HEARD BUT NOT SEEN: INSTRUCTOR-LED VIDEO AND ITS EFFECT ON LEARNING

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Educators and instructional designers are seeking ways to increase levels of learning. One of the ways this is being done is through cognitive load theory which attempts to reduce cognitive load through a better understanding of working memory and the factors that impact its function. Past studies have found that working memory processes visual and auditory information using separate and non-sharable resources (dual coding theory) and that by properly utilizing multimedia elements, information processing in working memory is more efficient (multimedia learning). What is not known is the effect that instructor-led video, which uses the visual channel but delivers no information, has on the cognitive load of the learner. Further, will the introduction of multimedia elements make the information processing of the learner more efficient? This study examined three ways in which instructional designers may create a more efficient learning environment through a better understanding of multimedia learning. First, by using the theories of multimedia learning, I examined a more efficient use of sensory memory. By minimizing extraneous load, which communication theory calls noise, on working memory through increased utilization of the visual and auditory channels, the effectiveness of instruction was increased. Secondly, the multimedia effect, defined as using visual helps and guides with spoken and written text, was shown to assist working memory in processing new information into existing schema. Last, by using the personalization principle set forth by Clark and Mayer (2008), I used both the video feed and multimedia together to foster a more social or conversational presentation to the learner.

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CHAPTER 1

INTRODUCTION

With the ever growing call for multimedia instruction in education, and the growth of learning on demand systems, educational institutions are discovering the need to develop complex computer and video based learning environments. These new learning environments are rich with multimedia, spanning multiple delivery methods from CD-ROMs, computer software, online learning, streaming video, etc. This leads educators and instructional designers to develop instructional methods which incorporate these multimedia rich learning environments, even though much of the available research in education has yet to develop and design effective multimedia instructions (Tabbers, Martens, & Merrienboer, 2004). Indeed, many instructional designers will impose extraneous cognitive load on the learner due to a lack of understanding of the cognitive makeup of learning (Paas, Renkl, & Sweller, 2003). The book E-learning and the Science of Instruction (Clark & Mayer, 2003) states that an essential part of any e-learning courseware are the instructional methods that support rather than defeat the human learning process (11).

Cognitive load theory has brought forward several theories of how the brain processes new learning. One key element that has arisen from this research is the importance of working memory and the different variables that impact its management of new information. Working memory processes new information coming in through our senses (sensory memory) and then merges it with the information already stored in our long term memory (schema theory) to create new knowledge (learning). This study looked specifically at how to minimize extraneous load by using the theories of multimedia learning (Clark & Mayer, 2003; Mayer, 2001), and how cognitive load can be enhanced through sensory memory management by looking at the multimedia effect.

Statement of the Problem

Educators and instructional designers are seeking ways to increase levels of learning. One of the ways this is being done is through cognitive load theory which attempts to reduce cognitive load through a better understanding of working memory and the factors that impact its function. Past studies have found that working memory processes visual and auditory information using separate and non-sharable resources (dual coding theory) and that by properly utilizing multimedia elements, information processing in working memory is more efficient (multimedia learning). What is not known is the effect that instructor led video, which uses the visual channel but delivers no information, has on the cognitive load of the learner and, will the introduction of multimedia elements make the information processing of the learner more efficient?

This study examined three ways in which instructional designers may create a more efficient learning environment through a better understanding of multimedia learning. First, by using the theories of multimedia learning, we examined a more efficient use of sensory memory. By minimizing extraneous load, which communication theory calls noise, on working memory through increased utilization of the visual and auditory channels, the effectiveness of instruction was increased. This was accomplished by limiting extraneous load created by the usage of the instructor video feed which offers no learning content to working memory through either the auditory or visual channels. Secondly, the multimedia effect, defined as using visual helps and guides with spoken and written text, was shown to assist working memory in processing new information into existing schema. Last, by using the personalization principle set forth by Clark and Mayer (2008), we will use both the video feed and multimedia together to foster a more social or conversational presentation to the learner.

Significance

Current research into the importance of each major section of instructional delivery systems (i.e. multimedia elements, efficiency of bandwidth usage, spoken versus written text, cohesion of the learning objects etc.) is demonstrating unequivocally that further empirical study into these areas must be done (Kirschner, 2002). Research has shown that the spoken instruction of the intrinsic information is important in the processing of working memory (Mayer, Heiser, & Lonn, 2001). It has also shown that the multimedia elements that assist working memory in creating, managing, and processing this information into schema development are also important to learning (Kalyuga, Chandler, & Sweller, 1999). However, the role of video feed of the instructor lecturing remains unclear.

Statement of Purpose

The purpose of this study was to determine the relative contributions of instructor led video and multimedia to learning.

Research Questions

Research in cognitive load theory has led to the question: “What impact does the video feed of the instructor delivering information via lecture have on learning?” Also, “How will multimedia impact the learning?” If the same instructional objective is achieved by using only the audio channel and no impact on learning is found by the presence or lack of presence of instructor video feed, then it can be deemed to be truly extraneous. Also, the effect that multimedia will have on learning will yield insight into a better understanding of learning with technology in education.

1. What effect does the instructor video feed have on learning?
2. What impact does multimedia have on learning?

Hypothesis

This study tested three hypotheses.

1. There will be no statistically significant difference between instruction delivered with instructor led video and instruction delivered without instructor led video.
2. There will be no statistically significant difference between instruction delivered with multimedia elements and instruction delivered without multimedia elements.
3. There will be no significant interaction effect between instructor led video and multimedia elements in instruction.

CHAPTER 2

LITERATURE REVIEW

One of the most exciting fields of study to grasp this problem in the last decade is cognitive load theory which was introduced in the late 1980's (Paas et al., 2003; Sweller, Merrienboer, & Paas, 1998) and only in the last decade has its position as a major theory providing a development framework for educators and instructional designers become well established (Paas et al., 2003).

Cognitive Load Theory

Cognitive load theory (Sweller, 1988; Sweller, 1994) is rooted in cognitive science and its mental processes of learning, memory and problem solving. Cognitive load theory describes our information processing system as being made up of three distinct types of memory: sensory, working and long term memory. Cognitive load theory seeks to explain not only how these modes of memory work but also how they interact one with another and what affect this has on learning. It also seeks to understand how other factors affect the efficiency of working memory.

As can be seen in Figure 1, sensory memory manages incoming information from our senses. Whether this is sights, sounds, smells, tastes or touch, it all passes through sensory memory. Research has shown that each sensory input is given its own unique partition in sensory memory. Sensory memory is powerful and has incredible bandwidth for funneling information into working memory. However, information in sensory memory must be processed quickly by working memory, i.e. visual information will expire in less than a second and audio information will expire in three seconds or less. If working memory is unavailable to process sensory information, it is simply lost.

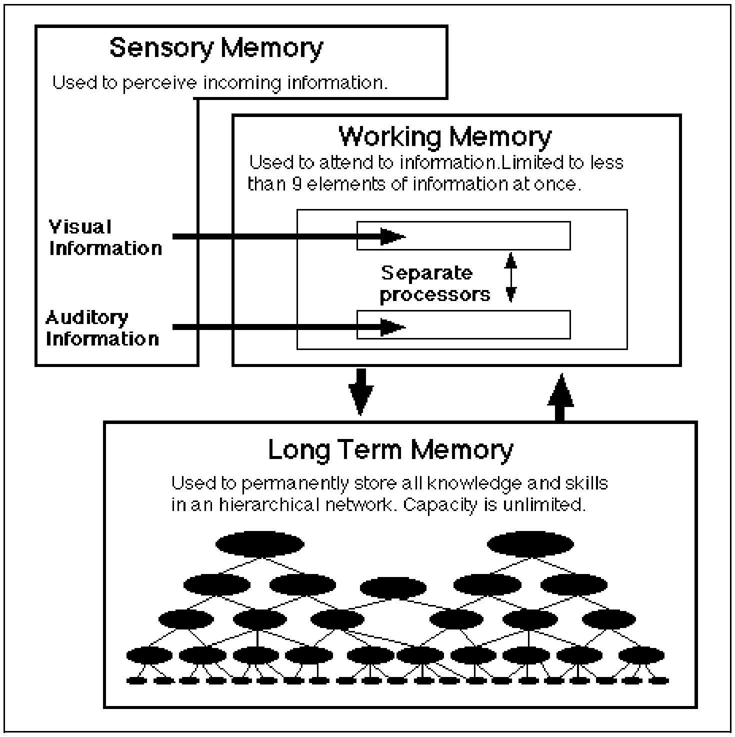


Figure 1. Sensory, Working and Long Term Memory

Long term memory is simply defined as the immeasurable amount of knowledge that is held in our minds. The things that we know such as our name, how to read, how to drive a car, social skills, etc. are all stored in long term memory. There is no one theory that can explain how this works. However, cognitive load theory typically uses schema theory to explain the functions of long term memory.

Working memory

Working memory is the central processor of our brain. It provides us our conscious and is the vehicle behind thought (Sweller, 1999). In a learning environment it takes the incoming information from sensory memory (regardless of whether the new information is visual or auditory) and combines it with pre-existing knowledge already in long term memory and builds the schema connections necessary so the new information can be recalled at a future date. However, like sensory memory it is limited in its capacity and can hold only about 7± pieces of information at a time (Miller, 1956). Therefore, course designers have long understood that the management of both sensory and working memory is limited in resources available to them. Most importantly, a proper understanding of these two types of memory is the only way to get information into, and most importantly, out of long term memory. Again, any information that is not processed by working memory will simply be ignored and will disappear from conscious thought. This effect is often referred to as cognitive overload (Sweller, 1999).

There are three basic constructs of cognitive load theory: intrinsic load, extraneous load and germane load (Paas et al., 2003). It has long been established that working memory has limitations. Intrinsic load is a reference to this limitation. The demands that are placed on memory by the intrinsic nature of the material are a physical limitation of memory (i.e. there are only so many place holders in memory). The brain can only juggle so many pieces of information before it starts to lose them. The only resolution to intrinsic overload is to manage how many of these balls can be juggled at one time by reducing them to a more manageable level. Each item will have to be processed into a schema simultaneously for learning to happen (Chandler & Sweller, 1991; Mayer et al., 2001).

Studies in cognitive load theory have demonstrated that the nature of the delivery system can cause undue load on working memory known as extraneous load. This extraneous load, or ineffective load, reduces the ability of working memory to process incoming information. In other words the learner may not be able to juggle as many balls if he is being distracted while trying to do so. Put more scientifically, when the manner of presentation and the learning activities are unnecessary and interfere with schema acquisition and automation, it therefore creates undue load and reduces the learner's capacity to learn (Sweller, 1999).

Intrinsic load is the amount of load necessary to understand the material. Extraneous load is the amount of load put in place by the delivery system. Germane load is the learner's effort expended assimilating or automating the new information with existing schemas in working memory (Gerjets & Scheiter, 2003; Paas et al., 2003).

Germane load seems to be the amount of resources used by working memory to process information into schema (Sweller, 1999). Intrinsic load, created by the nature of the material itself, plus extraneous load, created by the delivery system, take up a large portion of the resources within working memory. Germane load is the amount of resources leftover that allow working memory to process this information (Sweller et al., 1998). This unused working memory, due to low intrinsic and low extraneous load, can be directly used for schema construction through controlled cognitive processing designed into the system (Sweller, 1999). According to the information structures put forth by cognitive load theory, the level of prior learning is in direct correlation to the way in which information is managed in working memory (Clark & Mayer, 2003). Since novice learners in the subject field do not have the supporting schemas necessary to process the new intrinsic information, they are more prone to overload. It has often been the case that extraneous load, due to problems with the delivery system, decreases the effectiveness of the instruction (Mayer, 2001). Therefore instructional designers are seeking ways in which to minimize extraneous load and by default increase germane load that the learner may be experiencing due to the design of the delivery system.

Multimedia Learning

Research in cognitive load theory has produced several instructional strategies which have aided instructional designers in developing more effective instructional methods. This study used multimedia learning (Mayer, 2001) because it most closely related to the purposes of this study.

The goal of multimedia learning is to foster meaningful learning through a better understanding of how we process information. Multimedia learning takes three findings/strategies from cognitive load theory. The multimedia designer uses these three principles of cognitive load theory when creating effective multimedia elements (Mayer, 2001). First, dual coding and dual channel research (Baddeley, 1992; Paivio, 1986) has shown that learners process media information differently whether written, spoken, or graphical. Multimedia learning states the course must be engineered to better utilize these media elements to take advantage of the dual coding/channel nature of working memory. Second, multimedia learning combines the factors that contribute to load such as intrinsic and extraneous load (Sweller, 1999; Sweller & Chandler, 1994) and the limits of sensory and working memory (Mayer, 2001; Miller, 1956; Sweller, 1999). Third, multimedia learning engages active processes such as paying attention to relevant information, organizing and then integrating it with other knowledge (Mayer, 2001).

Personalization Principle

An emerging area of study in e-learning is the personalization principle (Clark & Mayer, 2008, p. 157). Simply stated, the personalization principle examines the use of a conversational style rather than a formal writing style when presenting learning material to the distance learner (Moreno & Mayer, 2000, 2004). Evidence has also emerged that suggests that the voice of the speaker also plays an important role and that conversational text may be more effective when heard audibly rather than in written form (Clark & Mayer, 2008, p. 166). Clark and Mayer (2008) also describe pedagogical agents, also known as coaches, which can be cartoon-like characters, talking head video or even virtual reality avatars (168). Recent research in this new area has shown that these pedagogical agents using the personalization principle generated more learning than without (Atkinson, 2002; Moreno, Mayer, Spires, & Lester, 2001). Some of this research has also shown that there does not appear to be a difference whether the agent is a computer animation or a talking head video (Moreno et al., 2001). The voice of the agent also seems to be important to learning. A recent study where some students were learning word problems from an agent with computer generated voice and some from a human voice found that they learned better from the human voice (Atkinson, 2002; Atkinson, Mayer, & Merrill, 2005).

CHAPTER 3

METHODS

This chapter explains the methodology used in carrying out the study from the participants in the study through the analysis of the data collected.

Context

The study took place at the University of North Texas during the spring and fall semester in 2007. The participants were enrolled in either an Introduction to Computer course or Introduction to Computers in Education Course in the College of Education. Since the syllabus of each of these two courses included a sequence titled Introduction to the Internet, it was determined that they were appropriate for the nature of this study.

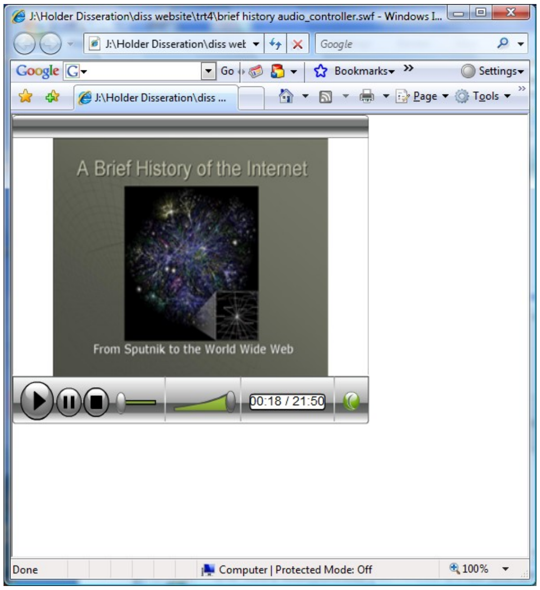
Subjects

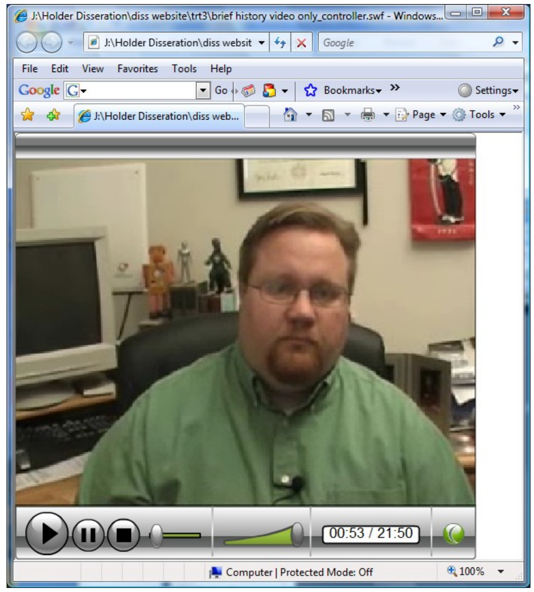
During the spring and fall semester of 2007, one hundred and twenty four students successfully completed the study ranging from freshman to seniors. The faculty of each course presented the study to the student in lieu of the Introduction to the Internet lecture. There were two classes used in this study. First was CECS 1100, an Introduction to Computers Class. This class is predominantly made up of freshman and sophomores. The second class is CECS 4100, Computers in the Classroom. This class is a junior and senior level class for training teachers in the use of technology in their classroom. The score on the quiz at the end was given the same weight as a quiz grade listed in the syllabus. It should be noted that these grades were later changed to completion grades and the actual score from the instrument was removed so as not to negatively impact the students' grade during the course of study. It was felt that since all treatments were not delivered in the same manner it was not prudent to actually assign them their score. However to assist the learners in their motivation to learn they were not told this until after the study.

Procedures

Each participant used an internet browser on a computer connected to the internet to participate in the study. The study was delivered using the web programming language PHP attached to a MySQL database, and consisted of a demographic section, treatment and measurement. The participants first filled out a short demographic survey which contained the following: name, age, academic progress (grade), gender and general contact information (Appendix A). Participants were assured that neither their personal identity nor personal information would be released in the dissertation (Appendix B). Once a participant submitted the demographic survey, the treatment program selected one of four treatments of the same instructional content as seen in Figure 2.

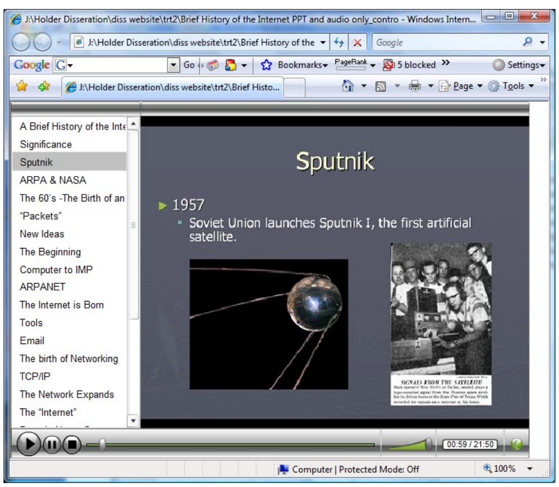
The database used a random reduction rule that randomly assigned the learner to one of the four groups. The next learner was then assigned to one of the three remaining groups. The third learner was assigned to one of the two remaining groups and the fourth was assigned to the remaining group. The fifth learner was assigned to one of four groups and so on until all participants were assigned to a group. This assured randomness in the distribution of the task. After participants viewed the approximately twenty five minutes of instructional material, they were then given the learning assessment (Appendix C). Once submitted to the treatment program, the database recorded the demographic information, version of the treatment, and assessment score to a serial number in the system for later retrieval and analysis. This was a custom developed web engine for creating and managing data. (See Appendix D for more information.)





No video, no multimedia treatment

Video treatment but no multimedia



Multimedia treatment but no video

Both video and multimedia treatment

Figure 2. Screen Shot of the Four Treatments

Task

The task was a 25 minute lesson on the history of the internet ranging from Sputnik and the foundation of ARPA (Advanced Research Project Association) to the commercialization of the internet in the early 1990's. It consisted of a review of the major themes and concepts to set the stage for the learning material followed by a quick summative review to assist in schema construction. Then, the core lesson was delivered to the learners followed by a review of the major themes and concepts to assist working memory in correlating the new information with previously held schema.

This information was chosen to give the research a more universal audience without being too specialized in any one field or curricula. Also, it had the ability to appear relevant to the student but had no actual impact on their course outcome unless the instructor wished it. Therefore the instructor could apply the lesson to a standard e-learning course without the study causing perceived interference with course outcomes.

Independent Variables

Two independent variables were used in this study: (1) instructor led video and (2) supportive multimedia elements. Each independent variable had two conditions; it was present or not present. Instructor led video is the actual video image of the instructor teaching. It has been commonly referred to in the industry as talking head video. Instructor led video is processed by working memory as video in the video channel of sensory memory.

Multimedia presentation was the second independent variable used in this study. Multimedia was utilized in the forms of graphics, charts, outline of program content, etc., thus augmenting the presentation of the core learning material presented in the study. Similar to instructor led video, multimedia also utilizes the video channel of sensory memory in working memory.

Dependent Variable

The dependent variable was a score obtained on a posttest at the end of the 25 minute presentation. At the conclusion of the lesson each student received a 15 question posttest over the material in the lesson. The test reviewed the major concepts, dates, people and places of the lesson. The questions addressed several sections of Bloom's Taxonomy from knowledge and understanding through application and analysis. Each of the four groups received the same posttest.

Experimental Design

An experimental posttest only 2X2 factorial design was used to examine the effects of instructor led video and multimedia learning on the learning task. The design consisted of four equal groups: three treatment groups and one control group.

Table 1

Chart of Groups

		Video	
Multimedia Elements		Present	Not present
	Not present	1	3
	Present	2	4

As seen in Table 1, the groups were arranged as follows:

Group 1 - video was present but not multimedia elements.

Group 2 - both video and multimedia were present.

Group 3 - neither video nor multimedia elements were present.

Group 4 – multimedia was present but not video.

The groups were chosen at random using the distance learning engine developed for the study. Each object was given the next available group in order as follows:

Table 2

Group Assignments

Group	Random	Treatment	Measurement
1	R	X_1	O
2	R	X_2	O
3	R	X_3	O
4	R	X_4	O

A Two -Way Analysis of Variance (ANOVA) was used to analyze the data from each of the four groups. An alpha of .05 was chosen as the minimal alpha for this study.

CHAPTER 4

RESULTS

Dependent variables in the form of quiz scores were obtained at the end of each lesson. Test scores were derived as percentage correct on a 100 point scale. The quiz can be seen in Appendix C. To determine the difference attributed to treatments, the mean of the quiz scores from each group were examined using Two-Way Analysis of Variance (ANOVA) along with Cohen's D for effect size (Cohen, 1988). Group scores descriptive statistics including number of participants, posttest scores and standard deviation of means are presented in Table 3.

Table 3

Descriptive Data

Between-Subject Factors

		Value Label	*N*
Video	1	Present	60
	2	Not Present	64
Multimedia	1	Present	63
	2	Not Present	61

Descriptive Statistics

Dependent Variable: Quiz Score

Video	Multimedia	Mean	Std. Deviation	
Present	Present	81.25	12.29	31
	Not Present	71.55	12.00	29
	Total	76.56	13.00	60
Not Present	Present	75.78	13.73	32
	Not Present	70.29	12.70	32
	Total	73.04	13.41	64
Total	Present	78.47	13.22	63
	Not Present	70.89	12.29	61
	Total	74.74	13.28	124

From table 3 it can be seen that the video only and audio only groups (groups 1 and 3) had virtually identical means (M=71.55, N=29 and M=70.28, N=32). However, group 4, multimedia only, scored slightly higher (M=75.78, N=32) than groups 1 and 3. The best performing group was group 2 with a mean of 81.25 (N=31).

The research questions asked: "What impact does the video feed of the instructor delivering information via lecture have on learning?" and "How will multimedia impact the learning process?" An online learning delivery system was developed to present learners with an environment that tested the three hypotheses. This system had four variants of the same instructional content which resulted in four different treatments.

Fisher's Two-Way Analysis of Variance was used to examine the data further.

Table 4

Two-Way ANOVA

Tests of Between-Subjects Effects

Dependent Variable: Quiz Score

Source	Type III Sum of Squares	df	Mean Square		*Sig.*
Corrected Model	2277.212a	3	759.071	4.694	.004
Intercept	691147.674	1	691147.674	4.274E3	.000
Video	350.601	1	350.601	2.168	.144
Multimedia	1785.428	1	1785.428	11.042	.001
Video * Multimedia	136.885	1	136.885	.847	.359
Error	19404.155	120	161.701		
Total	714389.625	124			
Corrected Total	21681.367	123			

The analysis of variance from Table 4 shows that the data is statistically significant at the .05 level, the main effect for multimedia, F =11.042 (p=.001) with an effect size of d=.083. This main effect indicates that there is a significant difference when multimedia is present. Group 2 and group 4 combined for an average mean of 78.47 and were significantly different from the average mean of 70.89 from group1 and group 3. Video by itself had almost no effect.

Hypothesis 1 – There will be no statistically significant difference between instruction delivered with instructor led video and instruction delivered without instructor led video was accepted.

When video was present the mean was 71.55 and when video was absent the mean was 70.29. This demonstrated an insignificant main effect for video, F=2.168 (p =.144) with an effect size of .017.

Hypothesis 2 - There will be no statistically significant difference between instruction delivered with multimedia elements and instruction delivered without multimedia elements.

As already presented the difference between this main effect was significant. Thus Hypothesis 2 was rejected.

Hypothesis 3 - There will be no significant interaction effect between instructor led video and multimedia elements in instruction.

There was no interaction effect between the individual treatments. Therefore, Hypothesis 3 was accepted.

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CHAPTER 5

DISCUSSION AND CONCLUSIONS

The purpose of this study was to examine how to minimize extraneous load in the learning process by using the theories of multimedia learning. The effect of instructor led video and the effect of multimedia on instruction was analyzed. An online learning system was developed that delivered the content material (titled "A Brief History of the Internet") to the learner. Three treatment groups and one control group were used to establish the effect of instructor led video, multimedia, and the combined effect of both on the learning process. The content was delivered to the learner using Internet Explorer on a computer connected to the internet.

To test the effect of instructor led video and multimedia elements on learning, a new distance learning system was created that delivered the same instruction to the learners in four different ways. The core content of the instruction was delivered through the audio of the instructor speaking. This audio only version became the control and was present in all four versions of the lesson. The video of the instructor lecturing was used to test whether or not the video contributed to learning even though it was not contributing or assisting the learning content. The audio only test was combined with a multimedia file to examine whether or not multimedia, which uses the visual channel, would aid working memory in processing the information to be learned. The fourth and last version combined the audio, video of the instructor and the multimedia together to examine if there was an interaction effect between the three.

As discussed earlier, working memory manages and processes new information that is coming in through the senses (sensory memory) and then merges it with information already stored in our long term memory (schema theory) thus creating new knowledge (learning). This study looked at the theories of multimedia learning and how to minimize extraneous load during the learning process (Clark & Mayer, 2003, 2008; Mayer, 2001). This was accomplished through better management of sensory memory. Specifically, by trying to eliminate extraneous visual information (the talking head of the professor) I hoped to show an increase in learning through a decrease in sensory load.

In the first test I wanted to see if by removing the video of the instructor I would see an increase in learning. The data returned between the groups demonstrated that the video feed had no observable effect. The video of the instructor teaching neither assisted learning nor hindered it. This is evidenced by their virtually identical means. It was thought that extraneous video, in this case the video of the instructor teaching, would have negligible impact on learning. I found this to be true.

In the second test I removed the video of the instructor and replaced it with assistive multimedia. I hoped that there would be a significant increase in learning from simply having audio alone. According to multimedia theory (Mayer, 2001), video of the instructor doesn't contribute in a significant way. However, assistive multimedia (i.e. power point presentation) would assist the learner by utilizing the processing power of the visual channel through schema construction (Mayer, 2001) and help organize and process the new information coming in through the audio channel. In the study I found that there was a significant increase in learning from multimedia.

In keeping with our findings in the literature review, multimedia proved to be an effective tool to increase the effectiveness of learning systems. However, when the means for multimedia are examined more closely (group 2, M=81.25, N= 31) (group 4, M=75.78, N=32) the cause for the significance can be observed. In group 2 both video and multimedia were present and contributed to the mean (*M*=81.25, *N*= 31). When multimedia was used independently of video the effect was not as pronounced (group 4, *M*=75.78, *N*=32). By itself group 4 does not have a large enough impact to significantly impact learning. This led to the discussion of the personalization principal to attempt to explain why video combined with multimedia had such a strong effect.

Using the personalization principle (Clark & Mayer, 2008), I believe that using the video in conjunction with the multimedia elements in a personal and conversational style, created a social presence with the learner similar to being in a conversation with the author (176). All groups were presented with the same content in a conversational or personal style. However, it wasn't until the instructor led video was combined with multimedia that significant results in learning were evident.

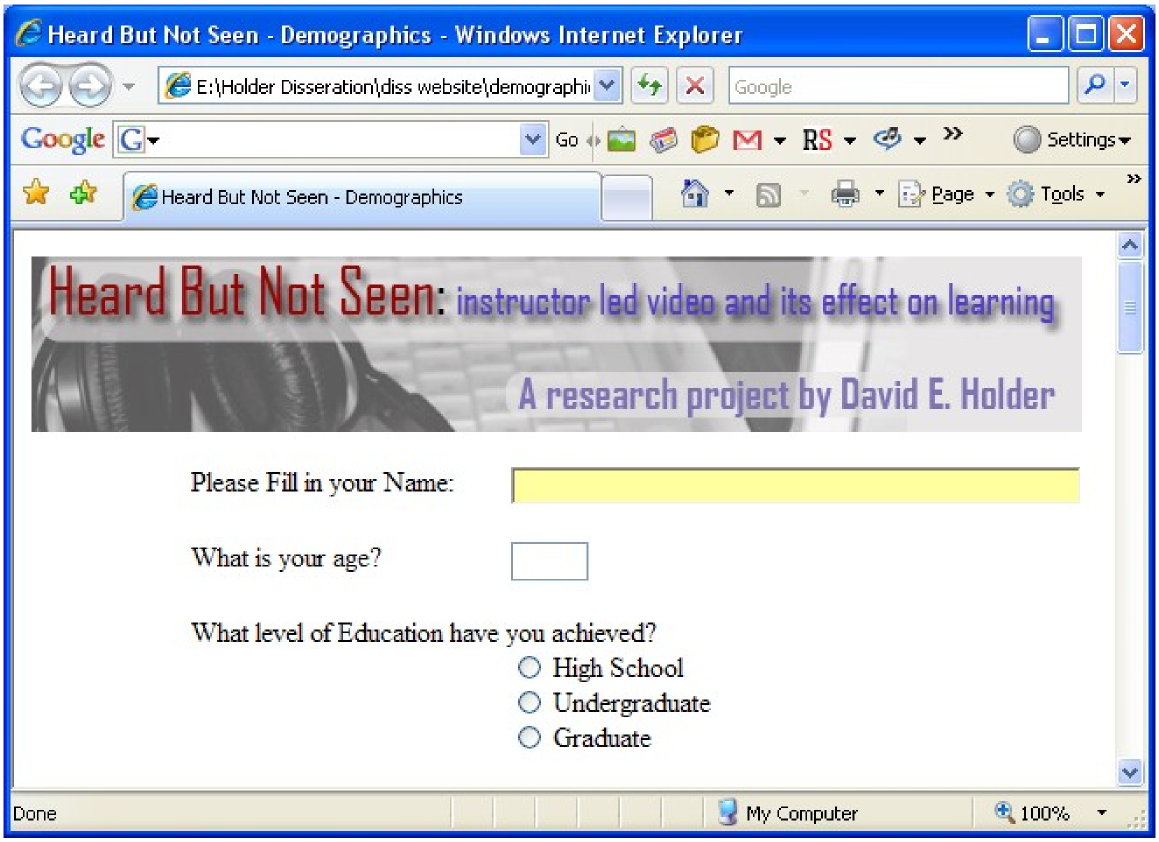
This study found that there was a statistically significant relationship between the different channels used in the learning environment. Even though video did not have a significant effect by itself, it did have an effect when combined with multimedia. Past research has explained that using a conversational style can have positive results over more former presentation methods (Clark & Mayer, 2008). However, this effect was not increased when the presence of an agent was added, in this case the video of an instructor teaching. Since the video channel was not being utilized by working memory the video channel had no measurable impact on the process of learning.

This study was aided in one version by either an agent to assist the learner or by a multimedia presentation to coincide with the learning material or both. It is the opinion of this author that video of the instructor teaching did not significantly function as a supportive agent when used by itself. This was due to both the content and the personalization effect being delivered by the audio channel. In effect, the video by itself made no further contribution to the learning environment. This was anticipated from the outset. The multimedia elements had the anticipated effect on learning but when used independently of video did not have a significant impact either. The author proposes that this may have been a result of the multimedia element not being able to hold the interest of the learner during the learning process. Therefore, the multimedia element was not able to contribute significantly to the learning environment. However, when the video of the instructor and the multimedia were combined, this permitted the two to work in conjunction to create a more efficient learning environment. The personalization effect was achieved through the conversational style of the audio lesson. However, the video added the visual agent that helped to keep the learner engaged and involved visually thus allowing the multimedia element to fulfill its task of scaffolding the learning content in a meaningful way to assist working memory in sorting through the new information. Neither the multimedia element nor the video elements were significant by themselves but together they were able to assist the learning process in a statistically significant way.

This study indicates that course designers need to examine the role in which each element plays its part. When listening to the individual instruments play in an orchestra the music does not deliver the message intended by the composer. However, when the instruments all play together and in harmony the audience hears and experiences the music as intended. It is the harmony we must seek as course designers. This study was unique in that it allowed the presentation of the same learning content in four different ways. No other study was found that could offer comparative research. More research using this type of engine needs to be done to further explore the relationship between the different media types. This will assist course designers in developing quality learning material that maximizes the way in which our brain processes information.

APPENDIX A

DEMOGRAPHIC DATA FORM



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Heard But Not Seen: instructor led video and its effect on learning
A research project by David E. Holder
Please Fill in your Name:
What is your age?
What level of Education have you achieved?
High School
Undergraduate
Graduate
Done
My Computer
100%

APPENDIX B

CONSENT FORM

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose and benefits of the study and how it will be conducted.

Title of Study: **Heard but Not Seen: Instructor led video and its non effect on learning**.

Principal Investigator: David E. Holder, a graduate student in the University of North Texas (UNT) Department of Technology and Cognition.

Purpose of the Study: You are being asked to participate in a research study where you will watch a lesson delivered over the Internet. This study will examine how we learn from media and how we can improve the delivery of content via computers and the Internet. The study looks at how we learn both from what we see and what we hear. Your participation is greatly appreciated.

Study Procedures: You will be asked to fill out a short survey that will collect demographic information used for examining the data. You will then watch a 20 minute presentation on the "history of the internet" followed by a short quiz on the presentation. This will take about 30-35 minutes of your time.

Foreseeable Risks: No foreseeable risks are involved in this study.

Benefits to the Subjects or Others: This study is not expected to be of any direct benefit to you, however we believe that a better understanding of the distance learning process will benefit all learners in this medium in the future.

Procedures for Maintaining Confidentiality of Research Records: Your confidentiality and anonymity are very important. All demographic information collected will not be stored with the survey results, and will only be connected through a unique ID created at the time of the survey. No other personal information will be collected. The confidentiality of your individual information will be maintained in any publications or presentations regarding this study.

Questions about the Study: If you have any questions about the study, you may contact **David E. Holder** at telephone number **XXX-XXX-XXXX** or the faculty sponsor, **Dr. Jon Young**, UNT Department of Technology and Cognition, at telephone number **940-565-2057.**_

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

> **David E. Holder** has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
>
> You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
>
> You understand why the study is being conducted and how it will be performed.
>
> You understand your rights as a research participant and you voluntarily consent to participate in this study.
>
> You have been told you will receive a copy of this form.

____
Printed Name of Participant

________________________________ ____________
Signature of Participant Date

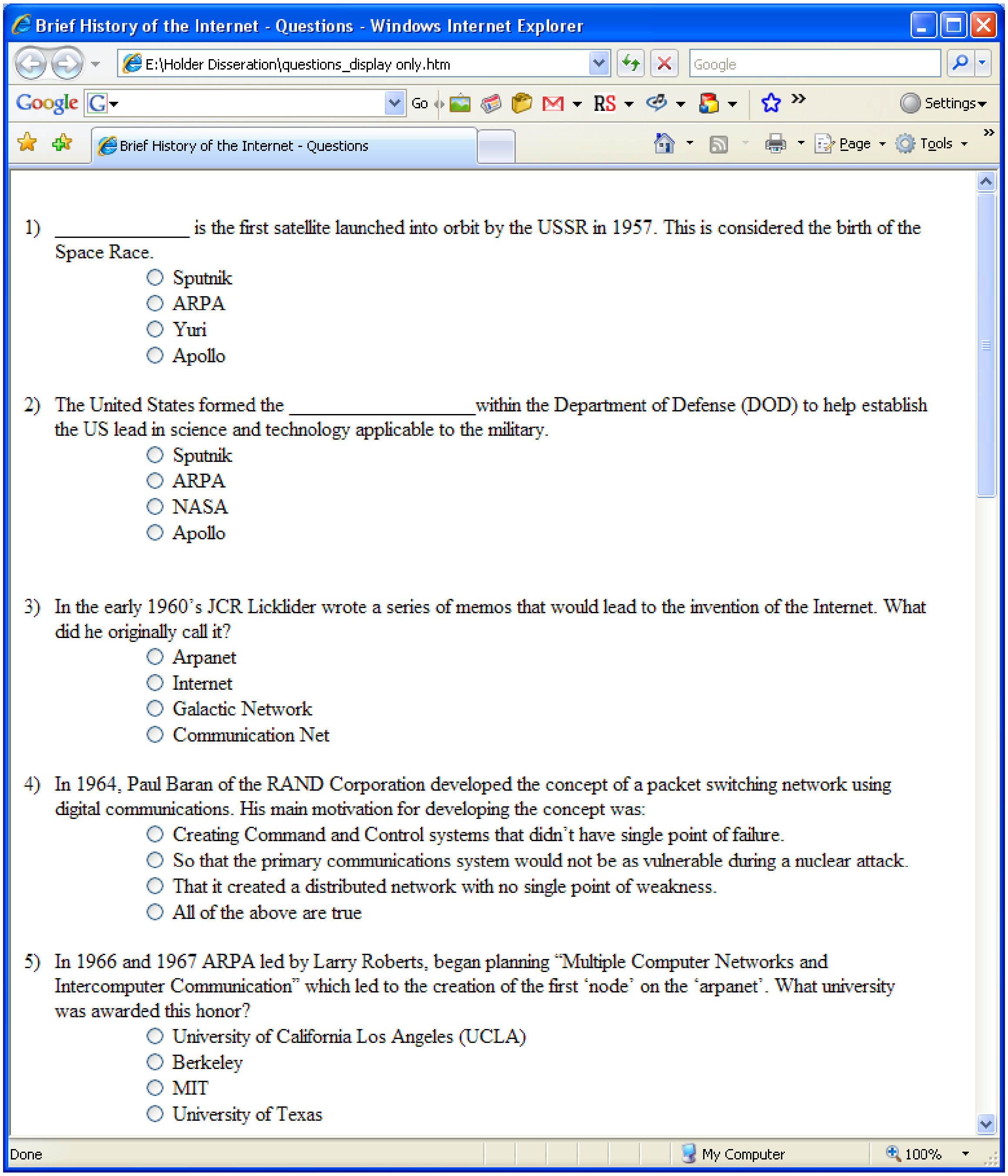
For the Principal Investigator or Designee:

I certify that I have reviewed the contents of this form with the participant signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the participant understood the explanation.

____ ___________
Signature of Principal Investigator or Designee Date

APPENDIX C

INSTRUMENT



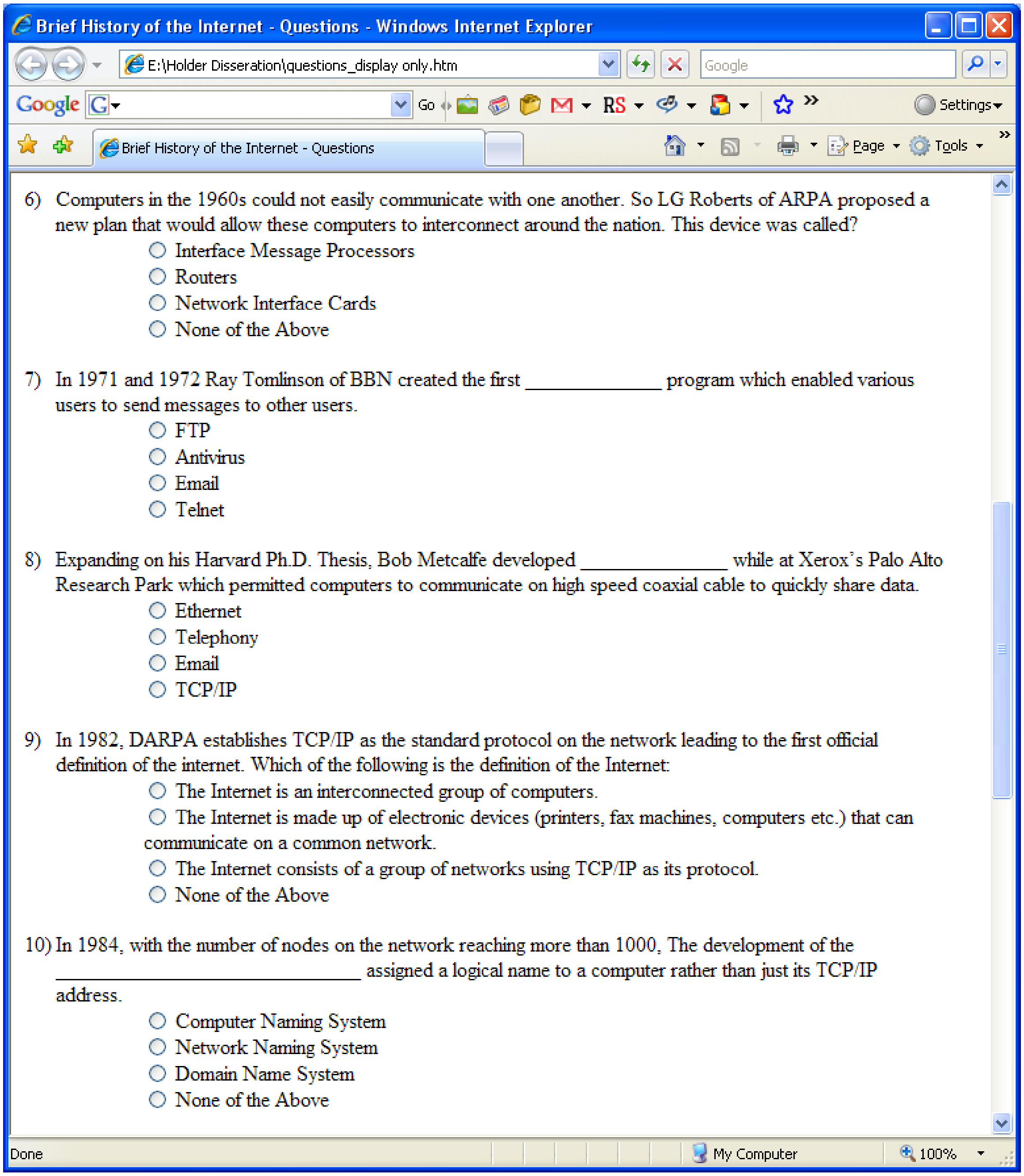
1) ______________ is the first satellite launched into orbit by the USSR in 1957. This is considered the birth of the Space Race.
- ○ Sputnik
- ○ ARPA
- ○ Yuri
- ○ Apollo

2) The United States formed the ___________________within the Department of Defense (DOD) to help establish the US lead in science and technology applicable to the military.
- ○ Sputnik
- ○ ARPA
- ○ NASA
- ○ Apollo

3) In the early 1960's JCR Licklider wrote a series of memos that would lead to the invention of the Internet. What did he originally call it?
- ○ Arpanet
- ○ Internet
- ○ Galactic Network
- ○ Communication Net

4) In 1964, Paul Baran of the RAND Corporation developed the concept of a packet switching network using digital communications. His main motivation for developing the concept was:
- ○ Creating Command and Control systems that didn't have single point of failure.
- ○ So that the primary communications system would not be as vulnerable during a nuclear attack.
- ○ That it created a distributed network with no single point of weakness.
- ○ All of the above are true

5) In 1966 and 1967 ARPA led by Larry Roberts, began planning "Multiple Computer Networks and Intercomputer Communication" which led to the creation of the first 'node' on the 'arpanet'. What university was awarded this honor?
- ○ University of California Los Angeles (UCLA)
- ○ Berkeley
- ○ MIT
- ○ University of Texas



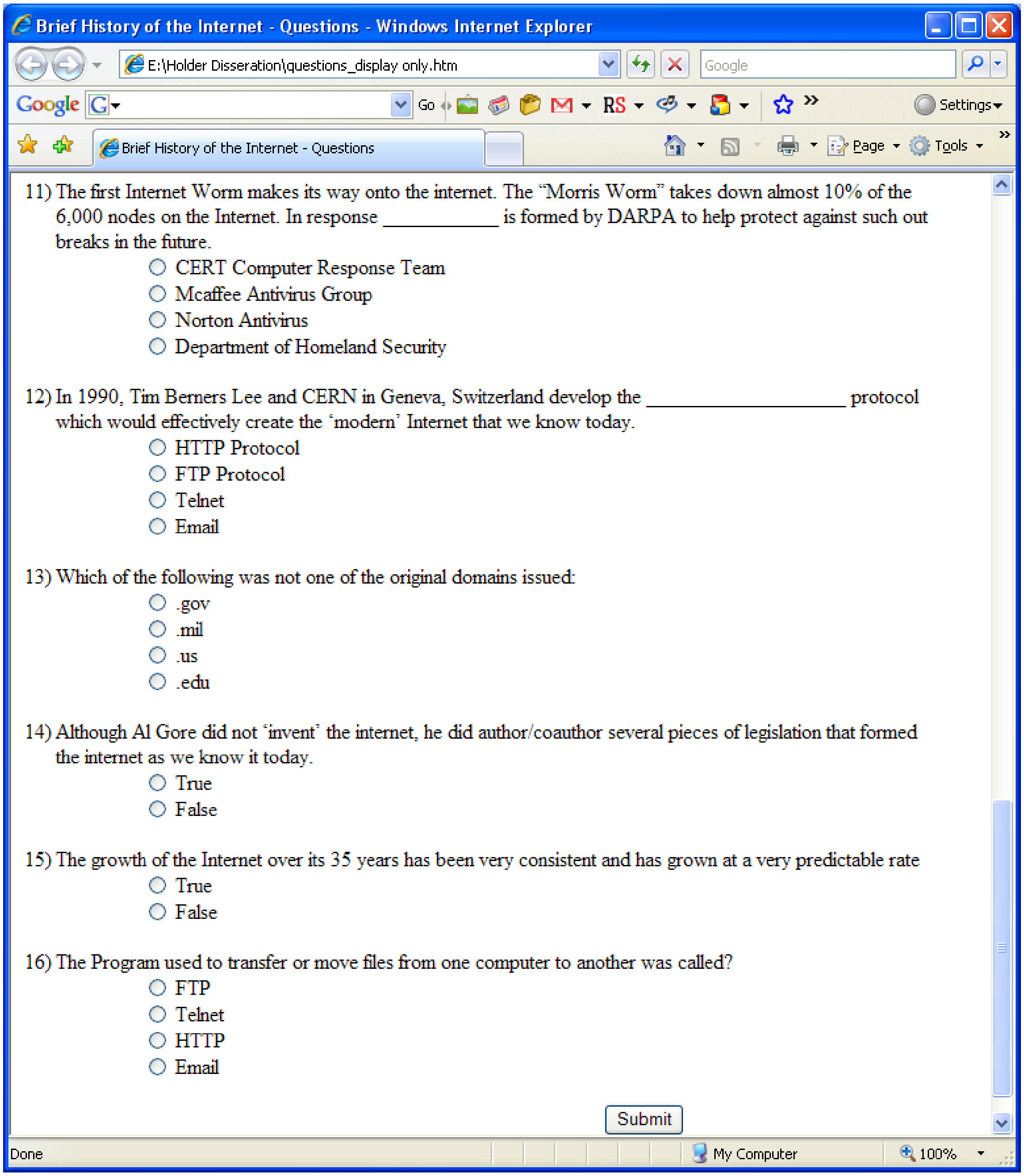
6) Computers in the 1960s could not easily communicate with one another. So LG Roberts of ARPA proposed a new plan that would allow these computers to interconnect around the nation. This device was called?
- ○ Interface Message Processors
- ○ Routers
- ○ Network Interface Cards
- ○ None of the Above

7) In 1971 and 1972 Ray Tomlinson of BBN created the first ____________ program which enabled various users to send messages to other users.
- ○ FTP
- ○ Antivirus
- ○ Email
- ○ Telnet

8) Expanding on his Harvard Ph.D. Thesis, Bob Metcalfe developed ____________ while at Xerox's Palo Alto Research Park which permitted computers to communicate on high speed coaxial cable to quickly share data.
- ○ Ethernet
- ○ Telephony
- ○ Email
- ○ TCP/IP

9) In 1982, DARPA establishes TCP/IP as the standard protocol on the network leading to the first official definition of the internet. Which of the following is the definition of the Internet:
- ○ The Internet is an interconnected group of computers.
- ○ The Internet is made up of electronic devices (printers, fax machines, computers etc.) that can communicate on a common network.
- ○ The Internet consists of a group of networks using TCP/IP as its protocol.
- ○ None of the Above

10) In 1984, with the number of nodes on the network reaching more than 1000, The development of the ________________________ assigned a logical name to a computer rather than just its TCP/IP address.
- ○ Computer Naming System
- ○ Network Naming System
- ○ Domain Name System
- ○ None of the Above



Brief History of the Internet - Questions - Windows Internet Explorer

11) The first Internet Worm makes its way onto the internet. The "Morris Worm" takes down almost 10% of the 6,000 nodes on the Internet. In response ___________ is formed by DARPA to help protect against such out breaks in the future.

- ○ CERT Computer Response Team
- ○ Mcaffee Antivirus Group
- ○ Norton Antivirus
- ○ Department of Homeland Security

12) In 1990, Tim Berners Lee and CERN in Geneva, Switzerland develop the ___________________ protocol which would effectively create the 'modern' Internet that we know today.

- ○ HTTP Protocol
- ○ FTP Protocol
- ○ Telnet
- ○ Email

13) Which of the following was not one of the original domains issued:

- ○ .gov
- ○ .mil
- ○ .us
- ○ .edu

14) Although Al Gore did not 'invent' the internet, he did author/coauthor several pieces of legislation that formed the internet as we know it today.

- ○ True
- ○ False

15) The growth of the Internet over its 35 years has been very consistent and has grown at a very predictable rate

- ○ True
- ○ False

16) The Program used to transfer or move files from one computer to another was called?

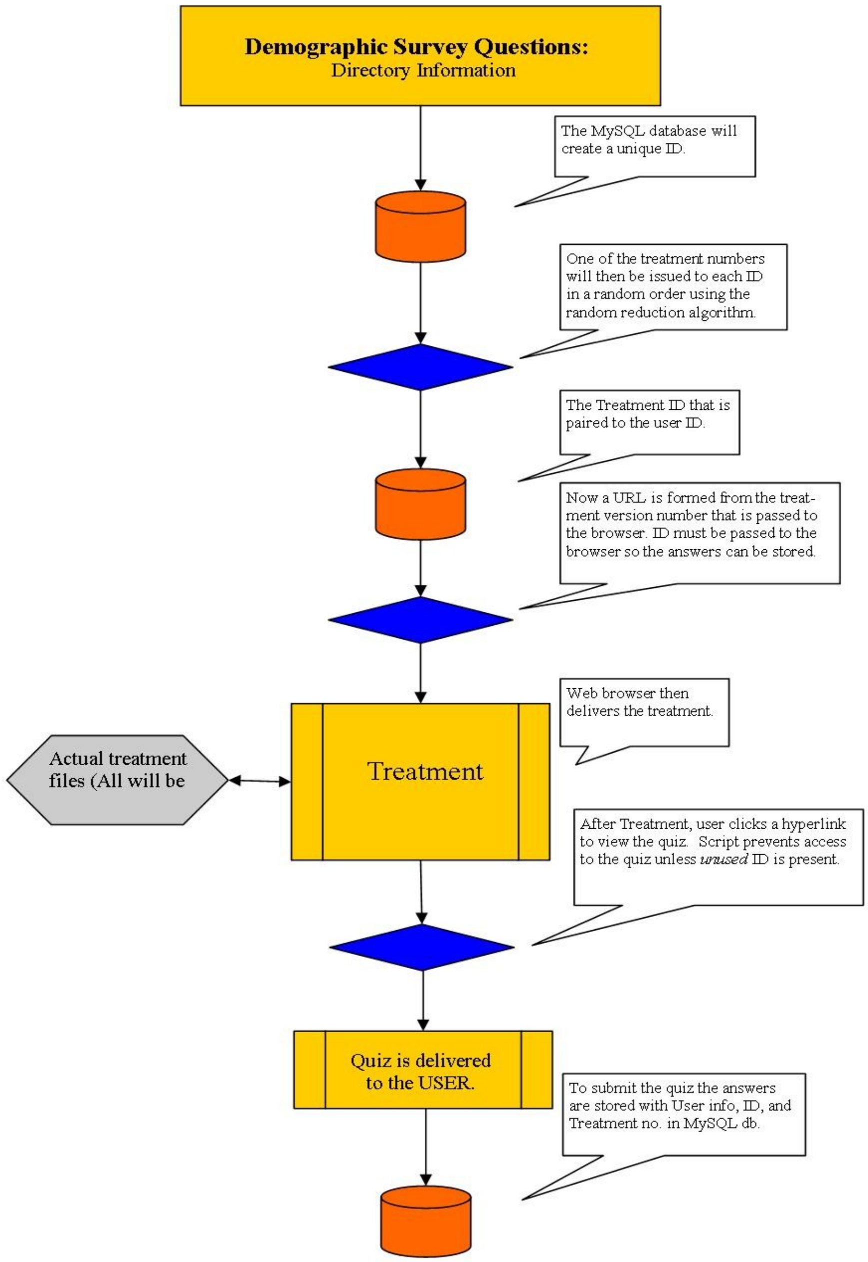
- ○ FTP
- ○ Telnet
- ○ HTTP
- ○ Email

Submit

APPENDIX D

SURVEY ENGINE FLOW CHART

Survey Engine Flow Chart



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