study	Many of the learning experiences were online thus raising expectations regarding participation in a particular method chosen by the lecturer.

There was little flexibility, however, regarding the sequencing of topics as we were required to take part in interactions with others on a regular basis and were required to study specific topics in sequence in order to participate. In the 1980s I was able to skip topics that I already knew or study things in different orders as long as my assignments were completed in a timely fashion. In the 1980s we were provided with a number of learning tasks and chose which ones to participate in. As a student I would normally undertake all of the learning activities, but it was my choice. In the 2000s, participation was online and there were requirements to participate regularly and to undertake learning activities. Although not all learning activities were assessed, they were moni-

tored. Expectations were therefore raised regarding participation. While this reduces flexibility, it did help me to learn.

Assessment

Assessments for online courses in the 1980s were normally in the form of written assessments or examinations. Written assessments included problem solving, creating computer programs or writing essays. Table 3 provides a comparison of the flexibility between assessment practices for the two periods. New technologies facilitated a much wider variety of assessments than had been possible in the 1980s.

Although assessment criteria in both years were fixed, there was no reason why they could not have been negotiated. All my assignments in the 1980s were individual, whereas my recent studies included opportunities to work cooperatively with my fellow students in group projects. I like to have my students work in groups, so I was surprised at how negatively I approached the idea of a group project. The group project meant less flexibility in time, fixed times when we needed to work and fixed schedules that had to suit others. I found it quite confronting to have my grade dependent on the work of others. The actual experience of group work was positive, however. It was fun to work with others and we were able to meet up face-to-face as well as online. We were all motivated and brought different experiences and backgrounds to the group, which worked well.

Table 3: Comparison of flexibility for assessment category

Flexibility Dimension	1982-1983 experience	2007-2008 experience
Assessment methods fixed or choice	Fixed – sometimes choice of topics for essays	Some choice given in choice of assessments or topics
Types of assessment	Written assessments – either short questions or essays. Examinations	Variety of assessments including: - Essays - Analyses of articles - Online Quizzes - Discussions - Group project - Reflections - Research project
Assessment criteria fixed or negotiated	Fixed	Fixed
Individual / Group assignments	Individual	Mostly individual but some group activities and one group project

Instructional Approach

Not surprisingly as shown in Table 4, the range of instructional approaches used, the technologies used, and the different formats for learning materials were much more varied in 2008 than they were in 1983. It was also much easier and more immediate to find materials. Although these different approaches were used in different units in my recent studies, students were largely not given any choices. We were told what to study and in what format. Sadler-Smith and Smith (2004) differentiate between instructive designs that are adaptive, where a range of options are available to cater for different students' learning styles, and those that are non-adaptive, where a range of styles might be used so that all learners are accommodated, but that the learner needs to cope with the different designs. The adaptive style would offer students the choice between watching a video or reading an article, for example, whereas the non-adaptive style would sometimes use video and at other times use articles. The approach used in my recent experience was semi-adaptive – although the student was given little choice, but there were a variety of learning approaches used. My experience in the 1980s was that styles used were limited. They were

mostly text-based, and the instructor's role was that of an expert rather than adapting from expert, to fellow investigator, to facilitator.

Table 4: Comparison of flexibility for instructional approaches category		
Flexibility Dimension	**1982-1983 experience**	**2007-2008 experience**
Social organisation of learning	Organised for individual learning. At times found someone doing the same subject and worked together in studying for exams.	Group activities and discussions encouraged. Individual work also required.
Formats of learning materials	Textbooks Paper-based materials Articles/reference books available in paper-based form by ordering from library	Textbooks Online learning materials Articles and book chapters available online Videos available online
Role of the instructor (Note that neither subject had tutors)	Subject expert Wrote materials Answered questions (rarely) Prepared and marked assessments Provided feedback to students	Subject expert Wrote online materials Facilitator (in online discussions – answering and asking questions) Prepared and marked assessments Provide feedback to students
Feedback methods from instructor	Hand written on submitted assignments	Hand written on assignments Discussion boards Computer Quiz Telephone discussions (e.g.. for project proposal for research project)

Collaborative learning was not built into the learning experiences in the 1980s but was a definite expectation in the 2000s. We were expected to participate in discussions, chats, and various online activities. We were graded on our participation and interaction with others in the class. We were expected to bring our own experiences into the learning. The collaborative experience was definitely a positive experience for me and I valued learning from others. The need to explain my reasoning to others also helped to develop my thinking.

Course Delivery

Technologies for communication with the lecturer and with other students have improved exponentially over the past 30 years. As shown in Table 5, there were many more ways in which we could communicate with the lecturer, and this allowed students to communicate in different ways that worked best for them. Some of the lecturers had special discussion forums for asking students questions, and this was very helpful as it allowed all students to see what someone had asked and what the lecturer had responded. Flexibility with regard to place was not improved dramatically, however, as I found myself printing off materials to read on the train or in doctor's offices. The laptop computer instead of a desktop one did give a bit more flexibility with regard to using the computer in a variety of places.

Table 5: Comparison of flexibility for course delivery category		
Flexibility Dimension	**1982-1983 experience**	**2007-2008 experience**
Communication with the lecturer	Letter, telephone	Email, discussion boards, telephone, teleconferences
Types of support available	Lecturer, library	Lecturer, academic support, library, technical support, fellow students
Place for study	Home, bus, reading material could be taken with you, computer fixed	Download reading materials if use remotely Home, train, laptop computer

Time

Time is one of the categories that does not seem to have improved as technology has progressed over the past 30 years as shown in Table 6. In some ways it has reduced flexibility. In one unit, we were expected to participate in a discussion group each week after reading the week's materials. For someone who is a dependent learner with set hours each week that they are able to study this may be fine, but it caused me much stress as I tried to juggle my competing responsibilities.

Table 6: Comparison of flexibility for time category

Flexibility Dimension	1982-1983 experience	2007-2008 experience
Starting time of subject	Flexible from time of enrolment to start of assessment period	Week 1 of semester
Times for participation within the subject	No specific times for participation except examination	Participation expected each week/fortnight in online discussions, teleconferences, etc
Learners pace themselves	Guidelines based around assessment but not specified	Participation expectations meant that you had to work at the pace specified
Timing of assessment	Fixed assessment dates	Fixed assessment dates

Learning Styles

Some of the sentiments expressed in the learning styles category overlap with what has gone before, and that is not surprising. As indicated in Table 7, my experiences in 2008 showed a greater variety of modes used for learning and a greater emphasis on collaboration. This is a positive trend. Where the trend seems negative is that the way in which the learning was structured in 2008 seems to be focussed on the dependent learner. The learning told you what to study, when it needed to be studied, where to find the materials, and how you had to participate each week. I found this frustrating and restrictive but can understand how it would be helpful to someone who was not able to self-direct their own learning.

Table 7: Comparison of flexibility for learning styles category

Flexibility Dimension	1982-1983 experience	2007-2008 experience
Autonomy (dependent vs independent learner)	Had to be an independent learner. Dependent learners would have struggled and many would have dropped out.	Seems to be more geared towards the dependent learner than the independent learner. Scaffolds learning and requires participation at particular times in specific ways.
Mode preference (verbal vs visual)	Mostly Verbal	Both modes used but generally required to use one or the other not both.
Collaborative vs Individual	Mostly individual, anything undertaken collaboratively was not facilitated by the distance learning	Combination of individual and collaborative work. Collaboration was encouraged and assessed.

Implications and Future Research

What does this mean for online course designers? Although the author's experience is that of one student, would others experience it in the same way? The author recognises that a different person with their own specific learning styles might have had a totally different experience to her own. This is something for future research.

There have been a lot of positives over the past 30 years. Technology has helped to give lecturers and students options regarding how, where, when, and what they study. This was evident in my experiences where a variety of learning experiences and technologies were used to offer a rich learning experience compared to that of my earlier studies in the 1980s.

There was, however, very little choice for students to determine what learning method they wanted to use for a particular part of the course. Sadler-Smith and Smith (2004) suggest that this is necessary in order for truly flexible learning. On the other hand, we want students who are able to adapt themselves and to work in different paradigms, use a variety of technologies, and work both independently and collaboratively. If we only provided students with their preferences, would we be reducing their ability to work flexibly themselves?

Looking to the literature, some of the issues that the author experienced have been suggested by others. Brindley, Walti and Blasschke (2009, p.13-14) note that "Learners who choose online study most often do so because of the flexibility and convenience of choosing their own study hours, usually because they have very busy lives. Particularly in the case of adult learners, other roles may be primary to that of student. Academic work is important but must fit around demands of career, home, and community. Group projects require that learners be present on a particular schedule, reducing the flexibility and convenience factor in online study and may cause anxiety and/or resentment, particularly if the purpose of the group work is not clear and the group experience is not positive." This is confirmed by Dalsgaard (2005) who says that it is possible to have flexibility of time and space if students work individually but where active collaboration is required the students have to work interdependently and that means that there needs to be coordination, resulting in a reduction in flexibility.

On the other hand, should online learners be deprived of social learning because they do not come on campus? As Brindley et al. (2009) suggest, learning should take place in a rich environment that offers opportunity for interaction and connectedness. There are many studies that confirm that interaction among students improves learning and enhances critical thinking in the online environment (Baggaley, 2008; Bassett, 2011; Brindley et al., 2009; Menchaca & Bekele, 2008). Being able to work collaboratively is one of our university's graduate attributes. We say that we develop this attribute through our courses. If we allow students to choose between working individually and working with others, we would be saying that those who work online do not need to develop this capability. Even in my own experience, I was negative about doing group assignments at first, but found that I was able to learn so much more through the collective expertise of the group that it was a worthwhile activity.

In a study of 552 students undertaking studies using print-based distance learning, web-based distance learning, and face-to-face classes, Hagel and Shaw (2006) found that online delivery was not better than print-based delivery for convenience, time-efficiency, or flexibility. They also found that web-based delivery was not able to bridge the gap in students' perceptions of engagement compared to on-campus learning. When staff tried to make units more engaging then distance students often lost what they valued most about studying at a distance – namely autonomy and convenience.

Bassett (2011), however, found that structuring discussions helped students to participate more effectively and students valued the collaborative experience. Students need to be made aware of their own learning styles as this will help them to identify their strengths and weaknesses and to adapt to the pressures of different learning requirements for their courses (Sadler-Smith & Smith, 2004). Lecturers should provide different learning experiences, but learners should also be able to adapt and be flexible in their learning.

Conclusion

As Willems (2005, p.245) says, "Flexible provision does not necessarily equate with effective learning, as simply providing a range of options does not bring with it deep learning. Students need ongoing support in how to operate in these various environments and how to effectively learn within them."

Constructivist theory encourages educators to involve students in social and practical activities in order to improve their learning. Educators are embracing technology as a way of supplementing other learning methods of engaging the students. As we increase engagement and activity we may be reducing flexibility as we require students to interact with others or participate in activities at a particular time.

It is impossible for educational designers to offer every student their preferred method of studying. Nevertheless they need to be aware that they have a variety of students in their class and that they may need to build in flexibility to cater for the diversity of students' learning styles and to fit in with the peaks and troughs of competing activities. The onus is not only on the lecturer, however. Students also need to learn to work with a diversity of other students in a variety of settings. Students may need help in order to cope with working outside of their comfort zone.

There is no simple recommendation for improving flexibility of e-learning. As one dimension of flexibility is improved, another may be reduced. The question remains, how do we improve interaction, a sense of presence and connectedness, and promote group activities while still allowing distance students the flexibility that they require to work around work and family commitments? This question deserves further research.

In hindsight, would I as a student have swapped the interactive discussions and the group activities for more flexibility? No, I would not. A great deal of learning took place by interacting with fellow students and learning from them. Was I stressed? Yes, I was. Was it worth the stress? Yes, it was. Could we do it better? Yes, we can.

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Biography

Dr Theda Thomas is Associate Dean (Learning and Teaching) at the Australian Catholic University and has held this position since 2007. She started her career working as a computer programmer at Ford Motor Company and then at the University of South Africa. She moved to teaching in the tertiary sector in 1987 and worked for many years at the Port Elizabeth Technikon (now known as the Nelson Mandella Metropolitan University) as a senior lecturer and Head of Department of Information Systems. She obtained her doctorate from the University of Pretoria in 2001.

Dr Thomas started publishing on learning and teaching in Information Systems in the late 1990s and has continued this interest in higher education research since this time. Her research investigated ways of developing non-technical skills (communication skills, interpersonal skills, critical thinking skills) required by Information Systems professionals.

Over the past few years she has expanded her research into developing graduate attributes across a wide range of discipline areas.

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Design and Development of an E-Learning Environment for the Course of Electrical Circuit Analysis

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Abstract

E-learning is an educational approach that combines different types of multimedia technologies to ensure better education experiences for students and teachers. Today, it is a popular approach among especially teachers and educators. In this sense, this paper describes a web based e-learning system that was designed and developed to be used in the "Electrical Circuit Analysis" course of electrical engineering education given at Afyon Kocatepe University. The developed system includes many lesson content pages that include content texts and some interactive simulations designed with Flash technology. Furthermore, the system also employs some online communication and assessment tools developed for teachers and students. In order to evaluate its effectiveness, the system was actively used within an experimental evaluation process. According to the obtained results, the developed system improves students' achievements on the course of Electrical Circuit Analysis and provides an effective way in engineering education.

Keywords: E-learning; web based education system; interactive learning environments; interactive simulations; blended learning

Introduction

The e-learning method allows teachers and educators to provide educational materials and the related knowledge to a wide-range of learners by using more effective and efficient communication channels. In a typical e-learning scenario, learners are not required to attend classrooms to follow face-to-face lecture parts of the given courses. Rather, they are enabled to join special course sessions and to establish contact with other learners or teachers via some advanced tools. All of these activities are performed with the support of the conventional or modern telecommunication infrastructure (Kambourakis, Kontoni, Rouskas, & Gritza, 2007).

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The use of computer and Internet technologies enables educators and learners to take advantage of e-learning systems from all over the world. So, enormous research efforts have been made to design and develop different types of e-learning systems, especially during the last few years (Takahama et al., 2005). As a result of rapid improvements in both computer and Internet technologies, features and functions of e-learning systems have been improved. It has also become easier to access online lesson content and interactive, electronic applications or tools from anywhere, at anytime. At this point, internet and the related technologies have an important role to play in all of these improvements and changes (Deperlioglu & Kose, 2010; Jou, 2005).

Nowadays, researchers place emphasis upon, not only developing improved and effective e-learning systems, but also providing more advanced and interactive e-learning environments and applications that enable teachers to make technical courses more attractive and effective for students. At this point, it is important to use more effective methods and techniques to present technical problems or complex course subjects as simply as possible. To this end, interactive animations are widely used in today's e-learning systems (Garrison & Kanuka, 2004). Apart from interactive animations, it is also possible to develop applications that enable students to combine the skills, knowledge, and competences required in the academic and laboratory environments (Cockbain, Blyth, Bovill, & Morss, 2009). These might be described as virtual laboratories and simulation programs that are developed for specific course subjects. Virtual laboratories and simulation programs are widely used, especially in higher education institutions, to provide the complex levels of interactivity needed by students (Pivic, 2007; Pulman, Scammell, & Martin, 2009; Yang & Liu, 2007). In addition to virtual laboratories and simulation programs, there are also many different e-learning applications and systems that were introduced in the literature and developed for specific course subjects by using well-known programming and development environments like Java™, Macromedia Shockwave™ and Macromedia Director™ (Drofenik, Kolar, van Duijsen, & Bauer; 2001; Gilbert, Wang, & Sim, 2005; Lazaridis, Paparrizos, Samaras, & Sifaleras, 2007; Méndez, Lorenzo, Acosta, Torres, & González, 2006; Ong, 2006; Toral, Barrero, Martínez-Torres, & Gallardo, 2007).

In order to provide effective e-learning experiences for students, it is also important to consider two different aspects of e-learning systems and applications: firstly, the e-learning activity platform, which is a complex environment with a number of integrated tools for teaching, learning, communicating and managing lesson contents or materials, and secondly, the didactic module, which is the educational content provided through the related activity platform (Costabile, Lanzilotti, Plantamura, & Roselli, 2005). At this point, ensuring harmony between activity platform and the didactic module is an important aspect of system design.

This paper describes a web based e-learning system that was designed and developed to be used in the "Electrical Circuit Analysis" course of electrical engineering education given at Afyon Kocatepe University, Turkey. The system is currently used within a mixed learning model that was designed and developed to be used for electrical engineering courses given at the Afyon Kocatepe University. At this point, a blended learning approach is used, which employs different types of learning and teaching methods for different in education processes. In this way, advantages of different education methods are combined in a single model. A community of learning and investigation is also facilitated by encouraging discussion, debate, and negotiation, which are known as attributes of higher education (Garrison & Kanuka, 2004).

The rest of the paper is structured as follows.

- The second section describes the main structure and some basic features of the e-learning system.

- The third section explains how to use the features of the e-learning interfaces and tools. In this way, educational activities that can be performed on the system are also described briefly.
- The fourth section is devoted to the experiment process, which were performed to evaluate effectiveness of the system.
- The fifth section outlines the conclusions that have been reached with the study and explains some future works.

A Web Based E-Learning System for Electrical Circuit Analysis Course

The system that was developed in this study provides an effective and efficient web platform where students and teachers can use different educational tools to perform related learning and teaching activities in the Electrical Circuit Analysis course. In order to ensure an effective educational environment, the system has been designed and developed with the support of different technologies. It is also important that both database (table groups associated with different sections of the system) and interface (page groups associated with different features and functions of the system) parts of the system have been formed on a structural scheme. The structure of the system is described below.

Main Structure of the Developed System

The system consists of two different parts: the "database system" and the "web platform system". The database system employs three database files, which were designed and developed using Microsoft Access™. Each database file is related to a different part of the system. One of these files is used to store information about system users (administrators, students, and teachers), main system features or functions, and some specific system tools. Another database file is used to store information about related adjustments for assessment tools provided within the system. Questions for system tests and exercises are also stored in this database. The final database file is used to store lesson contents that were added by teachers to the system. The whole database system is connected to the web platform system using various database functions. Figure 1 shows a brief overview of the database system.

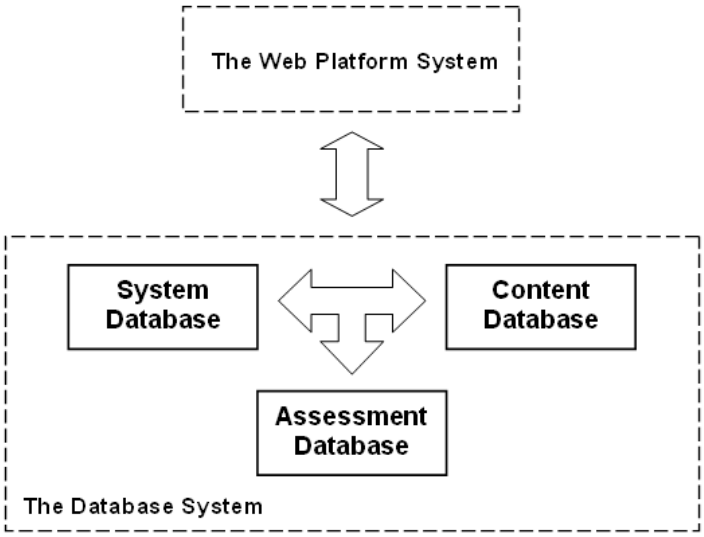

Figure 1. A brief overview of the database system

The web platform system corresponds to web interfaces and tools that are included in the system and provided to administrators, students, or teachers according to their activities in connection with the system. There are three different types of user: administrators, students, and teachers. In order to log into the system, all of these users must type their usernames and passwords on the login page of the system. After logging into the system, administrators can use different management tools to adjust main system features and edit other users' (students and teachers) personal information.

Students and teachers, on the other hand, can use educational tools to perform their own activities on the system.

- Students can use the related tools to view course lesson contents, study on simulations or animations, and perform other learning activities.
- Teachers can adjust features and functions of the educational tools and manage learning activities that are performed by students.

The system provides similar web interfaces for each user type and enables all users to perform their activities easily with the support of simple, fast and interactive features and functions. Figure 2 shows a brief overview of the web platform system.

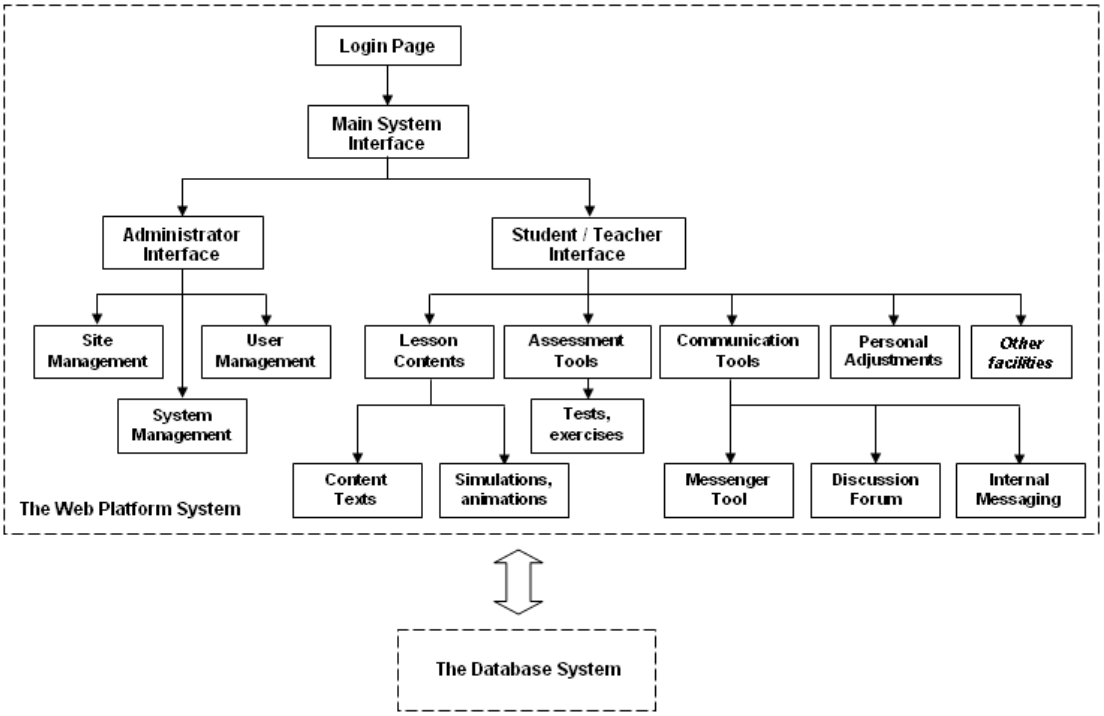

Figure 2. A brief overview of the web platform system

A typical online learning process is planned on the system according to students' and teachers' needs during the course.

Educational Activities with the Developed Web Based E-Learning System

The system provides an interactive, simple, and fast interface, which can be used easily by both students and teachers. The main system interface and educational tools are designed and developed by using ASP™ (Active Server Page) technology. In this way, an interactive web environ-

ment, which can perform different system functions according to students' and teachers' requests, is ensured. Currently, the developed web based e-learning system is provided under a LMS (learning management system) named @KU-UZEM. The related LMS is used for both hosting and facilitating the course management. This LMS is hosted at the url: www.uzem.aku.edu.tr

Main System Interface

The main system interface is the web page that is viewed for each student and teacher after the login process. Both students and teachers can use this interface to reach all system tools and perform related activities. Figure 3 shows a screenshot from the main system interface.

Figure 3. A screenshot from the main system interface

The main system interface includes four different panels that direct students and teachers to different parts of the system. There are two tool panels located at either side of the interface. The first of these provides some links for stored course lesson contents, active tests or exercises, and related system help pages. After the login process, students can use these links to view lesson contents, tests, or exercises immediately. Additionally, some statistical information about online users, stored lesson contents, files, etc. is viewed on this panel. The second tool panel includes some links and controls for different system tools provided for students and teachers. Controls and links included in this panel are automatically changed according to the user type as student or teacher. By default, both students and teachers can use some communication tools via this panel. Additionally, there are also some extra tools (calendar, personal diary) provided. This panel also allows teachers to use a small login tool to open more detailed management interface.

The third panel, which is located on the middle of the main system interface, is called the "Activity Panel". The Activity Panel is used to view interfaces of some specific system tools. After clicking on links of the related system tools, interfaces of these tools are automatically viewed on the Activity Panel. By default, system announcements and news are viewed on this panel. The last panel, which is also called "Link Bar", is located on top of the other panels; it employs some

links related to different system tools. There is also a “search box”, which can be used by students and teachers to search a word in the stored course lesson contents.

Management Interfaces

The system provides a detailed management interface that can be used by teachers to arrange and control online learning activities, manage course lesson contents, and adjust some specific features and functions of the educational tools. As mentioned before, this interface can be viewed by using the small login tool that is provided on the right tool panel of the main system interface. The management interface has been designed as similar to a typical admin panel. Thus, it comes with a simple and fast interface.

In the related interface, management activities are provided in separate panels that correspond to options of different educational tools and system functions. After clicking on any link, the corresponding management page is automatically viewed in the right side of the management interface.

In addition to the management interface, which was developed to be used by teachers, the system also includes another management interface that is used by only system administrators. After the login process, the system automatically directs administrators to this management interface - also called the “Admin Panel”. The Admin Panel has been developed with almost same design with the other management interface that is used by teachers. But it includes more options and management tools to adjust main system features and edit other users’ (students and teachers) personal information. On the Admin Panel, it is also possible to view some statistical information about system users, lesson contents, stored files, and some specific features or functions of the system. By using the related options, administrators can also control learning activities and manage course lesson contents.

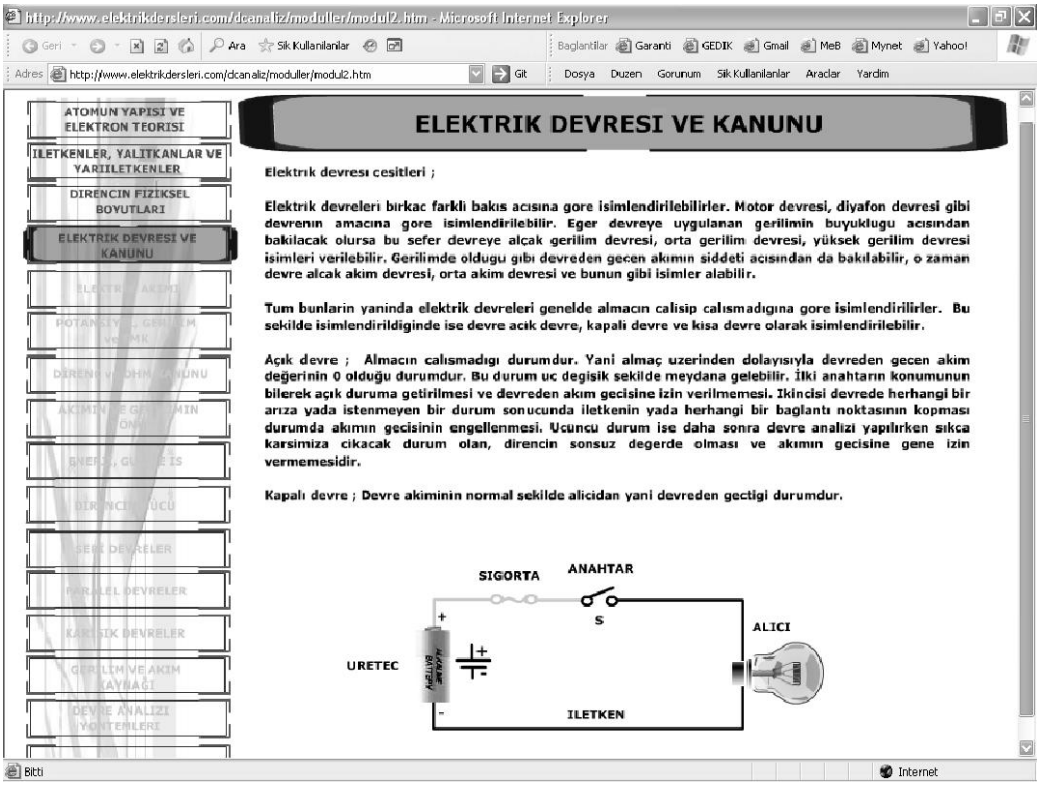

Figure 4. A screenshot from a sample content page

Course Lesson Contents and Interactive Simulations

In order to provide an effective and attractive online learning experience, the system provides visual and interactive lesson contents for the Electrical Circuit Analysis course. It is important to use more effective methods and techniques to enable students to understand and learn technical problems or complex subjects that are provided within a typical course. For this reason, course lesson content has been supported with Flash™ based simulations and animations. In addition to these elements, each course subject is also explained with simple and intelligible sentences. All course lesson contents can be viewed easily by clicking on the links provided on the left tool panel of the main system interface. Figure 4 shows a screenshot from a sample content page.

In the system, there are many different simulations and animations that are included within the provided course subjects. Animations are used to explain important subjects in dynamic and colourful scenes that are prepared using Flash™ technology. It is important that each animation corresponds to a particular lesson content text, which it explains with the help of different visual methods and techniques. Simulations are used to ensure highly interactive learning environments, which enable students to make different types of experiments, examine dynamic events, and evaluate results with the support of virtual tools. Eventually, students can understand and learn by using all of these objects included in course lesson contents of the system. It is also extremely important to note that many of these simulations enable students to perform more complex and advanced experiments than could be performed via mechanic experiment sets. This enables teachers to achieve their teaching goals easier and faster. Figure 5 shows some simulations provided in the system.

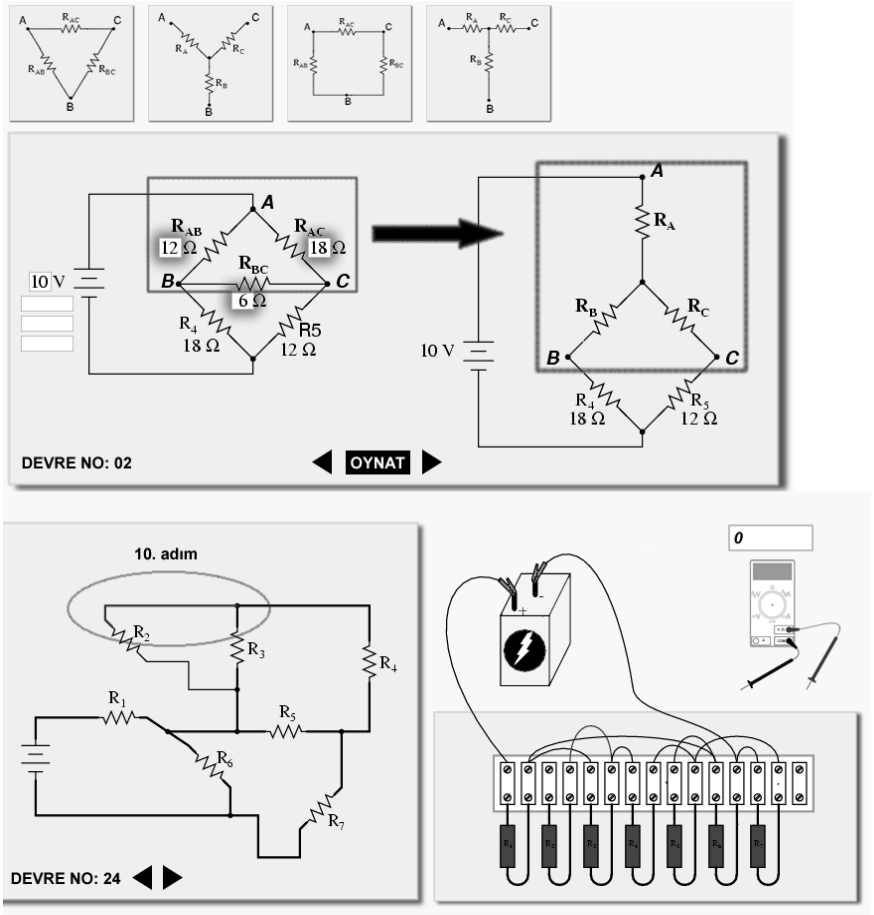

Figure 5. Some simulations provided in the system

Teachers can use the management interface to manage course lesson content. By using the related options, it is possible for teachers to edit any lesson content easily. By default, the Electrical Circuit Analysis course is provided with thirteen subject titles. But it is also possible to add new lesson content subjects to the system by using the related options on the management interface. The system employs a rich text editor that allows teachers to write and format content text and upload images or Flash™ objects to the content environment. Any stored content can also be edited by using this editor. For each item of lesson content, teachers can define a time period in which the content will be active to be viewed by students. It is also possible for teachers to associate any content with active test or exercises stored in the system. In this way, the students are not allowed to view new lesson contents without finishing the related tests or exercises.

Communication Tools

The system employs three different communication tools that can be used to ensure communication function among system users. Both students and teachers can start to use communication tools immediately with the help of provided links or controls on the right tool panel of the main system interface. All of these communication tools aim to improve the quality of the education activities by ensuring effective socialization processes among students and teachers.

- The first communication tool is a messenger application that can be used to make text based chat with other online users. It provides an interactive interface, where the user can see a list of online users. Upon clicking on any username, a chat session is immediately started. By using the related controls, it is possible to adjust user state as “online” or “offline”.
- The second communication tool is a forum tool, which is used to post new personal messages or make comments on existing ones. Forum titles provided for students may only be defined by teachers via the management interface. Discussions that are performed on the forum tool may also be moderated by teachers.
- The final communication tool of the system is an internal messaging tool, which allows students and teachers to send private messages to other users by using the system infrastructure.

Assessment Tools

Within the system, it is possible for students to check their own learning and knowledge levels by taking tests and exercises. Active tests and exercises are listed for students on the left tool panel of the main system interface. Students can take any test or exercise by clicking on the related link. In the system, a typical test includes 25 questions and allows students to finish test in 30 or 35 minutes. On the other hand, exercises are provided with 10 questions and have no time limitation. Figure 6 shows a screenshot from the test page.

At the end of each test and exercise, students are informed about their correct and incorrect answers and also gained total points. At this point, each student’s test and exercise results are stored in the system database. Thus, teachers can examine and evaluate test and exercise results via management interface.

By using the management interface, teachers are enabled to create new tests or exercises and prepare their own questions to be stored in the system database. The system provides a rich text editor, which can be used by teachers to prepare visual and specially formatted test or exercise questions. It is also possible for teachers to prepare and store questions for future use. In the system, five possible answers can be defined for each question. After determining the appropriate questions, a test or exercise can be created by using the related options and controls. For each test or

exercise teachers can define a time period in which the created test or exercise will be active for students. System link of each new test and exercise is automatically added to the related tool panel, by the system.

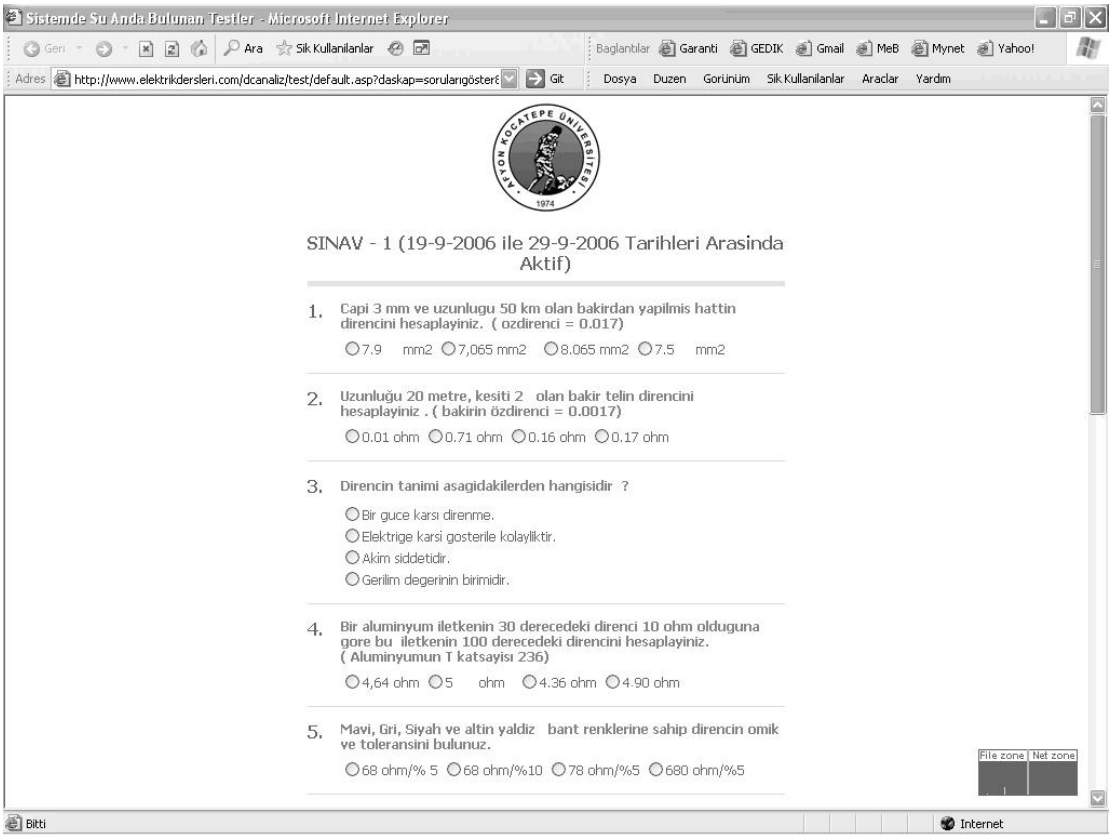

Figure 6. A screenshot from the test page

Evaluation

In order to evaluate the effectiveness of the e-learning system, an experiment, which was formed with an experimental group who used the system in the related learning activities and a control group who participated only in a face-to-face education process, was performed during the Electrical Circuit Analysis course. Additionally, the students who participated in the experimental group were asked to write down their comments about features and functions of the system. These helped the authors in deciding how to continue the development of the web based e-learning system.

Experimental Evaluation and Obtained Results

During the experimental evaluation, 50 students comprised the experimental group; the control group was comprised of another group of 50 students. Thus, a total of 100 students participated in the experiment. In this context, each student's past success rates (student grades) for previously courses were used to obtain "level-headed" groups. Students at similar levels were assigned to different groups to achieve the "balance" between the related groups. Thus, it was assured that the groups were matched before the experimental evaluation process. On the other hand, during the experimental evaluation process, the related learning-teaching activities explained below were performed for the experimental and the control group:

- The experimental group used the Web Based E-Learning system with its all features and functions (interactive interfaces, the related course contents, tests, Flash simulations, etc.) in the related learning activities.
- The control group used only some mechanical experiment sets provided by the teacher.
- For both groups, a total of 14 weeks lecture hours (4 hours for each week) were organized within one term. The related learning-teaching activities were performed for each group, in separately set course laboratories. In this context, the related tutoring supports were also given to the related groups. Additionally, support on usage of the Web Based E-Learning system was also given to the experimental group students.

At the end of the Electrical Circuit Analysis course, students' grades (on the scale of 100) were considered for the experimental evaluation. Table 1 below shows the obtained results for both experimental and control groups.

Table 1. Obtained results for experimental and control groups

	Students who passed the course (%)*	**Mean**	**St dev.**	**Median**
Control group *(50 students)*	44 %	51,93	12,27	54,3
Experimental group *(50 students)*	74 %	74,82	16,95	80,2

As it can be seen in Table 1, the percentage of the students who passed the given Electrical Circuit Analysis course is significantly high in the experimental group. The mean "student grade" of the experimental group is also higher than the value of the control group. As a result, experimental evaluation results show an improved student achievement and learning level after using the developed web based e-learning system. It is concluded that, the system provides effective and efficient approaches and methods for electrical engineering education. Figure 7 represents a graph that shows the number of control and experimental group students in different grade ranges.

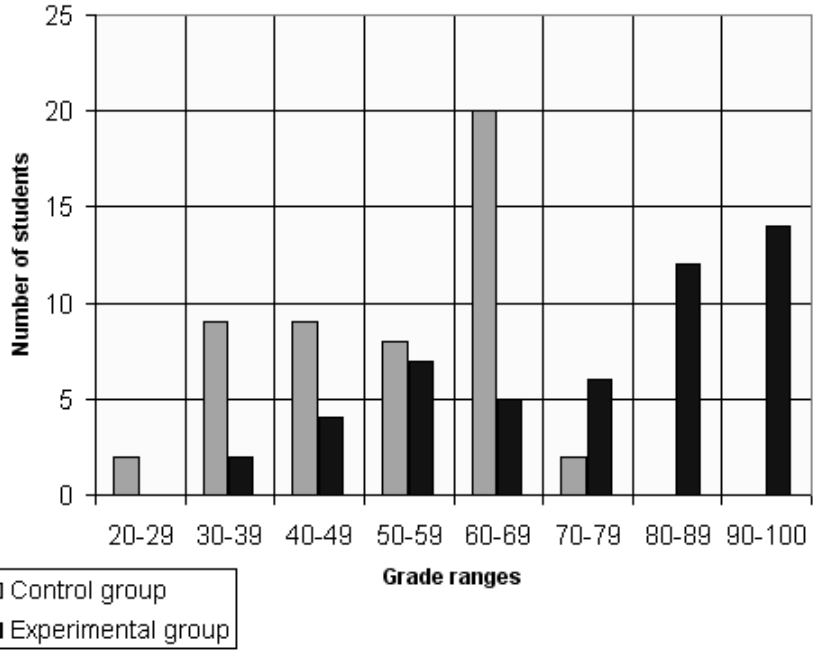

Figure 7. Number of control and experimental group students in different grade ranges

A statistical analysis was carried out to understand if the obtained results between the control and the experimental group grades were similar or not. In order to achieve this, an "independent samples t-test" was performed. Results suggest that the alternative hypothesis (H_1), which states that the means of the two samples are different, cannot be rejected (with 95% confidence).

Student Comments about the Developed System

At the end of the course, students in the experimental group wrote down their comments about features and functions of the system. The most remarkable and interesting comments are listed below:

- "The developed system includes effective simulations and animations that enable me to understand given course subjects easily."
- "As a result of using this system, my academic achievement has improved."
- "I liked the online learning process, which was performed via this system."
- "With the support of this system, fundamentals of electrical circuit analysis can be learned better."
- "This system provides a simple and fast interface."
- "I can not adjust visual features of the system according to my choice. There should be additional system tools that enable me to adjust some visual features of the system."
- "There should be more interactive communication tools like video conferencing in the system."
- "The system should be adapted to other electrical engineering courses."

Conclusions and Future Work

This paper describes a web based e-learning system that was designed and developed to be used in the "Electrical Circuit Analysis" course of electrical engineering education given at Afyon Kocatepe University, Turkey. The system aims to provide an effective and efficient way of teaching electrical circuit analysis, which is an important subject of the electrical engineering course.

Obtained results show that the system has provided an effective and efficient education process for the Electrical Circuit Analysis course. As a result of using the system in learning activities, students' academic achievements and also learning levels were improved greatly. Students were also satisfied with the system and performed online learning activities. According to students, interactive features and functions of the system allowed them to learn technical and complex course subjects better. Students also think that the provided simulations and animations played an important role in enabling them to learn course subjects easily.

Positive results have encouraged authors to think about some future work and continue development of the web based e-learning system. In this sense, the system will be adapted and used in other electrical engineering courses given at the Afyon Kocatepe University. In order to use the system in different courses, some features and functions of the system will be improved and more educational tools will be integrated to the system interface. At this point, students' comments about the system have an important role on this development. In the future, it is also possible to use the system in some master degree electric education courses.

Further future work will include the development of an interactive virtual laboratory application. With this application, both students and teachers will have a chance to prepare their own electri-

cal circuits and work on them by using some application tools. In this way, it will be possible to perform most of electrical experiments that are provided within the electrical engineering courses.

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