The Effectiveness of Streaming Video with Web Based Text in Online Course: Comparative Study on Three Types of Online Instruction for Korean College Students

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This study is to identify whether three types of online instruction (text-based, video-based, and video-based instruction without text) and age category have a different influence on students' comprehension and motivation. Online students were randomly assigned to one of six groups, and they attended two-week online lectures via Course Management System. The comprehension test and the short form of IMMS were implemented when 114 participants accomplished two-week online lectures. The results revealed that using instructional video in online instruction is more effective instructional medium than text only in order to promote learner's motivation. Besides, older adults aged 41-60 are significantly different from younger adults (21-40 years old) in terms of students' comprehension. Furthermore, three types of online instructions are likely to be influenced by age category.

Keywords: Video-Based Instruction, Web-Based Teaching Module, Cognitive Theory of Multimedia Learning, Online Education, Streaming Video

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Introduction

The number of educational institutions offering complete online college degree programs has increased exponentially (NCES, 2009). Numerous studies have compared the academic performance of distance learners with that of traditional learners (Baker, Hale, & Gifford, 1997; Diaz, 2000). Howel, Williams, and Lindsay (2003) suggest that online education is consistent with a constructivist model in which students are responsible for their own learning. Thus, online instruction tends to be more learner-centered (Howell, Williams, & Lindsay, 2003). McVay (2000) also states that online learners are expected to be independent learners who play active roles, control the pace of learning, and engage in interactive learning. Therefore, online learners need to have the capacity to adapt, reflect, evaluate, and learn from their instructors so that they continually improve their knowledge (Moore & Kearsley, 2005).

Understanding critical benefits and elements is important to online instructors. Online education has increased due to the Internet and availability of broadband access. Online courses are available to learners anywhere and anytime. Students indicate that online courses are desirable because of scheduling convenience and convenient learning at their own pace (Navarro & Shoemaker, 2000). The Internet and World Wide Web have become the important delivery mechanisms that allow instructors to plan and manage their courses helping students to track their learning progress (Tantrarungroj, 2008).

It is important for instructional designers or instructors to pay attention to details concerning students' perspectives, distance learners' characteristics, students' satisfaction, and students' learning styles in order to meet the needs of their online students (Gibson, 1998). Furthermore, Gibson (1998) suggests that online instructors and designers should be able to consider critical components (e.g., interaction, online testing, feedback, and access to course materials) by using diverse methods to deliver instructional contents in order to enhance students'

learning. Instructional media are able to serve as powerful aids to encourage learners to construct their knowledge (Kozma, 1994; Mayer, 2003). Smith and Ragan (1999) suggest that streaming media have the potential to enhance learners' retention and motivation.

Literature Review

Cognitive Theory of Multimedia Learning

Mayer (2003) suggests that students can learn more deeply from a well-designed multimedia contents consisting of words and pictures than from traditional modes of communication involving words alone. He also holds that if an instructional method promotes the same kinds of cognitive processing across different media, then it might result in the same benefits across media. The design of multimedia instruction should be based on an understanding of the nature of human learning (Mayer, 2003). Besides, using different technologies does not change the fundamental nature of how human mind works; however, to the extent that instructional technologies are intelligently designed, they are able to serve as powerful aids to human cognition for online students (Kozma, 1994; Mayer, 2003).

Mayer's cognitive theory of multimedia learning (2003) is based on Paivio's dual-coding theory (1986), load theory, and Baddeley's model of working memory (1992) that shows the flow of information between the multimedia presentation memory stores (i.e., sensory memory, working memory, and long-term memory). Dual-coding theory presents a cognitive model of multimedia learning intended to represent the human information processing system. Paivio (1986) explains that verbal and visual systems can be activated independently, but there are interconnections between the two systems that allow dual-coding of information. In Paivio's later study (1986), students construct their knowledge more effectively

when nonverbal and verbal groups in mental representations have connections.

According to cognitive load theory (Sweller, 1988), students might not be able to promote the understanding of the course content if instructional materials have too much extraneous information. Since working memory on information is limited, meaningful learning cannot occur while the processing channel is overloaded (Mousavi, Low, & Sweller, 1995). Mayer (2003) suggests that the cognitive load is balanced when learners process the presented material through their eyes (e.g., animation) and ears (e.g., words presented in narration). In contrast, when pictures and words are both presented visually (e.g., animation and text), visual/pictorial channel can become overloaded. However, auditory/verbal channel is underused.

It is necessary to understand that using a proper instructional method with instructional technology tools and multimedia is effective in online education. Kozma (1994) suggests that media and instructional methods interact with the cognitive and social processes by which knowledge is constructed. Similarly, Clark (1983) insists that effective instructional method will be effectively working into students' instruction. The design of multimedia instruction should be based on an understanding of the nature of human learning. Well-designed instruction with educational technologies can serve as powerful aids to human cognition (Mayer, 2003). Cognition and Technology Group at Vanderbilt (1992) holds that video-based instruction involving a constructivist approach is successful in promoting students' learning as well as enhancing attitudes toward mathematics and instruction. Integration of diverse technologies and combination of proper instructional method into online instruction can enhance students' learning with the promotion of human cognition.

Streaming Video

Shephard (2003) suggests that streaming video is defined as a sequence of moving images that are sent in compressed form over the Internet and displayed by

a viewer program as they arrive. Special software interprets the stream of data and begins to play the sample. While the first part of the sample is being played, the next is being downloaded. The second sample begins seamlessly, and the first is deleted (McGreal & Elliot, 2009). Among a variety of instructional media, video technology is believed to be particularly useful and suitable for problem-based learning because it can convey settings, characters, and action in an interesting way portraying complex and interconnected problems (Cognition and Technology Group at Vanderbilt, 1992; Overbaugh, 1995). Schwartz and Hartman (2007) maintain that video technology provides a powerful way to enhance learning.

Information obtained visually is more memorable, and the simultaneous processing with both auditory and visual information increases learner comprehension and retention (Choi & Johnson, 2005). The advent of affordable, high-quality consumer video technology has greatly increased its use in classroom instruction; particularly in teacher education because streaming video sustains learners' interest for a longer period of time (Beitzel & Derry, 2009; Derry, 2007). Thus, the attributes of the streaming video can enhance students' attention and learning (Boster, Meyer, Roberto, Inge, & Smith, 2006; Hartsell & Yuen, 2006). Finally, the streaming video has been shown to be an effective tool for online education and in face-to-face classroom settings (Mullins-Dove, 2006; Shephard, 2003).

Adults and Online Education

Erickson and Noonan (2010) hold that not only are late-career adults (aged 50-65) satisfied with online delivery, but they actually find their experiences to be more rewarding than their early-career (aged 21-35) and mid-career peers (aged 36-49) despite their differences in technical abilities. They initially require higher levels of technology support and digital interaction. However, after receiving the technical assistance, they perform as good as or better than their younger peers.

In addition, Mykityshyn, Fisk, and Rogers (2002) show in experiments that elderly people profit more from animated or video-based instructions in the use of technical devices than from written manuals because audiovisual presentations can compensate for reduced working memory capacities, reduced integration, and slow cognitive speed. Thorndike (as cited in Gibbons, 2003) was a great believer that all adults could learn no matter their age. He also holds that age is a minor factor in either success or failure but capacity, interest, energy and time are the essentials.

Purpose of the Study

Using instructional video in on/off-line educational settings is getting far more important and frequent to enhance students' learning and motivation. Besides, many researchers suggest that audiovisual tools (e.g., videotape, interactive video, and streaming video) have many learning advantages that enhance students' retention and memories and help students understand effectively about complicated physical or mechanical information (Cognition and Technology Group at Vanderbilt, 1992; Hartsell & Yuen, 2006; Veletsianos, & Navarrete, 2012). In online education with advanced Course Management System, instructional streaming media (e.g., streaming video and streaming audio) can be more conveniently used for online students to enhance their learning. Thus, in this study, it is important to examine the effectiveness of instructional streaming video with/without web-based comparing with the text-based instruction in online education.

Studies based upon instructional technologies show different findings, usually in favor of learning or recall benefits for text over video (DeFleur, Davenport, Cronin, & DeFleur, 1992; Robinson & Davis, 1990), or possibly no difference between text and video in learning or recall (Koehler, Yadav, & Phillips, 2005; Luyben & Warden, 2008). For example, Clark (1983) holds that media are mere delivery of instruction and do not influence student achievement in their learning. On the other hand,

studies suggest that online instructional techniques (e.g., streaming audio, streaming video, video conference, and collaborative online discussions) and appropriate instructional design of online courses impact on students' achievement and satisfaction (Smith, Smith, & Boone, 2000). Therefore, it will be meaningful to examine different types of online instruction with media or technology tools in diverse online settings, which can impact on students' motivation and learning. The primary purpose of this study is to examine whether three types of online instruction (e.g., text-based, video-based, and video-based instruction without text) and age category have a different effect on students' comprehension and motivation.

Research Question

To accomplish the purpose of this study, two research questions are as follows:

Research question one: Do three types of online instruction (e.g., text-based, video-based, and video-based instruction without text) and age have a different effect on students' motivation?

Research question two: Do three types of online instruction (e.g., text-based, video-based, and video-based instruction without text) and age significantly affect content-related comprehension?

Method

Research Design

This study was designed for applied experimental design with quantitative data. A between-groups experimental study was conducted with two posttests (e.g., a short form of IMMS and a content-related comprehension test). This paper

included two experimental groups (e.g., video-based instruction and video-based instruction without text) and one comparison group (e.g., online text-based instruction or web-based text). The web-based text for an instructional material was based on the Cognitive Theory of Multimedia Learning (Mayer, 2003).

The independent variables for this paper were three different types of online instruction (e.g., text-based, video-based, and video-based instruction without text) and age category (e.g., younger adults aged 21-40 and older adults aged 41-60). Text-based instruction was a control group that consists of a web-based text without using instructional streaming video. Video-based instruction and video-based instruction without text were experimental groups that used the instructional streaming video. In addition, the participants of the video-based instruction without reading could get instructional information such as educational goals and objectives for online lectures, and then watched the instructional streaming video. However, they could not get access to whole web-based text which was offered to the group of the video-based instruction.

Table 1. Experimental design (A between-groups experimental design with three levels and age category)

Two week lesson	Before lesson	Right after completing online lesson
$X_{VBI \times YA}$	O(Q)	E (C + M)
$X_{VBI \times OA}$	O(Q)	E(C + M)
$X_{VBIWT \times YA}$	O(Q)	E (C + M)
$X_{VBIWT \times OA}$	O(Q)	E (C + M)
$X_{TBI \times YA}$	O(Q)	E (C + M)
$X_{TBI \times OA}$	O(Q)	E (C + M)

Note. $X_{VBI} \times_{YA}$ = Video-Based Instruction with Online Text and Younger Adults (aged 21-40) (Experimental Treatment), $X_{VBI} \times_{OA}$ =Video-Based Instruction with Online Text and Older Adults (aged 41-60), X_{VBIWT} = Video-Based Instruction without Online Text (Experimental Treatment), X_{TBI} = Text-Based Instruction, O= Observation, Q= Questionnaire for Demographic Information of Participants, E= Examination (Test or Survey), C= Comprehension Test, M= Instructional Motivation.

The dependent variables in this study were a content-related comprehension test on counseling psychology course and a short form of Instructional Materials Motivation Survey (IMMS). The posttests to measure students' comprehension and instructional motivation were administered as soon as the treatments were completed by participants. The comprehension test and modified IMMS were collected by using a paper-and-pencil examination and questionnaire. The following Table 1 shows the design used in this study.

Participants

Participants were randomly assigned to one of six groups, and they attended two online lectures via Course Management System at the online university in Korea for two weeks. A total of 150 students participated in this study and 114 participants completed two-week online lectures (or web-based teaching modules) and two posttests (e.g., a short form of IMMS and a content-related comprehension examination). The target population of this study included the online college students majoring in the field of counseling and psychology in Korea.

Of the 114 online students who participated in this study, 95 students (83.3%) were female and 19 (16.7%) were male. The age range was 21 to 57 ($M = 40.10$). 25 students (21.9%) were freshmen, seven students (6.1%) were sophomores, 73 students (64.0%) were juniors, and 9 students (7.9%) were seniors. The participants' career distributions were as follows: 21 participants (18.4%) hold a professional job, 27 participants (23.7%) worked as officials, 32 participants (28.1%) were housewives and 33 participants (28.9%) were college students without any career. Almost half of participants were college students who had their jobs.

Instruments

This study used a short form of an instructional motivation modified from

Keller's Instructional Materials Motivation Survey (IMMS) and a content-related comprehension examination. A modified short form of IMMS was administered to evaluate the instructional motivation of Korean college students in an online course. The short form of IMMS was modified from the Keller's IMMS. The IMMS includes 36 items in a Likert-type scale and consists of 4 subscales (e.g., Attention, Relevance, Confidence, and Satisfaction) (Keller, 1993). The statements of Keller's IMMS were adjusted to meet the need of this study adding the fifth sub-scale of an external motivation; 19 statements were removed, and three statements were added. The statements in the short form of IMMS were translated into Korean language and examined by four professors to pursue a content validity (Heo & Han, 2011). Prior reliability testing of the IMMS instrument using Cronbach's alpha measure was greater than .81 in all four sub-scales (Attention, Relevance, Confidence, and Satisfaction) and ARCS total score in Keller (1993). The short form of IMMS (20 items) also yielded a high reliability coefficient (Cronbach' alpha = 0.92) (Heo & Han, 2011). The reliability of the modified IMMS produced a Chronbach's coefficient alpha of 0.87 in this study.

This study also implemented the comprehension test that includes the learning objectives of the online lessons on Counseling Psychology. The comprehension test was constructed to measure the content-related comprehension on counseling psychology lectures. The comprehension examination also consisted of 20 multiple-choice questions related to lesson objectives. The comprehension test was developed by a researcher and an instructor who had a professional experience in the online courses. Four professors related to this educational realm of counseling psychology reviewed the comprehension test to check whether the questions corresponded to learning objectives for these online lectures, so that the content validity of comprehension test was ensured. In addition, the split-half reliability of the comprehension test was 0.87.

Treatments

A research setting for this study was an online course via the Course Management System for Korean college students. Three different group treatments (e.g., text-based instruction, video-based instruction, and video-based instruction without text) were given to online students in order to answer research questions for the study. Thus, participants could take one of three different group treatments to deliver instructional materials with or without instructional streaming video. Interaction and feedback were given to the control and experimental groups by an instructor and two graduate assistants via email and a discussion board.

Each online lecture is composed of four main sections. Section one contains a welcome message, the purpose of this lecture, and instructional guidelines. Section two features conversational styled instructional content in a verbal channel with static graphics. Web-based text (for text-based instruction and video-based instruction) is constructed considering the critical effects of multimedia learning (Mayer, 2003). Section three includes instructional streaming video for the experimental groups. Section four has a short quiz to help online students to complete and understand their lessons.

All participants took two online lectures (or Web-based Teaching Modules) for two weeks. During online lectures for two weeks, participants were encouraged to activate online learning and interaction in a discussion board. Participants in the treatment of text-based instruction used web-based text only with static graphics and attached files. Participants in video-based instruction could use online text and instructional streaming video, while the treatment of video-based instruction without text used instructional streaming video with section one web-page including lesson purposes and instructional objectives.

Data Collection and Analysis

This study was conducted in the spring 2012 semester. The researchers asked students to participate in this study with their full agreement. In the first meeting with participants, a researcher informed the students on the purposes and procedures of this study. The participants were assigned randomly into different groups by three types of online instruction and two different age groups (e.g., younger adults of 21-40 age vs. older adults of 41-60 age). During two weeks to complete online lectures, online learning and interaction in a discussion board were monitored by a researcher. In addition, a researcher and an instructor promoted participants to complete online lectures with short quizzes.

Participants in a control group only used online texts with static graphics and attached files, which could allow students to print out instructional content for two-week online lectures. On the other hand, experimental groups (e.g., VBI and VBIWT) received the same instruction with instructional streaming video with/without web-based text. After the completion of two online lectures (or web-based teaching modules), the participants were directed to take a content-related comprehension test and instructional motivation questionnaire. The posttests to measure students' comprehension and instructional motivation were administered when two week online lectures were completed by participants. The comprehension examination and modified IMMS were also collected by using a paper-and-pencil questionnaire and examination.

Quantitative data were analyzed with basic descriptive statistics and a two-way ANOVA. For this study, an alpha level of 0.05 was used as the level of confidence for all statistical tests. Descriptive statistics were used to describe the characteristics of participants. For the research question one, a 3×2 factorial ANOVA was conducted to determine if there are any significant differences in the instructional motivation by different types of online instruction and age category. For the research question two, a two-way ANOVA was used to determine if there are any

significant differences in content-related comprehension examination according to three types of online instruction and age category.

Results

Motivation

The first research question investigated the effect of three online instruction types (or different types of web-based teaching modules). To answer this research question, a 3×2 factorial ANOVA (three types of online instruction × age) was conducted as the means to examine significant differences in the students' motivation.

To examine the effect of three types of media and age in IMMS, data were screened for missing data and outliers, and then the data were examined for the fulfillment of test assumptions. A normality was tested with the Kolmogorov-Smirnov test ($p = .20$ by the age category, $p = .20$ with VBI and TBI, and $p = .093$ with video-based instruction without texts). The normality of distribution of these scores was assumed. Homogeneity of variance was tested with Levene's test ($p = .75$). Therefore, the homogeneity was also assumed.

A 3×2 factorial ANOVA was conducted to examine the mean differences in students' motivation as a function of two independent variables, three types of media and age. Table 2 shows the results of whether three types of media and age category have a different effect on the student motivation. The two-way ANOVA showed that a significant main effect for three types of online instruction was found ($F (2, 108) = 4.25$, $p<.05$, partial $\eta^2 = .073$). However, the main effect for age category (e.g., older adults vs. younger adults) was not significant ($F (1, 108) = 3.13$, $p = .080$, partial $\eta^2 = .028$). Interaction between three types of instruction and age was not significant ($F (2, 108) = .28$, $p = .759$, partial $\eta^2 = .005$).

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Table 2. The 3×2 Factorial ANOVA on student motivation: (TBI/VB I/VBIWT) × (21-40 /41-55 age)

Source	Level	M	SD	N	F	p	Partial ES
Group	TBI	73.18	9.27	40	4.25	.017*	.073
	VBI	78.68	8.24	40			
	VBIWT	76.85	7.58	34			
Age Category	21-40	74.71	8.35	55	3.13	.080	.028
	41-55	77.59	8.83	59			
Group × Age Category					.28	.759	.005

*p < .05.

Bonferroni's post hoc test was conducted to determine which groups based on a different instruction were significantly different in the students' motivation. In Table 3, results revealed that a VBI group was significantly different from the group that received a text-based instruction in students' motivation. However, the ABIWT group was not significantly different from the other types of online instruction (e.g., video-based instruction and text-based instruction).

Table 3. Multiple comparisons among groups on student motivation

(I) group (n)	(J) group (n)	Mean Difference (I-J)	Std. Error	p
VBI (n=40)	TBI (n=40)	5.50*	1.88	.016
	VBIWT (n=34)	1.82	1.96	.651
TBI (n=40)	VBI (n=40)	-5.50*	1.88	.016
	VBIWT (n=34)	-3.68	1.96	.177

Note: * The mean difference is significant at the .05 level.

Comprehension

The second research question examined the effect of three types of online instruction and age on students' comprehension in the online course. For this research question, a 3×2 factorial ANOVA was conducted to determine the effect of three types of instruction and age on the students' comprehension.

Table 4. The 3×2 factorial ANOVA on content-related comprehension: (TBI/VB I/VBIWT) × (21-40 /41-55 age)

Source	Level	M	SD	N	F	p	Partial ES
Group	TBI	17.50	1.91	40	1.57	.213	.028
	VBI	17.03	1.72	40			
	VBIWT	16.79	1.84	34			
Age Category	21-40	16.73	1.85	55	4.77	.031*	.042
	41-55	17.49	1.75	59			
Group × Age Category					2.15	.122	.038

*$p < .05$.

Table 4 showed the results of whether three types of online instruction and age category have a significant influence on the content-related comprehension. A two-way ANOVA showed that a significant main effect for age category was found ($F(1, 108) = 4.77$, $p < .05$, partial $\eta^2 = .042$). However, the main effect for three types of online instruction was not significant ($F(2, 108) = 1.57$, $p = .213$, partial $\eta^2 = .028$). Although the interaction between online instruction and age was not significant ($F(2, 108) = 2.15$, $p = .122$, partial $\eta^2 = .038$). The treatments according to three types of online instruction were likely to be affected by different levels of age category (Figure 1).
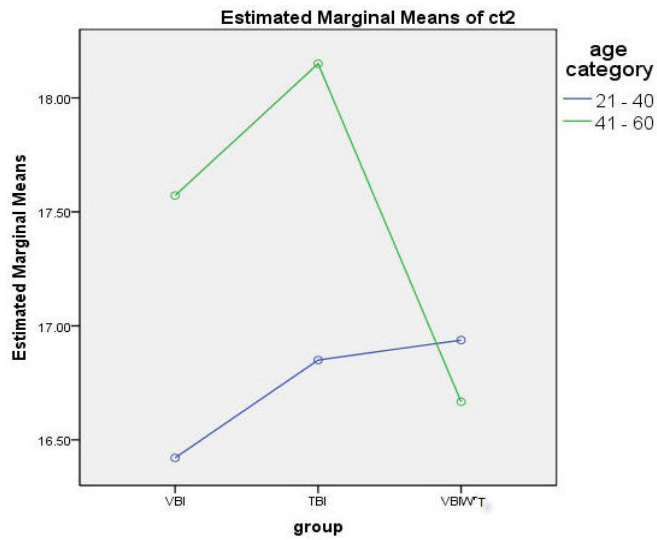
Figure 1. Line plot of interaction between groups and age category

Data were screened for missing data and outliers, and then the data were examined for the fulfillment of test assumptions. In data screening, the ct was transformed to ct2 as a means of reducing the number of outliers. The cases with the scores less than or equal to 12 were recorded as 13. Group sample sizes were fairly equivalent. In addition, ANOVA is robust to the violation of the normality. Thus, the normality will be assumed. The homogeneity of variance was tested with Levene's test (p=.21). Therefore, the homogeneity will be assumed.

The older adults (M = 17.49) got higher scores than the younger adults (M = 16.73) on the comprehension test. Table 5 showed that the older adults were higher than younger adults on the comprehension test in two groups of VBI and TBI. However, the participants of 41-60 years old that took a video-based instruction without text showed rather lower scores than the participants aged 21-40 in the content-related comprehension.

Table 5. The Means of comprehension test according to groups by online instruction and age

Group	Age (*n*)	Mean	N
TBI	21-40 age group (*n*=20)	16.85	20
	41-60 age group (*n*=20)	18.15*	20
	Total	17.50	40
VBI	21-40 age group (*n*=19)	16.42	19
	41-60 age group (*n*=21)	17.57	21
	Total	17.03	40
VBIWT	21-40 age group (*n*=16)	16.94	16
	41-60 age group (*n*=18)	16.67	18
	Total	16.79	34

Note: * The highest mean.

Conclusion and Discussion

This study revealed several important conclusions from the findings based on two research questions.

Student Motivation Analysis between Three Types of Online Instruction and Age

In the first research question, results reveal that a video-based instruction with text is more effective to enhance students' motivation than text only. Besides, using streaming media (e.g., video clips) with/without text in online instruction can be effective to motivate online students positively. According to the results of the study, the video-based instruction in online education is more effective for students' motivation than the text-based instruction.

This result for the student motivation is congruent with previous studies that video technologies can help students to pay better attention and increase their motivation (Bennett & Glover, 2008; Yadav et al., 2011; Zhang, Zhou, Briggs, & Nunamaker, 2006). In terms of online educational circumstances, embedded steaming video (or instructional video technologies) help students to have more positive motivation than using text only (Choi & Johnson, 2005;. Tantrarungroj, 2008). In particular, Kozma (1994) suggests that using instructional media as a vehicle of delivering instruction can be served as powerful aids to interact with other educational factors (e.g., contexts, social processes, motivation, satisfaction, etc). Using instructional technologies with effective multimedia design have the potential to encourage learners to construct their knowledge (Kozma, 1994; Mayer, 2003).

Results revealed that using instructional video clips in online instruction can be more effective educational medium than text. This result revealed that three types of online instruction (e.g., TBI, VBI, and VBIWT) can have a significant effect on student motivation in this online course. No significant differences between older adults and younger adults are found in the students' motivation. Nonetheless, the results show that older adults ($M = 77.59$) have the potential to be more positively motivated than younger adults ($M = 74.71$) in online education.

Student Comprehension Analysis between Three Types of Online Instruction and Age

In the results of the second research question, the three types of online instruction do not have a different effect on students' comprehension as evaluated by 20 multiple-choice questions. Older adults aged 41-60 are significantly better than younger adults of 21-40 in the students' comprehension. The treatments according to three types of online instruction (e.g., TBI, VBI, and VBIWT) are likely to be influenced by the age category (older adults vs. younger adults).

Three types of online instruction do not have a different influence on the content-related comprehension in the online education. The result for student comprehension is congruent with previous studies that reveal that adding educational media to instructions does not benefit students to enhance their learning in a cognitive realm (Koehler et al., 2005; Luyben & Warden, 2008). In other words, instructional video (or streaming video) does not have the potential to enhance the student comprehension more significantly than the traditional text only (Choi, 2006; Debuse, Hede, & Lawley, 2009; Tantraungroj, 2008). Clark (1983) insists that effective instructional methods will work effectively students' learning regardless of media. Consequently, the results of the study for students' comprehension show that three types of online instruction do not have a different effect on students' learning. Yadav et al. (2011) suggest that video is more powerful than text in the affective/engagement realm, but video and text have the similar effects as indicated by the cognitive processing, cognitive dissonance, and recall of information.

Age category (older adults vs. younger adults) has a significant effect on the content-related comprehension in this online course. Older adults aged 41-60 have significantly better comprehension than younger adults aged 21-40. Erickson and Noonan (2010) suggest that late-career adults perform as good as or better than their younger peers (e.g., early career and mid-career adults) when receiving the technical assistance with the evaluation of pre/posttest on case-based learning. Miles, as well as Thorndike, discover that older adults can perform as well as younger adults when speed is not involved in their tasks (as cited in Gibbons, 2003).

Although the interaction effect between three types of online instruction and age is not significant ($F(2, 108) = 2.15$, $p = .122$, partial $\eta^2 = .038$), three types of online instruction are likely to be affected by the different adults' age groups. The web-based text only (or text-based instruction) has the potential to promote the content-related comprehension more effectively than video-based instruction with/without text for older adults aged 41-60. However, video-based instruction without text in

the online course is likely to enhance the comprehension of younger adults aged 21-40 more successfully than text only and video-based instruction with text. Therefore, in the online education, the age factor should be considered to enhance students' comprehension. Besides, the different age groups of adults are likely to be affected by different types of online instruction including web-based text and streaming video in the online education. Thus, online instructors might be able to provide well-designed web-based text to older adults, and offer good-quality streaming video with positive motivation for younger adults in order to enhance their cognition /understanding in various online settings.

Recommendations

Recommendations and limitations have been established from the crucial findings of this study for online teachers and further researches. According to findings in this study, the use of video in the online education promotes motivation for online students. Learners can be given the multimedia instruction including diverse instructional technologies or instructional streaming media (e.g., streaming video or audio) to promote students' motivation. However, the findings of this study also suggest that the effect for students' comprehension does not show any significant influence according to the different types of online instruction. Recently, according to development of web-based course management system, instructors in diverse online courses can efficiently provide their learners with diverse media or web-based technologies (Emiroglu, 2007). Thus, online students can gain personalized access to effective streaming media or web-based technologies according to their learning styles and preferences on different instructional media through the Course Management System. Thus, applying diverse instructional media will be important for students who have different learning styles to promote their motivation and satisfaction. The effectiveness of the application of diverse

media can be examined by online instructors and researchers in order to develop effective online instruction.

This study put a strong emphasis on the statistical analyses of student motivation and comprehension through quantitative data. It is crucial to examine whether instructional streaming media have an influence on diverse online educational factors (e.g., feedback, teacher-student and/or student-student interaction, and responsibility). Feedback, comfortableness in using diverse technologies, responsibility, teacher-student interaction, and successful learning experiences can be critical elements for the success of independent learning in online education. Accordingly, further studies will be able to investigate whether diverse streaming media or instructional technologies have a different effect on the various factors (e.g., feedback, interaction, effectiveness, easiness on using educational technologies, responsibility, etc.) for successful online education.

References

Baddeley, A. (1992). Working memory. *Science, 255,* 556-559.

Baker, W., Hale, T., & Gifford, B. R. (1997). From theory to implementation: The mediated approach to computer-mediated instruction, learning, and assessment. *Education Review, 32*(5). Retrieved December 20, 2011 from http://net.educause.edu/apps/er/review/reviewarticles/32542.html.

Beitzel, B. D., & Derry, S. J. (2009). When the book is better than the movie: How contrasting video cases influence text learning. *J. Educational Computing Research, 40*(3), 337-355.

Bennett, P., & Glover, P. (2008). Video streaming: Implementation and evaluation in an undergraduate nursing program. *Nurse Education Today, 28*, 253-258.

Boster, F., Meyer, G., Roberto, A., Inge, C., & Smith, R. (2006). Some effects of video streaming on educational achievement. *Communication Education, 55*(1), 46-62.

Choi, H. (2006). *The effect of problem-based video instruction on learner satisfaction, comprehension, and retention in college courses.* Doctoral dissertation, university of Illinois at Urbana-Champaign, Illinois.

Choi, H., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *The American Journal of Distance Education, 19*(4), 215-227.

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53*(4), 445-459.

Cognition and Technology Group at Vanderbilt (1992). An anchored instruction approach to cognitive skills acquisition and intelligent tutoring. In J. W. Regian & V.J. Shute (Eds.), *Cognitive approaches to automated instruction* (pp.135-170). Hillsdale, NJ: Erlbaum.

Debuse, J. C., Hede, A., & Lawley, M. (2009). Learning efficacy of simultaneous audio and on- screen text in online lectures. *Australasian Journal of Educational*

Technology, 25(5), 748-762.

DeFleur, M. L., Davenport, L., Cronin, M., & DeFleur, M. (1992). Audience recall of news stories presented by newspaper, computer, television and radio. *Journalism Quarterly, 69*(4), 1010-1022.

Derry, S. J. (2007). *Guidelines for video research in education (Ed.).* Chicago: Data Research and Development Center.

Diaz, D. (2000). *Comparison of student characteristics, and evaluation of student success in an online health education course.* Unpublished doctoral dissertation, Nova Southeastern University, California.

Emiroglu, B. G. (2007). *Multimedia enhanced course management system: Web based interactive application development for universities.* Paper presented at the international Educational Technology (IETC) Conference, Turkish Republic of Northern Cyrus.

Erickson, A. S., & Noonan, P. M. (2010). *Late-career adults in online education: A rewarding experience for individuals ages 50 to 65.* Retrieved February 13, 2012 from http://jolt.merlot.org/vol6no2/erickson_0610.htm.

Gibbons, L. R. (2003). *Older adults learning online technologies: A qualitative case study of the experience and the process.* Doctoral dissertation, Virginia Polytechnic Institute and State University, Virginia.

Gibson, C. (1998). The distance learner's academic self-concept. In C. Gibson (Ed.), *Distance learners in high education: Institutional responses for quality outcomes* (pp.65-76). Madison, WI: Atwood Publications.

Hartsell, T., & Yuen, S. (2006). Video streaming in online learning. *AACE Journal, 14*, 31-43.

Heo, J., & Han, S. (2011). The college students' satisfaction related to expectation and interaction in the online counseling courses. *Educational Technology International, 12*(2), 117-134.

Howell, S., Williams, P., & Lindsay, N. (2003). *Thirty-two trends affecting distance education: An informed foundation for strategic planning.* Retrieved May 20, 2011,

from http://www.westga.edu/~distance/ojdla/fall63/howell63.html.

Keller, J. M. (1993). *Manual for instructional materials motivational survey (IMMS).* Tallahassee, FL.

Koehler, M., Yadav, A., & Phillips, M. (2005). What is video good for? Examining how media and story genre interact. *Journal of Educational Multimedia and Hypermedia, 14*(3), 247-272.

Kozma, R. B. (1994). Will media influence learning? Reframing the debate. *Educational Technology Research and Development, 42*(2), 7-19.

Luyben, P. D., & Warden, K. B. (2008). Comparative effectives of video-plus-text versus text only instructional formats on acquisition and generalization of concept learning to real life situations. *J. Educational Technology Systems, 37*(2), 159-174.

Mayer, R. E. (2003). The promise of multimedia learning: Using the same instructional design methods across different media. *Learning and Instruction, 13*(2), 125-139.

McGreal, R., & Elliott, M. (2009). Technologies of online learning (E-learning). In T. Anderson (2nd Ed.), *The theory and practice of online learning* (pp.143-165), Edmonton, AB: AUPRESS.

McVay, M. (2000). *How to be successful distance learning student: Learning on the Internet (2nd ed.).* Boston: Pearson Custom.

Moore, M., & Kearsley, G. (2005). *Distance education: A systems view (2nd ed.).* Belmont, CA: Thomson Wadsworth.

Mousavi, S., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology, 87,* 319-334.

Mullins-Dove, T. (2006). Streaming video and distance education. *Distance Learning, 3*(4), 6-71.

Mykityshyn, A., Fisk, A. D., & Rogers, W. A. (2002). Learning to use a home medical device: Mediating age-related differences with training. *Human Factors,*

44, 354-364.

Navarro, P., & Shoemaker, J. (2000). Performance and perceptions of distance learners in cyberspace. *The American Journal of Distance Education, 14*(2), 1-17.

National Center for Education Statistics (NCES). (2009). *Distance education at degree-granting postsecondary institutions 2006-2007.* Retrieved January 2nd, 2011, from http://nces.ed.gov/surveys/peqis/downloads.asp#p6.

Overbaught, R. C. (1995). The efficacy of interactive video for teaching basic techniques of lassroom management of pre-service teachers. *Computers in Human Behaviors 11*(3-4), 511-527.

Paivio, A. (1986). *Mental representations: A dual coding approach.* Oxford, England; Oxford University Press.

Robinson, J. P., & Davis, D. K. (1990). Television news and the informed public: An information processing approach. *Journal of Communication, 40*(3), 106-119.

Schwartz, D. L., & Hartman, K. (2007). It's not television anymore: Designing digital video for learning and assessment. In R. Goldman, R. Pea, B. Barron & S. J. Derry (Eds.), *Video research in the learning sciences* (pp.335-348). Mahwah, NJ: Lawrence Erlbaum Associates.

Shephard, K. (2003). Questioning, promoting and evaluating the use of streaming video to support student learning. *British Journal of Educational Technology, 34*, 295-308.

Smith, P., & Ragan, T. (1999). *Instructional design.* Hoboken, NJ: Wiley & Sons Publishing.

Smith, S., Smith, S., & Boone, R. (2000). Increasing access to teacher preparation: The effectiveness of traditional instructional methods in an online environment. *Journal of Special Education Technology, 15*(2), 37-46.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*, 257-285.

Tantrarungroj, P. (2008). *Effect of embedded streaming video strategy in an online learning environment on the learning neuroscience.* Doctoral Dissertation, Indiana State

University, Indiana.

Veletsianos, G., & Navarrete, C. (2012). Online social networks as formal learning environments: Learner experiences and activities. *The International Review of Research in Open and Distance Learning, 13*(1), 144-166.

Yadav, A., Phillips, M. M., Lundeberg, M. A., Koehler, M. J., Hilden, K., & Dirkin, K. H. (2011). If a picture is worth a thousand words is video worth a million? Differences in affective and cognitive processing of video and text cases. *Journal of Computing in Higher Education, 23,* 15-37.

Zhang, D., Zhou, L., Briggs, R., & Nunamaker, J. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information* & *Management, 43*(1), 15-27.

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