Factors Influencing the Faculty Adoption of Web Media Objects:

Identification and Recommendations

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(ABSTRACT)

The current and increasing advances in computer technology has afforded more ubiquitous use of multimedia design for information presentation. This research addresses university faculty's use of web media objects: text, images/graphics, animation, audio and video (Oracle, Inc., 1996) for their course instruction.

The framework used to assess the inclusion of web media objects in university course instruction was Rogers' (1995) Diffusion of Innovations model. The innovation was the inclusion of web media objects into university course instruction. The innovation was diffused through a faculty development workshop. It was determined that three factors influenced a faculty member's decision to adopt and implement the innovation: technology, pedagogy, and presentation style.

Quantitative, qualitative, and observational data were used to draw conclusions about the influential factors associated with adoption of the innovation. This research resulted in a number of pertinent outcomes. Those outcomes included: information regarding faculty members' perceptions towards the innovation adoption, adoption barriers and general lessons learned, potential design guidelines for advanced multimedia training developers and training support systems, and recommendations for improving the adoption of web media objects for university course instruction.

Results revealed that innovation characteristics: compatibility, trialability, relative advantage and observabilty are most important to consider for the adoption of web media objects for university course instruction. Discussion includes recommendations for improving faculty perception regarding these innovation characteristics and other related issues.

Dedication

This research is dedicated to my grandfather, Cecil Lurell Parker, Sr.

Grandfather,

Your mission on this earth was completed on May 16, 2001, just months short of the completion of this research. Nevertheless, your presence in my life, your leadership, your dedication and your commitment to our family was absolutely "Stellar." Never did your life lead you to college, or even high school; however, because of your dedication to your family, your children awarded you an honorary doctorate in "Fatherhood." Grandfather, you are still the greatest example of perseverance and achievement that I know. Your example has taught me, and is still teaching me, that "good success" in life is not a simple measure of the academic degrees and accolades I can accumulate; but more so, a measure of the character and integrity that I display in everything that I do. Thank you for constructing a solid foundation, upon which I can stand today, and build upon for future generations. For your diligence, work ethic, and love, I honor you with the completion of my research.

Grandfather, I present to you an honorary Master's degree in Industrial and Systems Engineering (by the way of your granddaughter). I love you eternally.

Your Eldest Granddaughter,
Kayenda

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"To God be the Glory, Great Things He Hath Done."

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"Jesus, You're my everything
The cross You did that just for me
So whatever You take me through
I promise You
I'll spend my always with You. "
(The Ministry of Kirk Franklin, 2002)

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INTRODUCTION

The ever-increasing advances in computer technology have afforded the development and use of web media objects as presentation tools in multimedia design. Web media objects include technologies such as text, graphics/images, animation, audio and video. Web media objects have primary application in the presentation of information. Computer-based information presentation, including web media objects, is an opportunity for further exploration of multimedia design.

Currently, the multimedia approach to the design of information rests in the forefront of large and small businesses, private homes, schools from kindergarten to 12th grade, and colleges and universities worldwide. Some suggest that multimedia presentation has the potential to be a more effective technique than traditional methods (e.g., overhead transparencies, chalkboard, or conventional lecture) to communicate ideas and information of varying types (Perry and Perry, 1998). Perceiving the potential enhancement that multimedia presentations may have on the presentation of information, many companies and institutions have set forth goals to implement a more ubiquitous use of multimedia design within their organizations. Initiating the use of multimedia as a means of information design begins with training potential users on how to develop multimedia content for their presentations. Large organizations and institutions commonly use hands-on workshops as a method of training potential users.

The research described addresses the idea of university faculty using advanced multimedia information presentation in their course instruction. Advanced multimedia encompasses the development and use of web media objects (Oracle, Inc., 1996). Web media objects include web-based text, audio, video, graphics/images, and animation. In addition, advanced multimedia incorporates the use of web-authoring tools to integrate media objects into a single information presentation.

Suggested Uses of Various Instructional Media

The primary learning resource, a textbook, should not be online (Carr-Chellman and Duchastel, 2000). In other words, large amounts of text from which students will read and study, should not be presented online. Textual material on a computer screen provides a less than adequate interface for readers, in comparison to the traditional textbook (Jonassen, 1982). It is easier to study from a traditional book as opposed to scrolling through lengthy online textual material. The portability of textbooks provides convenience for students as well. One case where online textual material is acceptable is when relatively new work in a field has not yet been published or put into textbook form.

Reiser and Gagné (1983) provide some considerations for effective instructional media selection. Their discussion of instructional media does not provide information directed toward media use in conjunction with current computer technology. However, their traditional discussion and application does point to occasions to use audio, video, filmstrips, charted diagrams and simulators. Their suggestions for media selection, in some instances can be transfered to use of some web media objects.

Of all the candidate media that Reiser and Gagné (1983) present, those relevant to pictures and diagrams are most useful in terms of web media objects. Media selection is based on Gagné's (1977) five domains of learning: intellectual (mental) skills, verbal information, cognitive strategies, motor skills and attitude (Gagné, 1977; Gagné and Briggs, 1979). Reiser and Gagné (1983) recommend using pictures and diagrams for instruction that involves intellectual skills and verbal information. Intellectual skills are associated with the teaching and learning of concepts, procedures or rules. Verbal information is concerned with a learner's ability to state the knowledge they have learned to convey basic meaning (Reiser and Gagné, 1983).

The use of images, whether they are photographic or diagrammatic, may be used to address both intellectual skills and verbal information (Reiser and Gagné, 1983). Images can be used to illustrate the relationship between events and objects. Images may also be used to illustrate the relationships of parts to a whole. For example, a diagram may show an organizational structure, parts of a system, blood circulation in the human body, or operations flow within an industrial process. Images may also illustrate spatial

relationships (Alessi and Trollip, 2001; Reiser and Gagné, 1983) denoting lapses in time between events, causes of preceding or subsequent events, and contributory events (Reiser and Gagné, 1983). Photographic images that display actual events, for example, historical events, will facilitate the learners' remembrance of associated information (Reiser and Gagné, 1983).

Reiser and Gagné's (1983) discussion of images was based on its more traditional use; however, Alessi and Trollip's (2001) discussion of graphics (which includes images of various types: simple line drawings, schematics, artistic drawings, diagrams, photographs and three-dimensional images) directly relates to their use as web media objects. Alessi and Trollip (2001) suggest that graphics can be used in four primary ways: as the primary information, as analogies or mnemonics, as organizers and as cues.

Alessi and Troliip (2001) also provide some recommendations for appropriate use of graphics. They suggest that graphic information design should be consistent with and integrated into the rest of the instructional content. For example, when teaching about the refrigeration cycle (used in refrigerators and air conditioning units), using a circular diagram would place emphasis on the cyclic nature of that process. A second recommendation is to limit excessive detail or realism in the graphics. Excessive detail may cause memory overload in learners. This memory overload can cause learners to be confused and not know where to place their focus. A third recommendation is to use simple line drawings when realistic photographs contain more details then needed. However, realistic photographs should be used when discussion involves such topics as art history.

Animation can be used for several purposes (Boyle, 1997). First, animation may be used to liven the presentation of course information. Second, it may be used when it is necessary to demonstrate concepts involving dynamic change (Alessi and Trollip, 2001). For example, an individual could illustrate the steps in an assembly process (Boyle, 1997). Use of an animated demonstration can be most effective for showing tasks that require the assembly of an object, or the arrangement of abstract categories (Boyle, 1997).

Carr-Chellman and Duchastel (2000) suggest that it is not enough to simply change a traditionally designed course to a web-based medium. Use of web-based material for course instruction needs to be viewed and understood as having its own unique design considerations for most effective use. There are many types of technologies that may potentially be involved in web-based course instruction. It is important to note that technologies such as audio, video, images, animation, and text are available for use, but not all may be appropriate for all types and areas of instruction.

Alessi and Trollip (2001) state that audio is primarily used for speech; however, it may also be used to demonstrate information aural in nature (e.g., learning bird calls and music). Audio may also be used to learn temporal information such as poetic meter (Alessi and Trollip, 2001).

Furthermore, audio and video may be used for some online mini-lectures. Audio and video should be used minimally (Barron, 1998; Boyle, 1997; Carr-Chellman and Duchastel, 2000), verses being used for lengthy lectures or speeches (Alessi and Trollip, 2001). Additionally, audio and video clips should be used for the purposes of identification with the instructor, and/or basic orientation to the relevant subject matter. The purpose of audio and video is not to be the main source of subject content, but rather to provide student motivation to learn (Alessi and Trollip, 2001), to enhance student identification with the course, and to provide a sense of the instructor's personality (Carr-Chellman and Duchastel, 2000).

Furthermore, use of various media for course instruction will utilize different learning senses, and thereby enhance learning. Courses that involve lab work or hands-on experience, such as engineering or medicine, could make use of various web media. The selected media should most appropriately facilitate the achievement of the course's specified learning objectives (Hashim, 1999).

Innovation Rate of Adoption

Rogers (1995) characterized an innovation's rate of adoption in his socio-technical systems model titled *Diffusion of Innovations*. Rogers (1995) defines *diffusion*

as the "process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Rogers (1995) defines an innovation as "an idea, practice, or object that is perceived as new by an individual or other unit on adoption" (p. 11). Furthermore, the model contains four main elements: an innovation, a communication channel, time and a social system. Rogers (1995) asserts that there are five characteristics that determine the rate at which an innovation will be adopted. Those five characteristics are: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to which an innovation is perceived as being more suitable than the most current idea. Compatibility is the degree to which an innovation is perceived as being congruent with formerly introduced ideas, existing socio-cultural values and beliefs, and any needs of potential adopters. Complexity is the degree to which potential adopters perceive the innovation as being hard to use and/or understand. Trialability is the degree to which an innovation may be experimented with on a temporary basis. Observability is the degree to which the results of innovation adoption are viewable by others.

Rogers' (1995) innovation attributes are either directly or inversely proportional to innovation adoption. An individual's perception of relative advantage, which may be described in terms of economic benefit, social status benefit and the like, is positively related to an innovation's rate of adoption. Perception of compatibility, trialability, and observability are also positively related to an innovation's rate of adoption. However, perception of complexity is negatively related to an innovation's rate of adoption (Rogers, 1995).

Individuals or units of adoption that perceive an innovation as having greater relative advantage, compatibility, trialability, observability and less complexity will adopt an innovation at a more rapid rate. The communication channel is the means by which information about the innovation is disseminated among individuals (Rogers, 1995). The time aspect is involved in the innovation decision process. The innovation decision process is the mental process through which an individual or other decision-making unit molds an attitude toward acceptance or rejection of an innovation. Finally, the social system refers to a group of interrelated units that work concurrently to achieve a common goal (Rogers, 1995).

Innovations Stages

The framework used for this research approach is the Diffusion of Innovations model. The innovation is the idea of including advanced multimedia information presentation in university level instructional material. Adoption and implementation of that innovation may be characterized as having three relevant stages: technology, pedagogy, and presentation style (Jason Lockhart, personal communication, 2001). Technology is the use or inclusion of web media objects within course instruction. Pedagogy concerns the instructional design and strategy that an educator would use to deliver their course content. Presentation Style refers to the medium used to present the course material.

As an individual contemplates adopting advanced multimedia information presentation for their course instruction, three important factors influence their decision: (1) the adoption of the technology, (2) the adoption of a new or modified pedagogy, and (3) the adoption of a new or modified presentation style. These influencing factors represent the stages of the innovation's adoption. The relationship between the innovation stages relevant to multimedia inclusion is depicted in Figure 1.

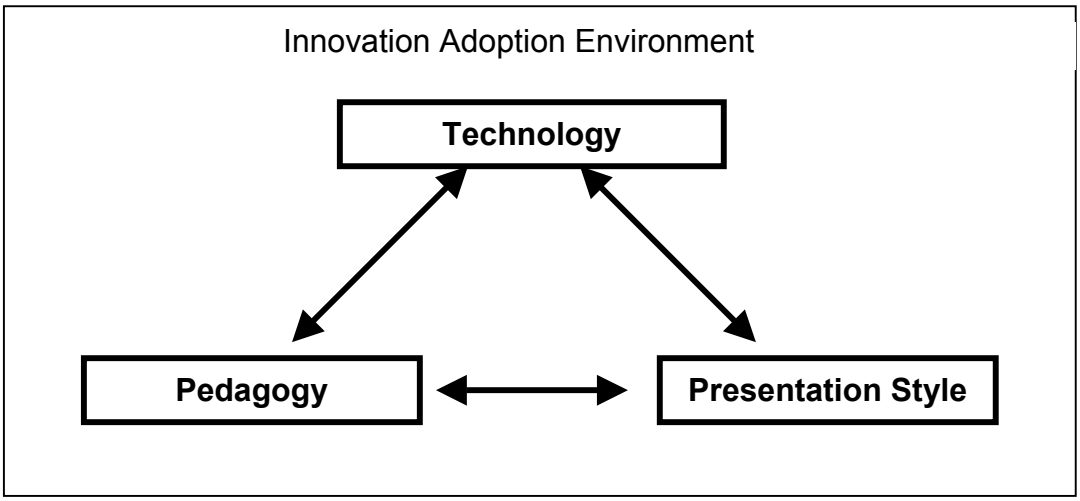

Figure 1 Relationship Between the Innovation Adoption Stages

According to Rogers (1995, p.30), "consequences are the changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation." There are three dimensions that categorize consequences: desirable versus undesirable, direct versus indirect, and anticipated versus unanticipated. "Direct consequences are the changes to an individual or a social system that occur in immediate response to an innovation" (Rogers, 1995, p. 415). Indirect consequences occur in response to the effects of direct consequences (Rogers, 1995). Various indirect consequences may exist in reaction to direct consequences resulting from the original innovation adoption. Technology, pedagogy or presentation style may be the leading innovation that causes direct and/or indirect consequences. For example, if an individual adopted a new pedagogy, one direct consequence may be the adoption of the technology. As a result of the adoption of the technology, the individual then adopts a new presentation style; adoption of a new presentation style is an indirect consequence of the original pedagogy adoption. Once the leading innovation is identified, the adoption of the other two innovation stages may be a direct or indirect consequence of the original adoption.

Each innovation adoption stage potentially influences adoption of the others in a continual and somewhat iterative process. For example, the adoption of the technology (some aspect of the technology) may result in the adoption of a new pedagogy. Once the new pedagogy is adopted, the individual may realize that there is a need to adopt some additional aspects of the technology. After adopting the additional aspects of the technology, an individual may adopt a new presentation style. There are no limits on the extent to which one innovation stage can influence adoption of another stage in a given situation.

The innovation adoption environment refers to the social system in which the innovation adoption occurs. For the purposes of this research, the social system is the university environment. More specifically, the social system refers to the environment in which the trained (in the use of web media objects) person performs their work. The associated communication channel is a series of workshop sessions that take place in this university environment. Rogers (1995) determined that issues within the social system such as social structure, system norms, types of innovation-decisions and consequences of innovation have an influence on the diffusion of new ideas.

Technology

The technology associated with this research is web media objects: text, images, animation, audio and video. Research and discussion of media in educational technology has led to a debate regarding if and how media influences learning. Clark (1983) stated that there is consistent evidence showing that no specific medium to deliver instruction provides any benefit to learning and that there never will be. Clark (1983) states that his conclusion is supported by (1) the many media comparison studies that show no significant difference in learning benefits between various media (Tiene and Ingram, 2001), and (2) the research of Wilbur Schramm (1977) and Levie and Dickie (1973), who stated that learning is more influenced by the content and instructional strategy embedded in the medium, than by a specific type of medium.

Clark (1983) stated that media are "mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" (p. 445). Kozma (1994) believes that considering media as "mere vehicles" will be an impediment to discovering the potential for an effective relationship between media and learning. In addition, Kozma (1994) sites two specific examples where the use of a computer based learning environment positively affected student performance. One of those examples was a computer based learning environment called *ThinkerTools* (White, 1993). This tool was designed to aid students in understanding Newtonian mechanics (e.g., sophisticated models of force and motion). After detailed interaction with the computer-based representations of motion and forces, students were asked to then identify the law (physics law) that best mapped to the behavior they viewed with the simulated learning environment. The students' success with *ThinkerTools* fueled Kozma's argument (1994) that media, through its attributes and capabilities, can have an influence on learning. One example media attribute is symbol systems. "Symbol systems are sets of symbolic expressions by which information is communicated about a field of reference" (Kozma, 1994, p. 11). Example symbol systems are printed text, spoken language, numbers, formulae, maps, and graphs.

In response to Kozma's argument (1994), Clark (1994) challenged Kozma and others to find viable evidence of any instance where a specific medium (or a set of media

attributes) is not replaceable by a different set media or media attributes. With this challenge, Clark suggests that there is no specific media (or medium) or set of media attributes that uniquely provide benefit to learning. In other words, these media can be replaced by other media to produce the same result. Clark (1994) states that this replaceability is a key aspect of his argument that media do not influence learning.

While the debate between the viewpoints of Clark and Kozma continued, Jonassen, Campbell and Davidson (1994) presented an argument suggesting that Clark and Kozma's debate concerning the importance of instructional methods versus media attributes, is the wrong issue for debate. Jonassen et al. (1994) believed that the debate should be reconceptualized by placing focus on the role of media in the learning process. Furthermore, Jonassen et al. (1994) put forth the idea that there should be a shift in the debate and the practice of instructional design to embrace a learner-centered approach. This learner-centered view focuses more on capabilities of the human learner and the learners' construction of knowledge. The debate should focus less on learning from media and more on learning with media. This argument hinges on the idea that the debate and discussion should be concerned with how media can be used to assist meaning making (defined later in this document) and knowledge construction (Jonassen et al., 1994).

Associated with the argument presented by Jonassen et al. (1994) is the belief that the environment in which learning takes place, defines the context of the learner's constructed knowledge. Constructivism is the idea that learners construct their own knowledge (Bruner, 1986; Heinich et al., 1996; Jonassen et al., 1999). An extension of that view is that learners can use multimedia (e.g., use of compact discs, video disk, slides, films etc.) or hypermedia (e.g., use of text, images, animation, audio, and video) to facilitate meaningful construction of knowledge (Jonassen et al., 1999). Hypermedia, which is a special type of multimedia, is the combination and integration of multimedia and hypertext (Jonassen et al., 1999). Hypertext is "a computer program that enables the user to access continually a large information base whenever additional information on a subject is needed" (Heinich et al., 1996, p. 410).

Web Media Objects. Jonassen et al. (1999) identify two basic ways that multimedia/hypermedia could be used to support meaningful learning. First, it may be used as student construction tool. Second, multimedia/hypermedia can be used to create carefully developed environments, designed to engage learners in the construction of knowledge.

Hypermedia can consist of any selection and combination of web media objects to create content. The first use of multimedia/hypermedia (as student construction tools) refers to projects where learners use multimedia/hypermedia to show their understanding of a unit of content. In these cases learners may show the complexity and relationships of ideas through their hypermedia designs. The second use of multimedia/hypermedia (as learning environments for knowledge construction) refers to using it as a means of providing resources and information to support learner-controlled investigations (Jonassen et al., 1999).

Pedagogy

With the advent of multimedia technologies into the learning environment, educators of all types are faced with the task of integrating that technology into instructional material. Effective integration of multimedia technology will potentially cause revolutionary changes in the teaching and learning process (Tiene and Ingram, 2001). With traditional teaching methods, educators maintain the role of lecturer, course designer, discussion moderator, and learning evaluators (Gillespie, 1998). The introduction of technology into education presents an opportunity for educators to transition from the more traditional faculty-centered teaching methods to more collaborative (Schofield and Verban, 1988) and student-centered methods (Collins, 1991). Constructivism, cooperative and collaborative approaches to learning lend themselves to use with technology (Collins, 1991; Heinich et al., 1996; Jonassen et al., 1999; Johnston and Cooley, 2001; Tiene and Ingram, 2001).

Constructivism is a philosophy and pedagogy that posits that learning is an active process where learners construct their own knowledge, using schemata and mental models resulting from previous experiences (Heinich et al., 1996; Jonassen et al., 1999).

Schemata are cognitive structures that individuals use to identify, process, and store incoming information; the individual uses that information to organize their perceived environment (Heinich et al., 1996). Mental models are described as cognitive structures that mirror the individual's understanding of the system (Wickens and Hollands, 2000). An educator who uses constructivism as a teaching pedagogy, has the task of designing a learning environment that engages learners to think, and, presumably, experience learning. This educator must provide activities that promote meaning making. Meaning making is a process that occurs when individuals interpret their experiences according to what they already know (Bruner, 1990). Meaning making is the goal of the constructivist approach. Meaning making is most effective when learners participate in authentic tasks prompted by a question, problem, confusion or disagreement (Jonassen et al., 1999).

Meaning making may also occur as a result of conversation as well. Humans are social creatures who use interaction with other humans to determine their identity. Also, individuals use interaction with others to assess the viability of their own personal beliefs (Jonassen et al., 1999). Meaning making during conversation is a principle component of ideas associated with social constructivism.

Meaning making, according to social constructivists, is defined as a process in which learners engage in negotiation through conversation and dialogue (Jonassen et al., 1999). Social constructivism is an extension of constructivism; the distinction lies in that social constructivism stresses the importance of the social context of learning and culture on cognitive development. In social constructivism the educator may serve as a guide to learners as they engage in problem solving. These educators may also encourage learners to interact within groups, to think through relevant issues and questions (http://www.coe.uh.edu/~ichen/ebook/ET-IT/social.htm).

As discussed in Slavin (1991), cooperative learning approaches have been successful in many areas of study (e.g., mathematics, language expression and mechanics, writing, foreign language, social studies, history and geography). Considering the literature according to Slavin (1991), cooperative learning approaches may potentially augment the learning process in many additional areas of study. Heinich et al. (1996) describes cooperative learning as a learning technique where only learners

are working together within a group. An additional technique is called collaborative learning. Collaborative learning is different in that the educator is an active participant within the group of learners (Heinich et al., 1996).

Collaborative and cooperative learning approaches are noted for being more common in technology supported learning environments (Dwyer et al., 1991; Collins, 1991; David, 1992). Therefore, there are a number of pedagogy alternatives for educators who adopt the inclusion of multimedia (applicable to web media objects as well) in the classroom environment. Each of these pedagogies supports a student-centered learning environment, where students are encouraged to construct their own learning. Each of these pedagogies is well accepted in learning environments supported with technology.

The literature concerning the use of technology use in the classroom (and the related pedagogies) suggests that educators need to consider their current teaching philosophies, and determine if they need to adopt new pedagogies to support their use of technology (Dwyer et al., 1991). Discussion concerning the use of technology in the classroom has direct implications for the inclusion of web media objects in course instruction. The use of web media objects in course instruction require educators to rethink their teaching pedagogy as well. Furthermore, educators who consider adopting the idea of including web media objects into their course instruction must first recognize and understand applicable pedagogies and the associated learning environment. Then educators must select an appropriate teaching philosophy that complements the web media object(s) chosen for course instruction and fits their preferred teaching styles.

Presentation Style

Educators have used various instructional aids to assist the teaching process since the early 1900s (Heinich et al., 1996). These aids were used to facilitate the delivery of educational content. Those instructional aids include: colored photographs, stereroscopic pictures, charts, films, viewgraphs, instructional television, etc. The chalkboard, the most typically used classroom display surface, is utilized primarily to accompany verbal presentation. Currently, overhead viewgraphs are most commonly used to aid

instructional presentations. Additionally, presentation software, such as Mircosoft's PowerPoint™ , has become popular with educators as well (Heinich et al., 1996). As technology is more widely adopted into the teaching and learning process, traditional instructional aids may need modification or need to be traded for new and more appropriate instructional aids.

Innovation Adoption Metrics

Relevant literature suggests that seven metrics may be considered when assessing the rate of adoption of the innovation previously described. Those metrics are drawn from Rogers' (1995) innovation attributes and two benchmarks from *Quality on the Line* (Institute for Higher Education Policy, 2000) research.

First are the innovation attributes set forth in Rogers' (1995) diffusion of innovations model. This model grew out of the diffusion research tradition which took root in published material dating back the to early nineteen hundreds. Nine research traditions consisting of academic disciplines and sub-disciplines such as anthropology, early sociology, rural sociology, education, public health and medical sociology, communication, marketing, geography and general sociology made the most prevalent contributions to the diffusion research (Rogers, 1995). Continued diffusion research has attempted to establish universal terminology for a classification scheme to describe the perceived attributes of innovations. Five different attributes of innovation have been used for over two decades. Research by Holloway (1977) and Tornatzky and Klein (1981) provide support for the selection of these five attributes. The attributes of innovations are (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability. These five attributes are not mutually exclusive; however, they are different conceptually (Rogers, 1995). These perceptual attributes can be used to explain relevant human behavior (Thomas and Znanieck, 1927; Wasson, 1960).

The two additional metrics are benchmarks noted in the *Quality on the Line* study, performed by the Institute for Higher Education Policy (2000). The Institute for Higher Education Policy (2000) recognized the resurfacing debates associated with Internet use for distance education. One argument of the debate maintains that online education will

eliminate all of the problems facing traditional education; others assert that online education will not be able to adequately live up to the traditional education standards. Therefore, the Institute of Higher Education Policy set forth with a mission to develop a set of distance education quality measurements. The effort began by examination of the benchmarks by studying active distance learning programs at various institutions of higher learning. The Institute of Higher Education Policy study resulted in a number of important benchmarks for determining quality in distance education.

Two of those benchmarks, institutional support and faculty support, can be used as metrics for determining an innovation's rate of adoption (relevant to the inclusion of web media objects in course instruction). Institutional and faculty support are important issues for a faculty member who desires to integrate advanced multimedia applications into their course material. Institutional support is characterized as: a plan that includes electronic security measures to uphold the validity and integrity of the developed material, a reliable delivery system, and a centralized system which provides support for developing and maintaining distance education foundation. Faculty support is described as: transition assistance for faculty as they change from traditional education to online education, instructor training, technical assistance for course development, and written resources for faculty concerning issues that may arise with student use of electronically accessed information. Institutional and faculty support are positively related to the innovation rate of adoption. Both of these benchmarks, given their operational definitions, may be adapted to measure innovation rate of adoption.

Justification for Faculty and Institutional Support

The combination of Roger's (1995) innovation attributes and the institutional and faculty support benchmarks from "Quality on the Line" (Institute for Higher Education Policy, 2000) were merged with socio-technical systems theory (Trist and Bamforth, 1951). Socio-technical systems theory posits that there must be congruence between people (personnel subsystem), work systems, and technology (technological subsystem) to achieve optimal effectiveness of work systems within an organization (Hendrick and Kleiner, 2001). Each of the elements of socio-technical systems theory (personnel

subsystem, work system and technological subsystem) is subject to an external environment.

The personnel subsystem considers issues such as cultural and psychosocial characteristics (Hendrick and Kleiner, 2001). The technological subsystem refers how the work or task(s) is performed, and also considers the methodologies and tools used to perform the work (Bancroft, 1992; Cummings, 1978). Work system refers to the manner in which people are organized in order to perform their work and their related processes (Hendrick and Kleiner, 2001).

One macroergonomics model of socio-technical systems theory states that there are three major constructs associated with socio-technical systems theory: joint causation, joint optimization, and joint work design. Joint causation, in concept, suggests that both the technological and personnel subsystems are affected by causal events in the external environment (e.g., competition, new government regulations). Joint optimization (which has the strongest implications for the design of the adoption metrics) suggests that both the technological and personnel subsystems should be jointly optimized in order to effectively respond to causal events in the external environment. Joint design is the idea that both subsystems should be designed together to produce the most optimal fit (Hendrick and Kleiner, 2001).

Hendrick and Kleiner (2001) also discuss the mutual interdependence of the four socio-technical elements (personnel subsystem, work systems, technological subsystem and the external environment). If any aspect of one element is modified, there will be subsequent effects on each of the remaining elements. It is essential to recognize and plan for the interdependence of the system; it is likely that ignoring the interdependence of the system will have a sub-optimal result on the overall system. Therefore, it is necessary to jointly consider the personnel subsystem, technological subsystem, the work system and the external environment.

This model of a socio-technical system has implications for the method and tools that the faculty members use to create and implement the web media objects within their course instruction. The method and tools used to create and implement web media objects represent the technological subsystem. The faculty members' cultural,

psychosocial characteristics and psychosocial needs (the personnel subsystem), as it relates to the university environment, are taken into account by the assessment of the faculty members' opinions of the innovation adoption according to Rogers' (1995) five innovation attributes. The work system is represented by the manner in which the faculty members decide to create their web media objects (i.e., how the faculty members organize themselves in order to perform the task of creating the web media objects). For example, a faculty member may decide to create web media objects on their own, with a group of other faculty members, or with an individual or group of individuals that provide university technical support. Finally, assessing the level of institutional and faculty support provides information about the faculty's external environment (i.e., the environment established and maintained at the university level).

Joint optimization suggests that it is pertinent for the metrics used to determine the innovation adoption include all issues that will potentially influence a faculty member's decision to adopt the innovation. Those issues can be addressed by consideration of the personnel subsystems and the support provided by the external environment. Therefore, the inclusion of faculty and institutional support is critical to obtaining a more holistic view of the factors related to faculty's adoption of the innovation.

Furthermore, discussion of challenges and barriers to adopting the use of technology in the classrooms present issues such as those addressed in the Quality on the Line's (Institute for Higher Education Policy, 2000) benchmarks: faculty and institutional support. Faculty and institutional support are necessary considerations as more educators are encouraged to include multimedia technology into the classroom environment. Taking full advantage of the investment of technology in the classroom requires careful planning for professional development support for faculty members. Full use of technology demands faculty to learn and develop new skill sets; therefore, faculty members need to have a support system in place that provides a resource for training, an opportunity to practice with the technology, and sufficient technological, pedagogical and scholarly support (Baldwin, 1998). Johnston and Cooley (2001) report that lack of technical assistance and support is a barrier to technology integration. While there are reports that faculty members need support to effectively adopt technology supported

learning environments, Taylor and Eustis (1999) state that the idea that faculty need support has transformed into a faculty expectation.

Faculty Support for Pedagogy. Faculty members not only need support for adopting the technology, but they also need assistance with the changes related to pedagogies. According to Frank Gillespie (1998), faculty members will need to be linked with faculty development personnel in the design of cognitive strategy learning tasks. He also suggests that faculty will require assistance with the task of converting from a teacher centered classroom, to a more student centered classroom. Moreover, faculty members need technical support providers with knowledge of instructional technology and curriculum integration (Baldwin, 1998; Byrom, 1998; Johnston and Cooley, 2001).

Other researchers have noted issues more closely related to institutional support. Foster and Hollowell (1999) discuss the importance of providing quality resources. These authors stress the importance of planning in the provision of quality information technology resources (i.e., software and servers, electronics and cabling, and support and service). They suggest that planners need to consider issues such as resource reliability and resource sustainability.

Another related issue involves copyrighted material. Currently, copyright concerns are problematic in traditional learning environments; those copyright concerns will remain an issue as learning environments transform into more technology-integrated environments (i.e., electronic distribution of related course materials). There are many questions associated with the fair use of copyrighted materials; for many of the relevant guidelines are open to interpretation. In addition, receiving permission and paying for access to copyrighted material are potential problems for educators who feel they need to provide access to their students (Tiene and Ingram, 2001). Therefore, it would be necessary to provide educators with clear and concise set of directives concerning the use of copyrighted materials.

Purpose of Research

The adoption and implementation of web media objects into course instruction has potential use and benefit in the university setting. The literature reviewed also suggests that the adoption of web media objects into course content would potentially cause an individual to consider their pedagogy and presentation style. In addition, Rogers' (1995) five innovation attributes (relative advantage, compatibility, complexity, trialability and observability) and the faculty and institutional support (Institute for Higher Education Policy, 2000) are also proposed to be influential factors for the adoption of the innovation.

The purpose of this research is to determine if individuals trained in the development and use of advanced multimedia tools, actually adopt the innovation of including advanced multimedia information presentation in instructional material, and to determine the influence of innovation adoption metrics upon their decision to adopt the technology, pedagogy and presentation style. The research objectives are to identify (a) any possible adoption barriers, by assessing trainee opinions toward adopting this innovation, (b) the training characteristics that affect the rate at which university faculty adopt the use of advanced multimedia information presentation for instructional material, and (c) any recommendations for improving innovation adoption.

First, the data collection and subsequent analyses were used to determine if the technology was adopted (i.e., if trainees integrated some aspect of advanced multimedia into their course instruction material). Second, data analyses were used to assess the participants' opinions toward adoption of the technology, new pedagogies, and new presentation styles. Third, data analyses were used to determine if there are any differences among the adoption and acceptance of the individual innovation stages (technology, pedagogy, and presentation style).

METHOD

The research method used both quantitative and qualitative data collection and analyses. The quantitative data used all participants, while the qualitative used a subset of those participants.

Participants

The participants in this research were university faculty members who participated in the Advanced Web Development workshops at Virginia Tech. A total of 19 faculty members, 14 males and 5 females (total response rate of 63%) participated. These participants were faculty members from two universities, Averett University (four faculty members) and Virginia Polytechnic Institute and State University (fifteen faculty members). The faculty members represented technical and non-technical fields and non-tenure track and tenure track positions (two instructors, 4 assistant professors, 7 associate professors and 6 full/professors). Areas of specialty included:

- Agriculture and Life Sciences
- Business
- Education
- Educational Leadership and Policy
- English
- Industrial and Systems Engineering
- Math
- Psychology
- Statistics
- Urban Studies
- Veterinary Medicine

The participants for the workshop were self-selected. The workshop participants were assumed to have a basic set of skills before entering the workshop:

- Specified need for multimedia course enhancement
- Basic understanding of computer operations and terms
- Previous experience creating web sites
- Basic to intermediate knowledge of web development
- Basic understanding of the World Wide Web
- Some knowledge of the client/server model of interaction on the web
- Some basic knowledge of digital graphics
- Basic knowledge of basic knowledge of production planning
- A specific need for audio and/or video in multimedia course enhancement
- Basic to intermediate knowledge in the creation of audio and/or video content creation, and
- Basic to intermediate knowledge in multimedia content creation

Procedure

Each of the participants in this research attended an advanced web development workshop, which included a multimedia presentation that introduced them to this research project. After completing the workshop, the participants completed a questionnaire; some of those participants were personally interviewed.

Workshop

Participants attended one of three, 3-day Advanced Web Development workshops presented at Virginia Tech. The goal of the workshop was to encourage faculty members to undertake web-based course enhancement by providing them with the most relevant skills. Table 1 describes the software introduced to the workshop participants across a three-day session.

Table 1 Software Applications and Function

Software	Function
Dreamweaver	Webpage Creation and Publishing
Photoshop	Image Editing/Interface Design
Peak (Mac) & Sound Forge (Windows)	Digital Audio Editing
Premiere	Digital Video Editting
Instant Lecture	Media Integration Tool
FreeHand	Drawing/Element Creation
Flash	Drawing and Animation

Exposure to these software applications was designed to provide the workshop participants with a basic introduction to the creation and integration of web media objects (text, images, animation, digital audio, and digital video). In addition to the software described, the workshop also featured discussion about Americans with Disabilities Act (ADA) compliance and a lecture concerning teaching philosophy in the face of technology advancements.

The participants had approximately one and a half hours of instruction and some practice for each of the software packages shown in Table 1. The primary focus of the instruction was to introduce the software applications and their basic functions. Throughout the workshop, the participants were encouraged to spend additional time (outside of workshop instruction) with the software creating actual course content, to get a more thorough understanding of the potential uses and benefits of the software packages for their individual needs. Individual exploration of the software would potentially provide the participants with the freedom to explore their own ideas, and begin to consider how the use of web media objects will benefit or augment their course instruction.

Multimedia Presentation

A brief online multimedia presentation was provided at each of the workshops. There were two purposes for this brief multimedia presentation:

- To serve as an introduction to the metrics that were used to measure innovation rate of adoption, and
- To provide a brief demonstration of the use and integration of web media objects that the faculty members became familiar with in the workshop.

This multimedia presentation was web-based and was divided into five sections. The first page of the five page website was an introduction which welcomed the workshop participants, introduced the primary researcher for the project, introduced the research, and stated the purpose of the research. Three subsequent pages presented operational definitions for the innovation presented in the research project, media objects, and the seven innovation attributes. The last page was a concluding page that thanked the workshop participants for their attention. The information presented on the web pages was supported with various media types such as video, audio, animation, images/graphics, and text.

See Appendix A for several screen captures of the multimedia presentation. The screen captures shown in Appendix A are snap shots of a specific web page (within the multimedia presentation), which provided definitions for the seven innovation metrics. This page was developed using JavaScript to drive the pass through all of the information. The viewer may have allowed the JavaScript to drive the pass through the definitions or the viewer may have looked at any definition he or she desired.

Questionnaire

One month after the opening of the academic semester following the workshop, 19 participants completed both an Informed Consent form (Appendix B) and a questionnaire (Appendix C). The Informed Consent form provided information about participation, and alerted participants of their rights. The administered questionnaire used a nine-point Likert-type rating scale.

The rating scale was developed to collect information about the participants' adoption or rejection of the innovation, and the reasons for the adoption or rejection. The

questionnaire was partitioned into two parts. The first section concerned participant demographics including gender, university, department, and faculty rank. The second section of the questionnaire provided a nine-point Likert-type scale, which was used to determine if the participants adopted the innovation (at any of its stages), and to determine participant opinions toward the innovation. The faculty members' opinions toward the innovation adoption were determined by the use of Rogers' (1995) innovation characteristics and several benchmarks from the *Quality on the Line* (Institute for Higher Education Policy, 2000) report: relative advantage, compatibility, complexity, trialability, observability (Rogers, 1995), institutional support, and faculty support (Institute for Higher Education Policy, 2000).

Follow-up Interviews

Individual telephone interviews (Dillman, 1978; Frey and Oishi, 1995) were conducted to gather additional information about the faculty's opinions about the innovation adoption. These interviews were semi-structured and were near thirty minutes in length. A semi-structured interview is a combination of a structured and an unstructured interview. Therefore, some of the questions were pre-planned while others were dependent upon the interviewee's responses. Appendix F describes the greeting/explanation and the telephone interview questions.

Participants. The interviews were conducted with 4 participants who were trained in the Advanced Web Development workshop. The interview participants were selected using a criterion sampling strategy of the purposeful sampling evaluation technique (Patton, 1990). In criterion sampling all cases that meet a predetermined criterion are reviewed. The purpose of using criterion sampling is to understand the cases that are potentially information rich; these information rich cases are likely to uncover major system weaknesses that may present opportunities for improvements (Patton, 1990).

The criterion set for the interviewed participants required each of the participants to:

- Have responded to the questionnaire,

- Have held a tenure track position,
- Rank as assistant professor or full professor, and
- Be a faculty member of a research institution (Virginia Tech).

These criteria were strategically selected to examine the point of views of assistant professors (non-tenured faculty) and full professors (tenured faculty) at a research institution. Galvin et al. (2001) discussed an interview with Dr. Holzer (a distance learning expert and faculty member at Virginia Tech), in which Dr. Holzer strongly suggests that assistant professors should not become involved in multimedia course development. The premise for his suggestion rests in the idea that assistant professors' primary goal is to establish themselves as researchers. Dr. Holzer states that an assistant professor will not survive the tenure process if they take on multimedia course development, because it requires a lot of time. Dr. Holzer recommended that only more established professors become involved in multimedia course development. Therefore, the criterion set for the interview participants will provide an opportunity to further scrutinize the impact of time on a faculty members' (assistant and full professors) decision to adopt web media objects into their course instruction.

Four of the 19 participants were selected for the follow-up interviews. These interview participants included two full professors and two assistant professors. With the permission of the participant, each telephone interview was recorded from the beginning to the end. After the recording was conducted, it was then transcribed. The participants' responses for each question were transcribed verbatim.

Content Analysis. A content analysis was performed on the transcripts of the telephone interview data. A phenomenological approach to content analysis was used. Phenomenological philosophy, as discussed in Patton (1990), suggests that every individual has a unique set of experiences, which should be treated as truth. Therefore, in this research project, each of the interviewees' individual responses was considered as important; no relevant responses were discarded or ignored. This phenomenological approach was used to complement the richness of the purposeful sample used for follow-

up interviewing. Since the interviewees were purposefully selected, it was important to consider each of their responses to the interview questions.

While each interviewee was asked a pre-structured set of questions, there were some occasions when probing questions were asked to uncover a more clear or detailed response. The questions are provided in Appendix F. The questions were divided into three sections: technology, pedagogy, and presentation style. Those questions focused on:

1. The type of web media objects used and the purpose of that use,
2. Changes in pedagogy,
3. Changes in presentation style,
4. The influence of the hypothesized predictors (i.e. relative advantage, compatibility, complexity, etc.), and
5. The impact of "time" on the faculty members' decision to adopt the technology (the use of web media objects), an adjusted pedagogy and an adjusted presentation.

The interview responses were coded into referential units and thematic units (Krippendorff, 1980). Referential units are units that can be defined by particular persons, events, objects, countries, acts, or ideas to which an expression makes reference. Thematic units are "identified by their correspondence to a particular structural definition of the content of narratives, explanations, or interpretations" (Krippendorff, 1980, p. 62).

The results obtained from the questionnaire responses and the follow-up interviews were considered in conjunction with the researcher's general observations of the Advanced Web Development workshop. The resulting quantitative, qualitative and observational information was used to develop relevant discussion and conclusions about the adoption of web media objects for classroom use among university faculty.

RESULTS

Regression analyses were performed to determine regression models that predict faculty member adoption at each stage of the innovation. Analysis of Variance was

performed to determine whether the participating faculty members had differing opinions of the innovation (i.e., technology, pedagogy and presentation style) and the adoption metrics (i.e., relative advantage, compatibility, complexity etc.) used on the questionnaire. Finally, content analysis was used to uncover any ideas or themes relevant to the faculty members' experience with the use of web media objects in their course instruction.

Multiple Regression Analyses

First, three separate regression analyses were performed on the questionnaire data collected from the faculty members for both Averett University and Virginia Tech. The individual regression analyses were performed on the relevant (1) technology, (2) pedagogy, and (3) presentation style questionnaire data. The dependent variables for the regression analyses were the faculty members' rating of their adoption of the technology (Y1), pedagogy (Y2), and presentation style (Y3). The outcome response section of the questionnaire provided in Appendix B contains a total of three statements. The first statement on the questionnaire requires the faculty members to rate how much they agree with the statement: "I have integrated web media objects into some of my course material" on a scale of 1 to 9. The faculty member's rating of the first statement was the dependent variable (Y1) for the technology regression/prediction model. The faculty members were asked to rate similar statements concerning the adoption of a new or adjusted pedagogy (Y2) and presentation style (Y3). The predicted responses by the three regression models concern the faculty's adoption or lack of adoption of the technology, new pedagogy and/or new presentation style. These three statements are in the Outcome Responses section of the questionnaire, provided in Appendix C.

There were a total of 24 statements on the questionnaire, three of which were used to determine the dependent variable for each regression/prediction model. The hypothesized predictors: relative advantage, compatibility, complexity etc. (also referred to as innovation adoption metrics) were the independent variables for the regression. In other words those seven hypothesized predictors for determining an innovation's rate of adoption were used as the model's regressors or predictors. The faculty members rated a

total of 21 statements concerning each of the hypothesized predictors across the three innovation stages. In Table 2 lists the innovation adoption metrics and the corresponding regression symbols.

Table 2 Hypothesized Predictors for the Innovation Adoption and the Associated Regression Symbols

METRICS	REGRESSION SYMBOLS
Relative Advantage	RA
Compatibility	CM
Complexity	CX
Trialability	TR
Observability	OB
Institutional Support	IS
Faculty Support	FS

Prediction models provide a quantitative measure of the percent increase or decrease of the innovation adoption for each of the three innovation stages (technology, pedagogy and presentation style). A prediction model also provides a quantitative overview of the effect of many factors collected from relevant data (Williges et al.,1992). The hypothesized first order polynomial prediction equations specified are:

Technology

$Y1 = b_0 + b_1(RA) + b_2(CM) + b_3(CX) + b_4(TR) + b_5(OB) + b_6(IS) + b_7(FS)$

Pedagogy

$Y2 = b_0 + b_1 (RA) + b_2(CM) + b_3(CX) + b_4(TR) + b_5(OB) + b_6(IS) + b_7(FS)$

Presentation Style

$Y3 = b_0 + b_1 (RA) + b_2(CM) + b_3(CX) + b_4(TR) + b_5(OB) + b_6(IS) + b_7(FS)$

The best subsets approach and stepwise regression was used to determine the regression models. The best subsets approach used several statistical model selection criteria (e.g., variance inflation factor (VIF), coefficient of determination (R^2), error variance (s^2), Adjusted (R^2) and Mallows' Cp) to determine the best candidate regression models (Myers, 1990). After the best candidate models were selected, an ANOVA was

performed on each model. The ANOVA revealed which predictors significantly contributed to the criterion, and which predictors did not significantly contribute to the criterion. Only the predictor variables that were significant contributors to the criterion were included in the final model.

Table 3 provides the prediction models for technology, pedagogy, and presentation style for the combined faculty and the related R^2 and adjusted R^2 values. The coefficient of determination (R^2) represents the percentage of variance accounted for by the prediction model. The variance refers to the difference between the predicted criterion values (i.e., Y1, Y2, and Y3) and the actual questionnaire ratings from the faculty members. The adjusted R^2 removes the bias related to R^2 by reducing its value.

Table 3 Prediction Models for Combined Faculty

Innovation	Model	R^2	Adj R^2
Technology (Y1)	Y1 = -1.01 + 0.776(CM) + 0.370(TR)	64%	60%
Pedagogy (Y2)	Y2 = 0.12 + 0.887(RA)	54%	52%
Presentation Style* (Y3)	Y3 = 1.14 + 0.837 (RA)	55%	52%

Note. n = 19, *n = 17

Note that this presentation style prediction model was developed using 17 of the 19 questionnaires returned; two cases of the returned questionnaires were missing a single response to a question. Therefore, the model used the 17 cases where every question was answered.

Appendix D shows all of the ANOVAs for the prediction models selected from the best subsets technique for each of the innovation stages, and it relevant ANOVA data. Appendix D also shows the ANOVA for the predictors that are in the final model for those prediction models developed using the stepwise regression. Also, general descriptive statistics including: means, standard deviations, and an inter-correlation matrix from the questionnaire data are provided (for the best subsets approach and stepwise method) in Appendix D as well. The inter-correlation matrix shows the relationship between the criterion (the variable being predicted) and the predictor

variables. Multiple regression was used to develop a first-order prediction model for each of the three innovation stages: technology, pedagogy, and presentation style.

Second, three separate regression analyses were performed on the questionnaire data for the Virginia Tech faculty members only. The Virginia Tech questionnaire data was separated out in order to assess the related results from a research one institution. The dependent variables for these regression analyses were the same as those from the combined faculty analyses. The total number of responses used for these computations was 15 (there were 15 Virginia Tech faculty). The best subsets approach (Myers, 1990) and the stepwise regression technique were used to determine the candidate regression models for the three innovation stages. Only the predictor variables that significantly contribute to the criterion were included in the final model. An analysis of variance (ANOVA) was conducted on each regression model. Each of the model's predicators were significant ($p<0.05$). Table 4 provides the prediction models for technology, pedagogy, and presentation style for the Virginia Tech faculty.

Table 4 Prediction Models for Virginia Tech Faculty

Innovation	Model	R^2	Adj R^2
Technology (Y1)	Y1 = -1.038 + 1.13(CM) + 0.66(TR) - 0.646(OB)	78.7%	73%
Pedagogy (Y2)	Y2 = 0.119 + 0.949(RA)	76%	74%
Presentation Style* (Y3)	Y3 = 1.84 + 0.725(RA)	46.3%	42%

Note. $n = 15$, $*n = 14$

Note that the presentation style prediction model was developed using 14 of the 15 Virginia Tech faculty questionnaires. There was one case of a single missing response to a question. Therefore, a total of 14 cases were used for that model.

Appendix E shows all of the ANOVAs for the prediction models selected from the best subsets technique for each of the innovation stages, and its relevant ANOVA data. Appendix E also shows the ANOVA for the predictors that are in the final model for those prediction models developed using the stepwise regression. General descriptive statistics including means, standard deviations, and an inter-correlation matrix from the questionnaire data are provided in Appendix E as well.

Analysis of Variance (ANOVA)

The questionnaire for both Averett University faculty and the Virginia Tech faculty were analyzed using a 3X7 within-subjects factors (Innovation X Predictor) ANOVA to determine whether the participating faculty members have differing opinions of the innovation (i.e., technology, pedagogy and presentation style) and the adoption metrics (i.e., relative advantage, compatibility, complexity etc.) used on the questionnaire. There were three levels of Innovation: technology, pedagogy and presentation style. Predictor main effect had seven levels: relative advantage, compatibility, complexity, trialability, observability, institutional support and faculty support. The responses to questionnaire statements in the sections labeled relative advantage, compatibility, complexity, trialability, observability, institutional support and faculty support were the dependent variables.

This analysis shown in Table 5 revealed that the main effect for Predictor and the interaction between Innovation and Predictor were not significant ($\underline{p} > 0.05$). However, the main effect for Innovation was significant ($\underline{p} < 0.05$).

Table 5 ANOVA Summary

Source	DF	SS	MS	F
Between				
Subject	18	468.775		
Within				
Innovation	2	20.717	10.359	8.62*
Innovation X Subjects	36	43.277	1.202	
Predictor	6	98.495	16.415	1.17
Predictor X Subjects	108	1511.699	13.997	
Innovation X Predictor	12	22.702	1.892	1.98
Innovation X Predictor X Subjects	214	204.754	0.957	
Total	396	2370.419		

***α = 0.05** Note. Due to missing data only 397 observations used

In addition, the Newman-Keuls post hoc test showed that there was a significant difference in the faculty members' ratings across all three levels of Innovation ($p < 0.05$). The post hoc comparison showed that the means at each level of the innovation: technology, pedagogy, and presentation style were significantly different from each other. Technology statements (M=6.05, SD=2.45) were rated significantly different from the pedagogy statements (M=5.75, SD=2.42) and the presentation style statements (M=5.47, SD=2.47). In addition, the mean questionnaire ratings for the pedagogy statements (M=5.75, SD=2.42) were significantly different from that of presentation style (M=5.47, SD=2.47).

Content Analysis

Content analyses were performed on the purposeful sample of VT faculty members. The results of the content analysis provided some insight into the reason why the hypothesized predictors were influential (or not influential) on the faculty members' decision to adopt the innovation (at either of its stages).

For each section (i.e., technology, pedagogy, and presentation style) only those hypothesized predictors that did not appear in the associated prediction model were included in the interview questions. For example, the pedagogy prediction model for the Virginia Tech faculty members included only relative advantage. Therefore, compatibility, complexity, trialability, observability, institutional support, and faculty support (the hypothesized predictors not in the pedagogy prediction model) were included in the pedagogy section of interview questions. Since observability was a significant predictor in the technology prediction model for the Virginia Tech faculty members, it was included in the interview questions for that section to determine why observability was negatively related to the adoption of the technology.

Each of the participants' transcribed responses was coded into thematic and referential units. First, in the coding process, the responses were divided into three sections: technology, pedagogy and presentation style. Some questions had two parts. The first part of the questions required a yes or no response, while the second part required an explanation. The explanation portions of the question were the focus of the coding. Second, each participant's response to a question was coded in terms of themes and referential units, and was listed in its own table. Each response to the interview questions was identified by a number, which corresponded to a specific respondent.

Next, all of the coded responses for a single question were combined into one table. In this table the frequency of occurrence of a coded response was recorded. Appendix G provides these tables of coded responses. However, the tables of coded responses shown in the body of this document were combined to present a simplified set of coded themes and referential units. Table 6 shows all of the unique responses (referential and thematic) for the related questions concerning:

1. Types of web media objects used,
2. Uses of those web media objects,
3. Changes in pedagogy, and
4. Changes in presentation style.

Table 6 Interview Response Code and Frequency for Type and Purpose of Web Media Objects, Changes in Pedagogy, and Changes in Presentation Style

What type of web media objects (text, images, animation, audio, video) did you create and use for your course instruction?	
Code (referential)	**Frequency**
Text	3
Images	2
Video	1
Audio	1
Animation	1
None	1
How were the web media objects used?	
Supplemental class information	2
Syllabic information	1
Illustration of an individual	1
Virtual tour	1
Instruction	1
Tutorial	1
Lecture notes	1
When you used web media objects, did you alter your pedagogy? If so, how or how much?	
[Yes] Added student interaction to lecture (Thematic)	3
[Yes] Added student practice (Thematic)	2
When you used web media objects, did you alter your presentation style? If so, how or how much?	
[Yes] Microsoft PowerPoint™	1
[Yes] Computer	1
[Yes] Computer projection	2
[Yes] Overhead projector	1
[Yes] Computer lab	2

The faculty members used web media objects including text, images, video, audio and animation. However, one faculty member adopted no web media objects. The web media objects were used for various purposes. The web media objects were used for

supplemental class information, syllabic information, illustrations of individuals (picture of a person), a virtual tour, instruction, tutorials and lecture notes. As a result of using web media objects faculty members changed their pedagogies by adding student interaction to the lecture and adding some practice for students within the class. In addition faculty members altered their presentation styles by using Microsoft PowerPoint™, a computer, computer projection, overhead projectors and a computer lab to accommodate the use of web media objects.

Tables 7 and 8 show the referential units and the themes that emerged from the faculty members' discussion about the influence of the hypothesized predictors. The coded responses in Tables 7 and 8 are an amalgamation of all the responses about the influence of relative advantage, compatibility, complexity, trialability, observability, and institutional support across each section of questions.

Table 7 Interview Response Code and Frequency for the Influence of the Hypothesized Predictors: Relative Advantage, Compatibility, Complexity, and Observability

Relative Advantage for Technology	
Code (Thematic)	**Frequency**
[Yes] Natural progression	1
[Yes] Saves time	1
[Yes] Class preparation for students	1
[Yes] Adjustability	1
[Yes] Efficient delivery method for non-textual information	1
[No] No influence	1
Compatibility for Pedagogy and Presentation Style	
[Yes] Natural progression	2
[Yes] Similarity	1
[Yes] Compatible with teaching goals	1
[Yes] Compatibility prompted change	1
[No] No pre-knowledge of pedagogy change	1
Complexity for Technology, Pedagogy, and Presentation Style	
[Yes] Administrative complexity	1
[Yes] Computer administration difficulties	1
[No] Easy task/Not Difficult	3
[No] No pre-knowledge of pedagogy change	2
[No] Difficulties worked out over time	1
Observability for Technology, Pedagogy and Presentation Style	
[Yes] Provides assurance/confidence	2
[Yes] Reminder of alternatives	1
[No] No one to observe	5

Table 8 Interview Response Code and Frequency for the Influence of the Hypothesized Predictors: Trialability, Faculty Support and Institutional Support

Trialability for Pedagogy and Presentation Style	
Code (Thematic)	**Frequency**
[Yes] Provided assurance/confidence	3
[No] No other alternative	2
[No] No pre-knowledge of presentation style change	1
Faculty Support for Technology, Pedagogy and Presentation Style	
[Yes] College of architecture webmaster (referential)	1
[Yes] Provided computer (referential)	1
[Yes] Provided experience	1
[Yes] Provided example alternatives	1
[No] Inadequate funds	1
[No] Not utilizing faculty support	1
[No] No adequate support available	4
Institutional Support for Technology, Pedagogy and Presentation Style	
[Yes] Computer/Laptop (referential)	2
[Yes] Computer projector (referential)	1
[Yes] Departmental server provided (referential)	2
[No] Hindered adoption	1
[No] No pre-knowledge of pedagogy change	1
[No] Unnecessary	1
[No] No adequate support available	2

The content analysis revealed useful information concerning the influence of relative advantage, compatibility, complexity, trialability, observability, and institutional support. The majority of the faculty members stated that relative advantage influenced their decision to adopt the technology. The perceived relative advantages included class time savings, adjustability of the course material (when web media objects were used), student preparation for class, efficiency of delivery method for presenting non-textual information, and a natural progression into the use of technology in the classroom. However, one faculty member who did not adopt any web media objects stated that relative advantage was not at all influential.

Some of the interviewed faculty members mentioned that compatibility influenced their decision to adopt a new or modified pedagogy and presentation, while another stated that compatibility did not influence their decision to adopt. Compatibility influences their decision to adopted by being a natural progression into the use of technology in the classroom, similar to previously introduced ideas, compatible with teaching goals, and the catalyst for making a change in presentation style. There was one instance where a faculty member stated that compatibility for pedagogy did not influence their decisions because they had no pre-knowledge that there would be a need to change their pedagogy.

Complexity influenced some faculty member's decision to adopt because of difficulty coordinating administrators to implement the use of web media objects in the classroom, and difficulty with computer administration. However, other faculty members stated that complexity concerning technology pedagogy, and presentation style did not influence their decision to adopt because the task was not difficult, they had no pre-knowledge that there would be a need to change their pedagogy, and the associated difficulties were worked out over time.

Observability (associated with technology, pedagogy and presentation style) influenced participants' decision to adopt by providing the faculty members with confidence that web media objects could be used successfully, and reminding them of the alternatives for presenting course content. However, other faculty members mentioned that observability did not influence their decision to adopt because they had no one to observe.

One reason that trialability influenced pedagogy and presentation style was that it provided a faculty member with confidence that the use a web media object(s) would work effectively. Several reasons why trialability was stated to not influence their decision were that there were no other alternatives to using the web media objects for instruction, and that there was no pre-knowledge of a need for a change in presentation style.

Faculty support for technology, pedagogy, and presentation style influenced the web media object adoption by providing technical support from a webmaster, a computer,

experience with web media object creation, and example web media object alternatives. Faculty support was stated to not have been an influence because there were inadequate funds for some web media object implementation, the faculty support provided was not being used, and there was no adequate faculty support.

Institutional support for technology, pedagogy and presentation style influenced adoption by providing a laptop, computer projector and a departmental server. Some reasons why institutional support did not influence the adoption decision were that there was no pre-knowledge that there would be a need for a change in pedagogy, there was no need for institutional support, and there was no adequate institutional support available.

Table 9 summarizes the themes that resulted from the faculty members' discussion of the impact of "time" on their decision to adopt the technology, an adjusted pedagogy and an adjusted presentation style. Related statements or questions are also shown in Table 9 as well.

Table 9 Interview Response Code and Frequency for the Impact of Time on the Innovation Adoption

Describe the impact of time on your decision to adopt the use of web media objects, a new or adjusted pedagogy and a new or adjusted presentation style.	
Code (Thematic)	**Frequency**
Time consuming personnel coordination	1
Too time consuming/Lack of Time	4
Saves class time	6
Desire increased utilization	2
Steep learning curve	1
Constrained by other responsibilities	3
No great impact	1
Some preparation time needed	1
If you spent the time creating and implementing web media objects, what other things would be traded off?	
1. Home life	1
2. Tenure requirements	2
3. Research development	1
4. Pedagogy development	1
5. Teaching	1
6. Doctoral student advising	1
7. Writing	1
8. Administrative responsibilities	1
9. Committee work	1

Open/Additional Comment: One assistant (non-tenured) professor mentioned the need to apply for a grant and/or release time to in order to focus on web media object development.

The faculty members mentioned a number of ways that time impacted their decision to adopt the technology, a new or modified pedagogy and presentation style which include: being time consuming, being constrained by other responsibilities, desiring to increase web media object utilization, being associated with a steep learning curve, saving class time, not being of any great impact, requiring some preparation time.

In addition, the faculty members mentioned some things that would have to be traded off if they were to spend the necessary time to develop web media objects. Those

trade offs include: quality of home life, tenure requirements, research development, pedagogy development, teaching, doctoral student advising, writing, administrative responsibilities, and committee work.

In Appendix G, there is a separate table for each interview question. Each table contains the relevant code and the frequency counts for the interview responses. Frequency counts refer to the number instances where an object or theme appeared. There were some instances where the interview sample size (n) for the coded responses was less than four (the number of faculty interviewed). These instances occur for one of two reasons: (1) a respondent did not appropriately answer the question and/or (2) the question was not applicable for the respondent's experience with web media objects.

Additional Responses

The instances where the respondent did not answer the question appropriately were an indication of some respondent confusion about the differences between pedagogy and presentation style. For example, in response to the questions **"**Did receiving institutional support (for changing your pedagogy) influence your decision to change your pedagogy? Why or why not?" one faculty member stated:

> *Yes. I think so. I think that the computing center has been really good as* far as the lab is concerned…real good.

That particular response is more related to receiving institutional support for changing the presentation style. This individual faculty member held related classes in a computing center. The web media objects adopted were presented in this computing center environment. In this example, the computing center would not be involved in providing help with changes in pedagogy.

A second example that points out some confusion with pedagogy and presentation style, was related to the questions "Did perceiving the complexity of reconsidering your pedagogy influence your decision to change your pedagogy? Why or Why not?" One faculty member first responded:

> *The complexity is in the fact that you have to talk to seventeen people to organize…compared to writing on the blackboard, you don't have to talk to anybody. The chalk is there, the blackboard is there, the room is arranged for you. There is hardly no effort. With this computer thing you have to check with the computing center, to get the software, the hardware. If you don't have the software, you have to find some way to buy it.*

This response is clearly referring to the complexity of organizing the essential components for a change in presentation style, not pedagogy. There, again, there was apparent confusion about the difference between pedagogy and presentation style. Therefore, the confusion demonstrated in these examples clearly indicates that there are some challenges in distinguishing between pedagogy and presentation style.

DISCUSSION

This research resulted in four outcomes. Those outcomes include: data about workshop participants' perceptions towards the innovation adoption, general lessons learned, including any adoption barriers, research implications, and potential guidelines for training developers and training support systems.

Faculty Member Perceptions of Innovation Adoption

The ANOVA and subsequent post hoc comparison results suggested that, overall, the combined faculty, have a greater perception (shown by higher ratings) of the adoption metrics for technology as compared to pedagogy and presentation style. In other words the post hoc comparison results on the significant main effect (innovation) suggest that the faculty members' mean ratings across the hypothesized predictors (relative advantage, compatibility, complexity, etc.) for technology were significantly higher than the mean ratings for pedagogy and presentation style. The post hoc comparison also revealed that the faculty members' mean ratings across the hypothesized predictors for pedagogy were significantly higher than the mean ratings for presentation style.

These results provide some insight into the differences in the faculty members' perceptions (as it relates to the adoption metrics) of the three innovation stages. It seems

that faculty have had more exposure to and support for the idea of adopting the technology (web media objects into their course instruction) than exposure to and support for adopting a new or adjusted pedagogy or presentation style.

The training faculty members received in the three-day workshops and the faculty members' general understanding of the inclusion of web media objects provided more focus in the area of technology, and less focus on necessary information concerning the potential need for new or adjusted pedagogy and/or presentation style. These findings have implications for the content necessary for more effective and inclusive training programs. This research supports the literature (Dwyer et al., 1991), which suggests that there should be discussion about the potential need to adopt or adjust a pedagogy or presentation style. The faculty members need to recognize that their traditional pedagogical methods and presentation style methods may need some minor or even major adjustments in order to facilitate student learning with web media objects. The faculty members not only need awareness of possible shifts in pedagogy and presentation style, but they also need technical support to complement that awareness (Baldwin, 1998; Byrom, 1998; Gillespie, 1998; Johnston and Cooley, 2001).

There were no significant differences found among the Predictor ratings for technology, pedagogy, and presentation style. Those findings showed that the faculty did not rate any single adoption metric significantly higher or lower than any other adoption metric. Therefore, there was no single adoption metric of which the faculty seemed to have a higher or lower perception. The fact that the faculty members have similar perceptions of the adoption metrics for the innovation implies that they have nearly equal levels of perception across relative advantage, compatibility, complexity, trialability, observability, institutional support and faculty support.

Hypothesized Predictor Variables

The hypothesized predictor variables and the direction of their relationship for the adoption of the innovation for each of the three stages: technology, pedagogy, presentation style are illustrated in Figure 2.

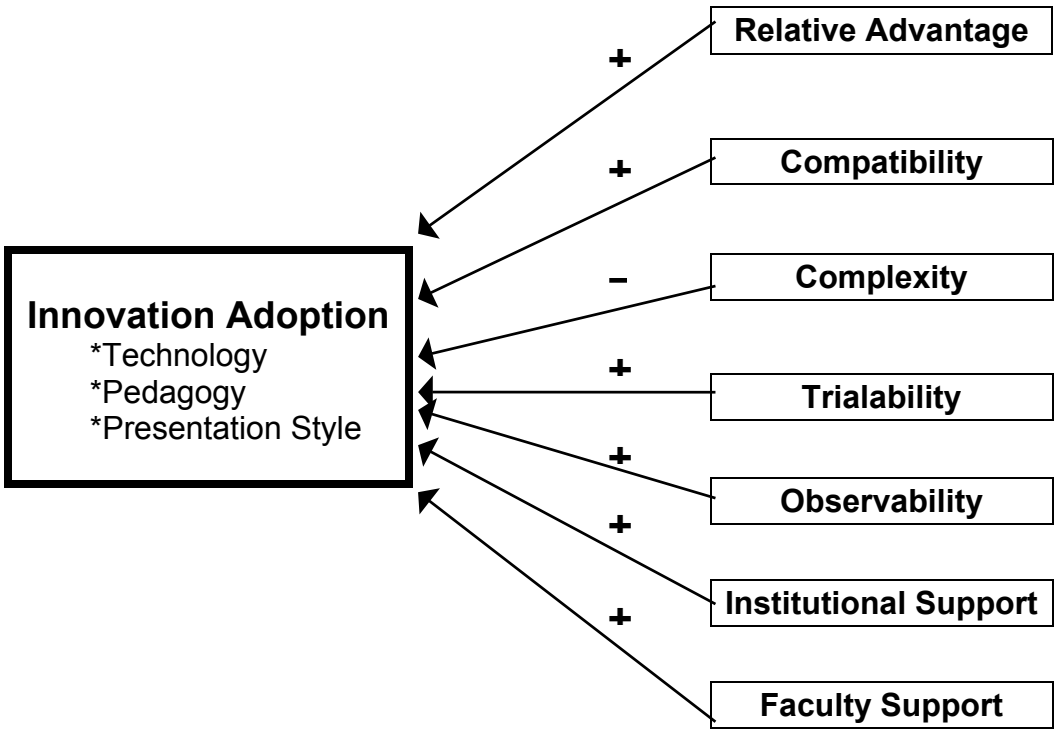

Figure 2 A Model of the Hypothesized Predictors of Innovation Adoption

The multiple regression performed on the questionnaire data revealed that not all of the hypothesized predictor variables significantly contributed to the prediction of the adoption of the technology, a new or adjusted pedagogy, and a new or adjusted presentation style. Therefore, the original hypothesized model for predictors of the innovation adoption was not confirmed. Nevertheless, one or some of the predictors were significantly related to the innovation adoption at its various stages: technology, pedagogy, and presentation style.

Prediction Models

The prediction models serve as tools for advanced multimedia training developers and advanced multimedia training support systems. Advanced multimedia training support includes those systems set in place to assist faculty with the technical and non-technical aspects of web media object creation, use, and maintenance. These prediction tools are most useful when there is interest in identifying trade-offs in the development of web media object training instruction and training support systems that support a high

rate of innovation adoption. In other words, these prediction models provide a quantitative method for selecting the factors on which to focus, in order to achieve and maintain higher rates of innovation adoption. For example, the multiple regression analysis performed on the combined faculty data revealed that compatibility and trialability were significant and positive contributors to the prediction of the technology. In this case a training designer may consider incorporating activities within the training that augment the faculty members' perceptions of compatibility and trialability. Since compatibility and trialability are positively related to the adoption of the technology, increasing compatibility and trialability would potentially increase the adoption of the technology.

Technology for Combined Faculty

The resulting technology regression model for the combined faculty contained two predictors: compatibility and trialability. Each of those predictors was positively related to the prediction of technology adoption. These two adoption attributes, as components of the regression model, indicate that compatibility and trialability were the only hypothesized prediction variables that were adequately able to predict the adoption of the technology. These findings suggest that the faculty's perception of the technology's (the inclusion of web media objects into course instruction) consistency with other ideas to which the faculty have been introduced, in addition to the faculty's ability to try out the technology before full implementation, are adequate predictors for a faculty members' adoption of the technology.

These two adoption attributes certainly have implications for the advanced web development faculty-training designers. Those individuals who are developing advanced web development training programs for university faculty need to place concentrated focus on helping the faculty to perceive high compatibility and trialability with the idea of including web media objects into their course instruction. According to the regression model determined for technology, the allocation of ample training focus on increasing the perceived level of compatibility and trialability will potentially increase the adoption of web media objects into university faculty's course instruction.

Pedagogy and Presentation Style for Combined Faculty

The literature reviewed in the introduction of this document provide strong indication that a faculty member may need to adopt a new or adjusted pedagogy and/or presentation style, after adopting the use of web media into their course instruction.

For the adoption of pedagogy and presentation style, only relative advantage was a significant predictor. The Newman Keuls post hoc comparison results revealed a significant decrease in the adoption metrics means across the three innovation stages. The mean for technology rated highest, pedagogy immediately followed technology, and the mean for presentation style rated the lowest. The differences in mean ratings may be the result of the faculty members' decreased amount of knowledge about pedagogy and presentation style. Therefore, compatibility, complexity, trialability, and observability may not be included in these models as a result of the faculty members' lack of information and knowledge about the importance of reconsidering their existing pedagogies and presentation styles for the use of web media objects in course instruction. Since that general knowledge is not present, the faculty members do not have any (or much) information upon which to base perceptions about compatibility, complexity, trialability, and observability.

Also, the faculty members do not seem to be aware of any institutional or faculty support to help them make the necessary changes to their pedagogies and presentation styles. The faculty's lack of information about pedagogy and presentation style was also noted from the purposeful sample interviews upon which content analysis was performed.

Technology for VT Faculty

The resulting technology regression model for the VT faculty contained three predictors: compatibility, trialability and observability. This model reveals that compatibility and trialability were positively related to the adoption of the technology. However, observability was negatively related to the adoption of the technology. Therefore, an increased rating of compatibility and trialability will cause an increased

adoption of the technology; a decreased rating of observability will increase the adoption of the technology.

The prediction model shown in Figure 2 hypothesizes that observability would be positively related to the adoption of the innovation (technology). One possible reason for this discrepancy may be linked to the fact that faculty members (those interviewed with the purposeful sampling technique) refer to themselves as pioneers of web media objects inclusion in course instruction. Two of the four faculty members stated that they did not have anyone in the departments to observe using web media object in their course instruction. Therefore, these faculty members did not have any visible examples of web media object use in their area of study and teaching. It is very possible that this is true for the other faculty members, which would result in low ratings for observability on the questionnaire. However, it is not completely clear why there is a negative relationship between the adoption of the technology and observability.

Pedagogy and Presentation Style for VT Faculty

The pedagogy and presentation style prediction models for the VT faculty were the same as the pedagogy and presentation style prediction models for the combined faculty. Furthermore, the related implications are the same as those for the combined faculty.

Lessons Learned

During the course of data collection and analysis for this research project, there were a number of issues that can be listed among lessons learned. The lessons learned are primarily interesting observations and specific issues that faculty may have encountered. These observations were determined from the follow-up interviews.

The first lesson learned involves the idea concerning the hypothesized relationship between the adoption of the technology (inclusion of web media objects into course instruction) and the subsequent adoption of a new or adjusted pedagogy and/or presentation style. Figure 1 in the introduction of this document presented the idea that

once the technology is adopted (adoption may be partial in that only specific aspects of the technology were adopted) a new pedagogy and new presentation style may be a direct or indirect consequence (Rogers, 1995) of the technology adoption. In addition, once those new pedagogies and/or new presentation styles are adopted, it is likely that they will have a continual influence upon each other.

One interview from the purposeful sample provided an actual example of one aspect of the idea depicted in Figure 1. The interviewee provided the following statements concerning the adoption of the technology and the subsequent adoption of a new pedagogy and presentation style:

> After adopting the technology*...I think the presentation style changed first. Then I realized that it changed the pedagogy. I don't think that I intentionally put everything on the web thinking that I would interact more with the students. It just happened that way…*

This example supports the hypothesized relationship between the technology adoption, and the subsequent adoption of a new pedagogy and new presentation style. This statement also implies a natural progression from the adoption of one aspect of the innovation (of including web media objects in course instruction) to the adoption of the other aspects of the innovation (pedagogy and presentation style). Therefore, this example provides support for the hypothesized relationship between the innovation adoption stages depicted in Figure 1.

A second lesson learned involves the impact of time on the faculty's decision to adopt web media objects. When each faculty member was asked about the impact of time on their decision, they generally responded in two parts. First, three of the four interviewees mentioned the time savings in class that they experienced having used the web media object(s) of their choice. The fourth interviewee had not adopted any web media objects for time related issues that are discussed later in this document. Second, the interviewees discussed the impact of time as being a barrier to the adoption of web media objects.

There were a number of things that the faculty would have to trade-off in order to make more use of web media objects within their course instruction. In each case the trade-offs would have been too costly to pursue. For example, the assistant professors

mentioned having to trade-off tenure requirements (such as research/publications). One assistant professor repeatedly stressed the desire to adopt more web media objects for course instruction, but could not because of heavy time commitments to research and publishing. Another assistant professor mentioned trying to acquire some release time in order to dedicate a sufficient amount of time to create more web media objects.

Full professors responded differently to the question about trade-offs required to pursue an increased use of web media objects. One full professor suggested that his quality of home-life was an object of concern that would have been traded off. The second full professor had not adopted any web media objects into his course instruction. This full professor had a departmental appointment to an administrative position, which accounted for 40% of this full professor's job description. This full professor maintained the departmental appointment in addition to the same load of responsibilities as before the departmental appointment. This full professor stated that there is no time available for creating web media objects. Again, the trade-off would be too costly. Those trade-offs would include: time for doctoral student advising, teaching, writing, committee work, departmental administrative work and research development.

Time seems to have a substantial impact on the VT (research institution) faculty members. It also seems that those faculty members who find the time to create and implement web media objects, can only do so at a rather minimal level.

Additional barriers to the adoption of web media objects, new or adjusted pedagogies and new or adjusted presentation styles included: (1) lack of faculty support and (2) lack of observability. Foster and Hollowell (1999) assert the significance of providing faculty with resources such as software, servers, and general support and service. The relative importance of Foster and Hollowell's (1999) assertion was confirmed as the faculty members discussed their lack of support. Due to the lack of faculty support, one faculty member did not have adequate funds to purchase the required material for implementing web media objects in the desired manner. Faculty members also reported that they did not receive any faculty support to help them transition into new or adjusted pedagogies and/or presentation styles. There was also some confusion among faculty members about the difference between pedagogy and presentation style. In

general, faculty members had no pre-knowledge that there would be a potential need to change their existing pedagogies and presentation styles. The lack of observability may also be a barrier to the adoption of web media objects. The faculty members mentioned that there was no one in their departments to observe using any web media objects.

Future Research Implications

There were several limitations of this research project that present opportunities for future research. One such limitation was the absence of planned analyses to determine why there was a difference between the combined faculty prediction model and the VT faculty prediction model. It is possible that the differences between a teaching-focused university and a research-focused university have an have an effect on on the ratings of the innovation adoption and hypothesized predictors. Second, there were no conclusive findings as to why all of the hypothesized predictors were not included in the each of the regression models. Further research for determining why each of the hypothesized predictors was not included in each of the prediction models could be designed to have university faculty rate the importance of the hypothesized predictors (as it relates to the innovation adoption). Third, it was unclear as to why there was a negative relationship between the adoption of the technology and observability for the VT faculty. Finally, since untenured faculty do not seem to have time to heavily make use of web media objects in their classes, the question may be asked: who (which group or groups of faculty members) should be targeted for the adoption of web media objects in the classroom?

Potential Guidelines for Workshops

There were a number of potential guidelines that resulted from the consideration of the various prediction models. Both the combined faculty prediction model and the VT faculty prediction model were considered together to form a comprehensive set of guidelines. The guidelines were divided in terms of the three innovation stages.

Technology Guidelines

Two guidelines for training developers emerged from the related regression model. Those training developers who want to design a training program that will facilitate the adoption of the technology should:

1. Provide workshop activities that will increase the faculty's perception of compatibility with the innovation,
2. Provide workshop activities that will increase the faculty's perception of trialability with the innovation, and
3. Provide workshop activities that will increase the faculty's perception of observability.

Some potential ways to improve the perception of compatibility are provided below.

1. The faculty may need to be given some examples of university-wide initiatives that could benefit from faculty member's integration of web media objects into their course instruction.
2. Offer the group of faculty (in the training) examples of how they could incorporate web-based text, images, animation, audio, and/or video into their course instruction. These examples should cover a wide range of applications for a wide range of topic areas.

When the workshop instructors provide the faculty members with examples of how they could incorporate web media objects into their course instruction, they could also use that opportunity to present the suggested uses of the various web media objects. For example, this would be an opportunity to make the faculty members aware of the guidelines for using graphic information, online textual material, animation, online audio, video presentations, etc.

The more general purpose for these examples (concerning the perception of compatibility) would be to show the faculty that using web media objects in the classroom is not such an abstract and far-off concept. Those examples will potentially augment the faculty's perceptions about the general compatibility of using web media

objects within course instruction. The goal here would be to close the gap on any faculty member's perception that web media objects and course instruction are incompatible ideas. This aspect of the training can be used to show the faculty that this is not just another irrelevant training course, but rather, is one that is in alignment with the university goals, as well as a faculty's individual professional goals.

One potential way to improve the faculty's perception of trialability is to encourage them to come to the workshop with ideas of what they could develop for their courses, and provide time scheduled every day of the workshop to begin the development of that idea. One technique for idea development may be to have open discussions where the faculty can informally present their ideas and receive feedback from the other faculty members in the training workshop and from the training facilitator(s). Each faculty member may chose to briefly walk through the details of their plan to implement the use of web media objects for their instruction.

This open discussion/feedback session would allow them to "try out" the development aspect of the web media object(s), and may give them an opportunity to refine their idea(s) for implementation. It is known that it is not sufficient to simply change a traditionally designed course to a web-based medium, based on the precept that not all web media objects are appropriate in all types/areas of instruction (Carr-Chellman and Duchastel, 2000). Therefore, the discussion session may provide the faculty members with some feedback concerning what web media object(s) would be most appropriate for their specific instructional situation. This discussion session can also be used to receive feedback about how the web media objects could be used to create a more learner centered approach to meaningful construction of knowledge (Jonassen et al., 1999).

In an attempt to provide some level of observability, training designers should aggregate a set of examples where faculty members can see other faculty members using web media objects in their courses. As more an more faculty begin incorporating web media objects into their course instruction, faculty who are not yet familiar with the use of web media object (in the context of the classroom) will have others to observe. This suggestion would potentially increase observability over time.

Pedagogy and Presentation Style Guidelines

Two guidelines for training developers emerged from the pedagogy and presentation style regression models. Those training developers should:

1. Provide workshop activities that will increase the faculty's understanding of the potential need to reconsider their pedagogy with the use of the technology, and
2. Provide workshop activities that will increase the faculty's understanding of the potential need to reconsider their presentation style with the use of the technology.

Two potential ways to increase awareness and understanding would be to:

1. Include discussion about the possible to need to adopt a new or adjusted pedagogy as a portion of the training session.
2. Provide examples and possibly demonstrations of pedagogies that are most effective with the use of various web media objects.

The discussion and examples would provide the faculty with at least a basic awareness of the difference between pedagogy and presentation style. The discussion and examples will also provide awareness of the relevance and importance of reconsidering their existing pedagogies and/or presentation styles with the adoption of web media objects.

Consideration of the Social System on Innovation Adoption

Rogers' (1995) discussion of the importance of considering the social system, which includes a social structure, system norms, types of innovation-decisions and consequences of innovation, as a key component to the diffusion of an innovation has implications for the adoption of web media objects. The university social structure is one that has several dimensions. The university social structure can be characterized as being hierarchical in design. Generally, it consists of positions giving those of higher rank the authority to issue orders to individuals of lower rank. While hierarchical positions are a more formal aspect of social systems, there is also an informal structure within the social systems that determines who interfaces with whom and in what situations (Rogers, 1995).

In this informal communication structure it is typical for individuals to communicate with others with whom they are similar. For example, faculty members of a university department may maintain this type informal communication relationship among themselves.

Universities that desire to fully exploit the use of web media objects as a tool within the classroom, must first establish a supportive formal social structure and set complementary policies. This formal social structure and set of policies should allot more time and resources to enable efficient and effective use of web media objects. One restructuring example involves tenure requirements. The faculty members' need to fulfill tenure requirements may potentially act as a barrier for the adoption of web media objects. In a more optimal structure, tenure requirements should in some manner include the use of web media object as a part of course instruction (adoption of web media objects should be an optional innovation-decision based on appropriateness and benefit). These restructured tenure requirements should not only include the use of web media objects, but could be arranged to free up some time for the faculty to begin and complete its development.

Another aspect of a social structure is the systems norms. There are norms, which are "the established behavior patterns" (Rogers, 1995, p.26), that exist in terms of the formal social structure, and norms that exist for the informal communication structure. Since the Advanced Web Development workshop was the mechanism for the diffusion of the innovation, the dynamics of the social norms should have been factored into workshop's design. The workshop designers should, have benefited from the fact that individuals typically group themselves into informal social networks with individuals similar to themselves. These types of social networks may often evolve into work groups. In terms of university faculty, groups of faculty members within the social networks typically decide to work together on the development and completion of projects. Workshop designers or instructors should encourage faculty member to use their naturally evolved social networks as a team of individuals to work on web media object development.

In addition, the university web development training programs need to be more comprehensive, providing relevant information and awareness about each aspect of the adoption of web media objects (in the context of the classroom use). Faculty members' use of web media objects as a portion of their course instruction potentially involves three different stages of adoption: technology, pedagogy, and presentation style. The adoption of one stage may result in the adoption of another innovation stage (innovation adoption consequence). Therefore, the university and the workshop designers need to be jointly responsible for providing adequate information, awareness, and resources about each aspect of the adoption of web media objects.

CONCLUSION

The use of Roger's (1995) five innovation attributes: relative advantage, compatibility, complexity, trialability, and observability, in conjunction with the Institute for Higher Education Policy's (Institute for Higher Education Policy, 2000) institutional support and faculty support benchmarks provided some insight into issues concerning university faculty's adoption of web media objects into their course instruction. Four of Roger's (1995) innovation attributes: relative advantage, compatibility, trialability, and observability were among the predictors of the innovation adoption specified in this research. Even though the benchmarks from the Institute for Higher Education Policy's report (2000), institutional support and faculty support, were included as innovation adoption metrics, they did not have a significant effect on the adoption of the innovation.

One resulting outcome for this research project was a set of guidelines for advance web development training designers. The goal of this set of guidelines is to provide the training designers with some assistance in designing a training course that maximizes the level of innovation (at its three stages: technology, pedagogy, and presentation style) adoption. These guidelines consider each aspect of the innovation according to the prediction models that were built using the relevant questionnaire data. The guidelines for both data sets (the combined faculty and the VT faculty) were compiled, in an attempt provide a more comprehensive guideline set. The compiled list of guidelines is as follows:

1. Provide workshop activities that will increase the faculty's perception of compatibility with the innovation,
2. Provide workshop activities that will increase the faculty's perception of trialability with the innovation,
3. Provide workshop activities that will increase the faculty's perception of observability,
4. Provide workshop activities that will increase the faculty's understanding of the potential need to reconsider their pedagogy with the use of the technology, and
5. Provide workshop activities that will increase the faculty's understanding of the potential need to reconsider their presentation style with the use of the technology.

Various analyses of the questionnaire and follow-up interview data suggest that university faculty members are generally less knowledgeable of the potential need to change their existing pedagogies and presentation styles to provide effective integration of the web media objects into the teaching and learning process. If universities desired to fully benefit from the use of web media objects in the classroom, they need to provide more comprehensive training programs, which include discussion of potential pedagogy and presentation style changes.

Finally, faculty interviews revealed that time heavily impacted their decision to adopt various web media objects. In other words, the needed to create and implement the web media objects was a barrier towards the inclusion web media object into their course instruction. Untenured faculty members stated that they would have to sacrifice the time spent on tenure requirements in order to increase their adoption of web media objects for classroom use. Furthermore, universities may need to restructure their social structures and develop policies that support the use of web media objects in order to obtain full benefit.

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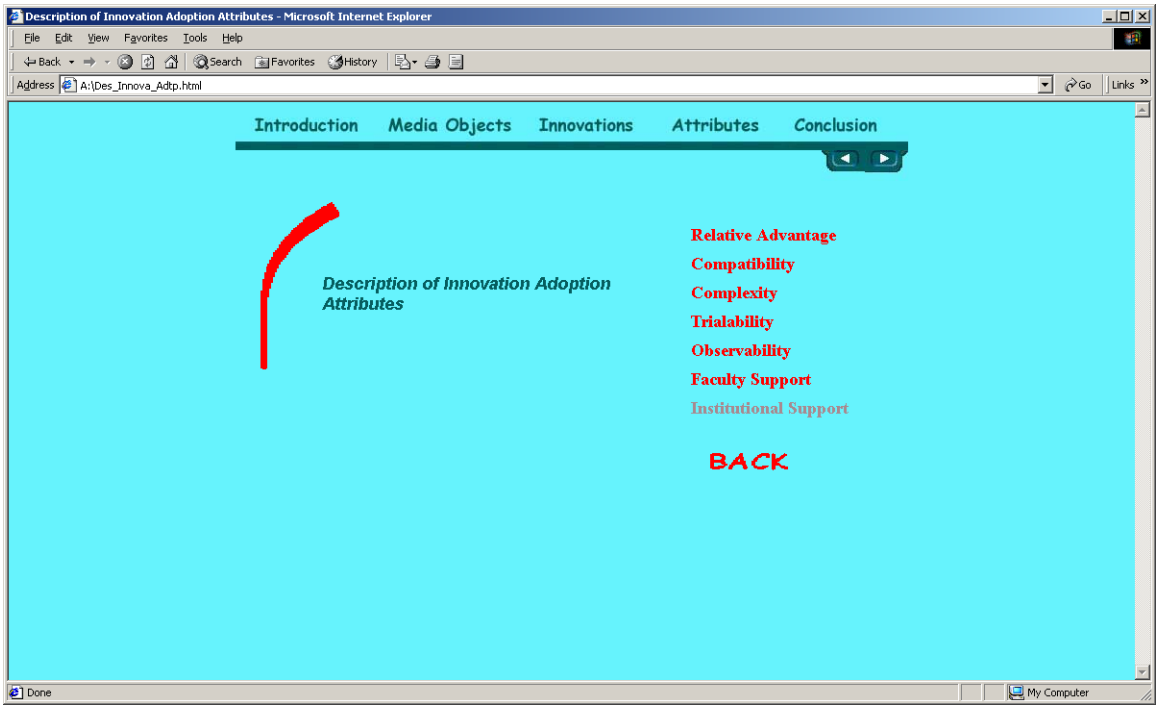
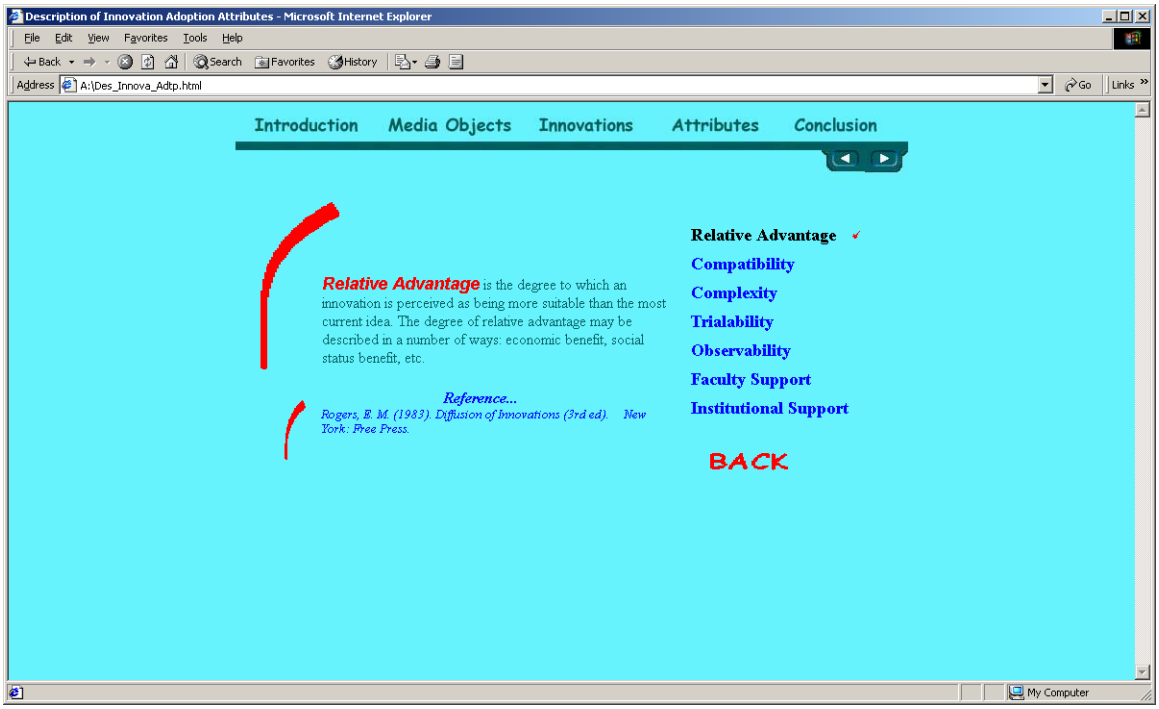
APPENDIX A

Multimedia Presentation Screen Captures





APPENDIX B

INFORMED CONSENT FORM

Title of Project: Investigation of an Innovation Adoption Survey **IRB** #01-392
Principal Investigator: Kayenda Johnson
Robert Williges (chair)

PURPOSE OF PROJECT

You are invited to participate in a research project designed to determine the advanced web course development trained faculty's innovation rate of adoption. More specifically, the innovation is described as including advanced multimedia information presentation into course materials. You will be asked to complete relevant statements on a 9-point rating scale. In addition to your completion of the questionnaire, you will be asked participate in a personal interview. In an interview setting you will be asked to answer a number of questions concerning your opinions about the adoption of advanced multimedia inclusion in your course instruction.

INFORMATION

You will be asked to fill out one short questionnaire concerning your use of the advanced web course development instruction presented in the FDI workshop. You will also be asked to answer a number of questions concerning you use of web media objects in you course instruction.

RISKS

There are no physical or emotional risks associated with this research project.

BENEFITS

At the end of this session, you will be provided with a copy of this form. At the bottom of this form, you will find contact information that can be used to contact the principal investigator after the research has been completed in order to receive information about the results.

CONFIDENTIALITY

The information gained in this research project will be kept strictly confidential. At no time will the researcher release the results of the study to anyone other than individuals working on the project without your written consent.

You will be identified only by a 3-digit study code. Data will be stored securely and will be made available only in the context of research publications and discussion. No reference will be made in oral or written reports that could link you to the data; nor will you ever be identified as a participant in the project.

COMPENSATION

In addition, your participation will benefit future development of web course training material for university faculty and the lay public who may encounter situations such as those used in this experiment

FREEDOM TO WITHDRAW

You are free to withdraw from this study at any time without penalty.

APPROVAL

It is very important that you keep the activities and information discussed confidential, since others will be participating in this research.

QUESTIONS

If you have questions or do not understand information on this form, please feel free to ask them now.

PARTICIPANT'S PERMISSION

I have read and understood the Informed Consent and conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project.

If I participate, I may withdraw at any time without penalty. I agree to abide by rules of this project.

Signature _____

Email _____ **Date** _____

CONTACT

If you have questions at any time about the project or the procedures, you may contact the principal investigator, Kayenda Johnson at kajohns5@vt.edu .

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant have been violated during the course of this project, you may contact the Chair of the Institutional Review Board Research Division, Dr. David M. Moore, at 540-231-4991.

APPENDIX C

Description of Seven Innovation Adoption Attributes

If necessary, you may refer to these descriptions as you proceed through the questionnaire.

Five attributes of innovations are (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability. These five attributes are somewhat empirically interrelated with the others.

Relative advantage is the degree to which an innovation is perceived as being more suitable than the most current idea. The degree of relative advantage may be described in a number of ways: economic benefit, social status benefit, etc.

Compatibility is the degree to which an innovation is perceived as being congruent with formerly introduced ideas, existing socio-cultural values and beliefs, and needs any potential adopters.

Complexity is the degree to which potential adopters perceive the innovation as being hard to use and understand.

Trialability is the degree to which an innovation may be temporarily used. Trialability gives a potential adopter an opportunity to try out the innovation.

Observability is the degree to which the results of innovation adoption are viewable by others.

The two additional metrics are benchmarks noted in the *Quality on the Line* study, performed by the Institute for Higher Education Policy. Two of those benchmarks are institutional support and faculty support.

Institutional support is characterized as: (1) a plan that includes electronic security measures to uphold the validity and integrity of the developed material, (2) a reliable delivery system, and (3) a centralized system which provides support for developing and maintaining distance education foundation.

Faculty support is described as: (1) transition assistance for faculty as they change from tradition education to online education, (2) instructor training, (3) technical assistance for course development, and (4) written resources for faculty concerning issues that may arise with student use of electronically accessed information.

Innovation Stages Defined

Technology is the use or inclusion of web media objects as material within your course instruction.

Pedagogy refers to the instructional design that you use to deliver the content of your course material.

Presentation Style refers to the medium by which you present your course material. Examples: PowerPoint, Overhead slides, chalkboard etc.

Purpose: This questionnaire will be used to gather information concerning the advanced web course development trained faculty's innovation rate of adoption. The innovation is described as (1) including advanced multimedia information presentation into your course materials, (2) developing and adopting a suitable pedagogy, and (3) developing and adopting a suitable presentation style. Please follow the provided instructions carefully.

Part I Fill in the appropriate response in the space provided.

Gender _____ College & Department _____

Faculty Rank _____

Part II

a. Ask yourself how you feel about the statements given. How much do you agree with these statements concerning this innovation adoption?
b. Please respond with the numerical rating as shown below:

Strongly Disagree		**Disagree**		**Neutral**		**Agree**		**Strongly Agree**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Place your rating choice in the space that corresponds to the appropriate statement.

Outcome Responses

___ I have integrated advanced media objects into my of your course material.

___ I have adjusted my pedagogy to include use of advanced media objects.

___ I have adjusted my presentation style to include use of advanced media objects.

Relative Advantage

___ I perceive that there is relative advantage in including advanced media objects into my course material.

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree
1	2	3	4	5	6	7	8	9

___ I perceive that there is relative advantage in adopting a new pedagogy that is suitable for the my use of advantage media objects in my course material.

___ I perceive that there is relative advantage in adopting a new presentation style that is suitable for the my use of advantage media objects in my course material.

Compatibility

___ Including advanced media objects in my course material is consistent with the existing socio-cultural values and beliefs (within the university system).

___ Adopting a suitable pedagogy that includes use of advanced media objects in my course material is consistent with the existing socio-cultural values and beliefs (within the university system).

___ Adopting a suitable presentation style that includes use of advanced media objects in my course material is consistent with the existing socio-cultural values and beliefs (within the university system).

Complexity

___ Development/Implementation of useful advanced media objects to include in my course material is high in complexity.

___ Development/Implementation of an appropriate pedagogy useful with the inclusion of advanced media objects into my course material is high in complexity.

___ Development/Implementation of an appropriate presentation style useful with the inclusion of advanced media objects into my course material is high in complexity.

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree
1	2	3	4	5	6	7	8	9

Trialability

___ I was able to experiment with including advanced media objects in some course material on a trial basis.

___ I was able to experiment with my newly adopted pedagogy which includes the use advanced media objects on a trial basis.

___ I was able to experiment with my newly adopted presentation style which includes the use advanced media objects on a trial basis.

Observability

___ The effects of including advanced media objects in my course material is visible to me.

___ The effects of adopting a suitable pedagogy that pertains to the use of advanced media objects in my course material is visible to me.

___ The effects of adopting a suitable presentation style that pertains to the use of advanced media objects in my course material is visible to me.

Institutional Support

___ University support is important for me to successfully integrate advanced media objects into my course material.

___ University support is important for me to successfully adjust my pedagogy pertaining to the use advanced media objects into my course material.

___ University support is important for me to successfully adjust my presentation style pertaining to the use advanced media objects into my course material.

Faculty Support

___ As a faculty member, I believe that it is important for me to receive support relevant to integrating advanced media objects into my course material.

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree
1	2	3	4	5	6	7	8	9

___ As a faculty member, I believe that it is important for me to receive support necessary to transition to a more relevant pedagogy for use with advanced media objects into my course material.

___ As a faculty member, I believe that it is important for me to receive support necessary to transition to a more relevant presentation style for use with advanced media objects into my course material.

Please return this questionnaire to Kayenda Johnson (kajohns5@vt.edu)

Thank you for your participation!! ☺

APPENDIX D

Table D1 Technology Best Subset Model for the Combined Faculty

Predictor	Coef	StDev	P
Constant	-1.714	1.721	0.338
CM	1.0034	0.2534	0.002
CX	0.1758	0.1459	0.250
TR	0.5917	0.1954	0.010
OB	-0.4478	0.2937	0.151
FS	-0.1008	0.1441	0.497

n=19, R-Sq = 73.9%, R-Sq(adj) = 63.9%

The regression equation is:
Y1 = - 1.71 + 1.00 CM + 0.176 CX + 0.592 TR - 0.448 OB - 0.101 FS

Table D2 Technology Regression ANOVA on Best Subset Model for the Combined Faculty

Source	DF	SS	MS	F	P
Regression	5	93.211	18.642	7.37	0.001
Residual Error	13	32.894	2.530		
Total	18	126.105			

Table D3 Technology Regression Sequential Sum of Squares for the Combined Faculty

Source	DF	Seq SS
CM	1	62.252
CX	1	3.479
TR	1	20.026
OB	1	6.215
FS	1	1.238

Table D4 Means and Standard Deviations for Technology Adoption for Combined Faculty

Variable	M	SD
Y1	6.316	2.647
RA	6.895	1.912
CM	6.632	1.978
CX	6.211	2.616
TR	5.895	2.885
OB	5.947	2.345
IS	5.421	2.631
FS	5.368	2.629

Note. n = 19.

Table D5 Pearson Correlations for Technology Adoption for the Combined Faculty for the Combined Faculty

Variable	Y1	RA	CM	CX	TR	OB	IS	FS
Y1	------							
RA	0.677 0.001	------						
CM	0.703 0.001	0.694 0.001	------					
CX	0.215 0.378	0194 0.427	0.070 0.777	------				
TR	0.579 0.009	0.582 0.009	0.304 0.205	-0.056 0.821	------			
OB	0.513 0.025	0.631 0.004	0.619 0.005	-0.080 0.746	0.722 0.000	------		
IS	-0.108 0.660	-0.466 0.045	-0.011 0.964	-0.361 0.129	0.087 0.724	0.175 0.474	------	
FS	-0.050 0.840	-0.379 0.110	0.102 0.677	0.069 0.779	-0.024 0.923	0.057 0.815	0.715 0.001	------

Note. n = 19. Cell Contents (correlation and p values)

Table D6 Regression ANOVA Summary for the Adoption of a New or Modified Pedagogy for the Combined Faculty

Source	**DF**	**SS**	**MS**	**F**
Regression	(1)	61.515	61.515	20.33*
RA	1	61.515	61.515	
Residual Error	(17)	51.432	3.025	
Lack of Fit	6	15.682	2.614	0.80
Pure Error	11	35.750	3.250	
Total	18	112.947		

***α = 0.05**

Table D7 Means and Standard Deviations for the Adoption of a New of Modified Pedagogy for the Combined Faculty

Variable	**M**	**SD**
Y2	6.053	2.505
RA	6.684	2.083
CM	6.368	2.241
CX	5.947	2.438
TR	5.368	2.872
OB	5.421	2.269
IS	5.632	2.338
FS	4.842	2.522

Note. n = 19.

Table D8 Pearson Correlations for the Adoption of a New or Modified Pedagogy for the Combined Faculty

Variable	Y2	RA	CM	CX	TR	OB	IS	FS
Y2	------							
RA	0.738 0.000	------						
CM	0.729 0.000	0.788 0.000	------					
CX	0.264 0.274	0.095 0.699	0.197 0.419	------				
TR	0.337 0.158	0.476 0.040	0.211 0.386	-0.053 0.831	------			
OB	0.319 0.184	0.594 0.007	0.427 0.068	-0.267 0.269	0.691 0.001	------		
IS	-0.300 0.212	-0.493 0.032	-0.079 0.749	-0.218 0.370	-0.152 0.533	-0.095 0.699	------	
FS	-0.130 0.594	-0.422 0.072	-0.038 0.876	0.206 0.397	-0.137 0.575	-0.240 0.322	0.715 0.001	------

Note. n = 19. Cell Content (correlation and p values)

Table D9 Regression ANOVA Summary for the Adoption of a New or Modified Presentation Style for the Combined Faculty

Source	DF	SS	MS	F
Regression	(1)	62.861	62.861	18.10*
RA	1	62.861	62.861	
Residual Error	(15)	52.081	3.472	
Lack of Fit	6	8.247	1.375	0.28
Pure Error	9	43.833	4.870	
Total	16	114.941		

***α = 0.05**

Table D10 Means and Standard Deviations for the Adoption of a New or Modified Presentation Style for the Combined Faculty

Variable	M	SD
Y3	5.684	2.810
RA	5.737	2.557
CM*	6.500	2.121
CX*	5.167	2.455
TR	4.895	2.904
OB	5.211	2.371
IS	5.842	2.455
FS	4.947	2.297

Note. n = 19. *n =18

Table D11 Pearson Correlations for the Adoption of a New or Modified Presentation Style for the Combined Faculty

Variable	Y3	RA	CM	CX	TR	OB	IS	FS
Y3	------							
RA	0.730 0.000	------						
CM*	0.708 0.001	0.664 0.003	------					
CX*	0.210 0.001	0.102 0.688	0.035 0.894	------				
TR	0.370 0.119	0.482 0.043	0.200 0.425	-0.088 0.730	------			
OB	0.486 0.035	0.468 0.043	0.576 0.012	-0.363 0.139	0.496 0.031	------		
IS	-0.370 0.119	-0.573 0.010	-0.187 0.457	-0.157 0.534	-0.236 0.330	-0.032 0.896	------	
FS	-0.347 0.145	-0.466 0.044	-0.311 0.209	0.264 0.290	-0.151 0.538	-0.294 0.222	0.718 0.001	------

Note. n = 19. *n = 18. Cell Contents (correlation and p values)

APPENDIX E

Table E1 Technology Best Subset Model for the Virginia Tech Faculty

Predictor	Coef	StDev	P
Constant	-2.543	1.957	0.226
RA	0.7591	0.4343	0.114
CM	0.7400	0.3117	0.042
TR	0.4998	0.2102	0.041
OB	-0.7177	0.2607	0.022
FS	0.0649	0.1957	0.748

n=15, R-Sq = 86.3%, R-Sq(adj) = 78.6%

The regression equation is:
Y1 = - 2.54 + 0.759 RA + 0.740 CM + 0.500 TR – 0.718 OB + 0.065 FS

Table E2 Technology Regression ANOVA on Best Subset Model for the Virginia Tech Faculty

Source	DF	SS	MS	F	P
Regression	5	86.603	17.321	11.30	0.001
Residual Error	9	13.797	1.533		
Total	14	100.400			

Table E3 Technology Regression Sequential Sum of Squares for the Virginia Tech Faculty

Source	DF	Seq SS
RA	1	65.664
CM	1	6.930
TR	1	2.012
OB	1	11.827
FS	1	0.169

Table E4 Means and Standard Deviations for Technology Adoption for the Virginia Tech Faculty

Variable	M	SD
Y1	6.2600	2.678
RA	6.533	1.959
CM	6.333	2.093
CX	5.933	2.865
TR	5.733	3.011
OB	5.733	2.492
IS	5.800	2.651
FS	5.333	2.498

Note. n = 15.

Table E5 Pearson Correlations for the Technology Adoption for the Virginia Tech Faculty

Variable	Y1	RA	CM	CX	TR	OB	IS	FS
Y1	------							
RA	0.809 0.000	------						
CM	0.765 0.001	0.720 0.002	------					
CX	0.263 0.345	0.159 0.570	-0.008 0.978	------				
TR	0.547 0.035	0.595 0.019	0.310 0.261	-0.035 0.901	------			
OB	0.490 0.064	0.704 0.003	0.580 0.023	-0.143 0.612	0.780 0.001	------		
IS	-0.165 0.557	-0.418 0.121	0.013 0.964	-0.369 0.176	0.109 0.699	0.164 0.558	------	
FS	-0.150 0.595	-0.448 0.094	-0.009 0.974	0.033 0.906	-0.054 0.849	-0.111 0.694	0.712 0.003	------

Note. n = 15. Cell Contents (correlation and p values)

Table E6 Pedagogy Best Subset Model for the Virginia Tech Faculty

Predictor	Coef	StDev	P
Constant	-2.421	2.026	0.263
RA	1.2790	0.2267	0.000
CX	0.0999	0.1615	0.552
OB	-0.2648	0.1834	0.183
IS	0.2951	0.2368	0.244
FS	-0.0795	0.2178	0.724

n=15, R-Sq = 83.6%, R-Sq(adj) = 74.5%

The regression equation is:
Y2 = - 2.42 + 1.28 RA + 0.100 CX - 0.265 OB + 0.295 IS - 0.079 FS

Table E7 Pedagogy Regression ANOVA on Best Subset Model for the Virginia Tech Faculty

Source	DF	SS	MS	F	P
Regression	5	62.672	12.534	9.20	0.002
Residual Error	9	12.261	1.362		
Total	14	74.933			

Table E8 Pedagogy Regression Sequential Sum of Squares for the Virginia Tech Faculty

Source	DF	Seq SS
RA	1	56.696
CX	1	0.970
OB	1	1.686
IS	1	3.138
FS	1	0.181

Table E9 Means and Standard Deviations for the Adoption of a New or Modified Pedagogy for the Virginia Tech Faculty

Variable	M	SD
Y2	6.067	2.314
RA	6.267	2.120
CM	6.133	2.356
CX	5.733	2.434
TR	5.067	2.939
OB	5.333	2.526
IS	5.867	2.446
FS	5.267	2.520

Note. n = 15

Table E10 Pearson Correlations for the Adoption of a New or Modified Pedagogy for the Virginia Tech Faculty

Variable	Y2	RA	CM	CX	TR	OB	IS	FS
Y2	------							
RA	0.870 0.000	------						
CM	0.811 0.000	0.793 0.000	------					
CX	0.054 0.848	-0.068 0.809	0.044 0.876	------				
TR	0.283 0.848	0.421 0.118	0.122 0.664	-0.267 0.336	------			
OB	0.411 0.128	0.636 0.011	0.412 0.127	-0.356 0.192	0.738 0.002	------		
IS	-0.276 0.319	-0.461 0.084	-0.046 0.870	-0.162 0.563	-0.019 0.948	-0.108 0.702	------	
FS	-0.187 0.505	-0.375 0.168	-0.055 0.847	0.269 0.333	-0.089 0.751	-0.307 0.266	0.713 0.003	------

Note. N = 15. Cell Contents (correlation and p values)

Table E11 Regression ANOVA Summary for the Adoption of a New or Modified Presentation Style for the Virginia Tech Faculty

Source	DF	SS	MS	F
Regression	(1)	37.450	37.450	10.34
RA	1	37.450	37.450	
Residual Error	(12)	43.478	3.623	
Lack of Fit	6	12.312	2.052	0.40
Pure Error	6	31.167	5.194	
Total	13	80.929		

***α = 0.05**

Table E12 Means and Standard Deviations for the Adoption of a New or Modified Presentation Style for the Virginia Tech Faculty

Variable	M	SD
Y3	5.600	2.720
RA	5.333	2.554
CM*	6.200	2.178
CX	5.071	2.495
TR	4.800	2.981
OB	5.333	2.610
IS	6.067	2.549
FS	5.133	2.532

Note. n = 15. *n = 14

Table E13 Pearson Correlations for the Adoption of a New or Modified Presentation Style for the Virginia Tech Faculty

Variable	Y3	RA	CM	CX	TR	OB	IS	FS
Y3	------							
RA	0.750 0.001	------						
CM	0.738 0.002	0.629 0.012	------					
CX*	0.100 0.734	-0.074 0.801	-0.083 0.778	------				
TR	0.430 0.110	0.563 0.029	0.249 0.371	0.031 0.916	------			
OB	0.674 0.006	0.614 0.015	0.716 0.003	-0.329 0.251	0.505 0.055	------		
IS	-0.315 0.252	-0.563 0.029	-0.144 0.608	-0.214 0.463	-0.111 0.694	-0.036 0.899	------	
FS	-0.386 0.156	-0.504 0.055	-0.290 0.294	0.248 0.393	-0.100 0.722	-0.321 0.244	0.729 0.002	------

Note. n = 15. *n = 14. Cell Contents (correlation and p values)

APPENDIX F

Greeting and Explanation

Good Morning or Afternoon Dr. _____!!

Thank you so very much for agreeing to speak with me today.

Your input is extremely valuable to my thesis research.

Just as a quick refresher…….My thesis research is focused around determining those training characteristics that influence university faculty's adoption of web media objects (text, images, animation, audio and video) into their course instruction.

The purpose of this interview is to follow-up on the questionnaire that you completed for me earlier this semester. Therefore, the questions that I ask today are related to those on the questionnaire.

Dr. _____,
I would like to record this interview, so that I can transcribe it later. Is that okay with you?

Thank you!!

If you don't have any questions, I am ready to begin.

The questions are divided up into 3 sections…..the 1st section involves the technology (which is the inclusion of web media objects into your course instruction).

You may refer to the definition sheet that I sent via email on yesterday at anytime.

Telephone Interview Questions

Technology

Directions: Please consider your adoption or lack of adoption of including web media objects in your course instruction (the innovation) when you respond to the following questions in this section.

1. What type of web media objects (text, images, animation, audio, video) did you create and use for your course instruction?

2.

   a. Did perceiving the *relative advantage* influence your decision to adopt the use of web media objects? Why or why not?

   b. Did perceiving the *complexity* influence your decision to adopt the use of web media objects? Why or why not?

   c. Did perceiving the *observability* influence your decision to adopt the use of web media objects? Why or why not?

   d. Did receiving *faculty support* influence your decision to adopt the use of web media objects? Why or why not?

   e. Did receiving *institutional support* influence your decision to adopt web media objects? Why or why not?

3a. Please describe the impact of time on your decision to adopt the use of web media objects (i.e. the time it would take to create and implement web media objects into your course instruction).

3b. If you spent the time creating and implementing web media objects, what other things would be traded-off?

Pedagogy

Directions: Please consider your adoption or lack of adoption of a new or modified pedagogy when you respond to the following questions in this section.

1. When you used web media objects, did you alter your pedagogy? If so how or how much?
2.

    a. Did perceiving the *compatibility* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

    b. Did perceiving the *complexity* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

    c. Did perceiving the *trialability* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

    d. Did perceiving the *observability* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

    e. Did receiving *faculty support (*for changing your pedagogy) influence your decision to change your pedagogy? Why or why not?

    f. Did receiving *institutional support* (for changing your pedagogy) influence your decision to change your pedagogy? Why or why not?

3. Please describe the impact of time on your decision to alter your pedagogy (i.e. the time it would take to integrate a new or modified pedagogy into your course).

Presentation Style

Directions: Please consider your adoption or lack of adoption of a new or modified presentation style when you respond to the following questions in this section.

1. When you used web media objects, did you alter your presentation style? If so how or how much?

2.
   a. Did perceiving the *compatibility* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

   b. Did perceiving the *complexity* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

   c. Did perceiving the *trialability* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

   d. Did perceiving the *observability* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

   e. Did receiving *faculty support (*for altering your presentation style) influence your decision to change your presentation style? Why or why not?

   f. Did receiving *institutional support* (for altering your presentation style) influence your decision to change your presentation style? Why or why not?

3. Please describe the impact of time on your decision to alter your presentation style (i.e. the time it would take to integrate a new or modified presentation style into your course).

APPENDIX G

Technology

Question 1a: What type of web media objects (text, images, animation, audio, video) did you create and use for your course instruction?

Table G1 Question 1 Interview Response Code and Frequency

Code (Referential)	**Frequency**
1. Text	3
2. Images	2
3. Video	1
4. Audio	1
5. Animation	1
6. None	1

Note: n = 4

Question 1b: How were the web media objects used?

Table G2 Question 1b Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. Supplemental class information	2
2. Syllabic information	1
3. Illustration of an individual	1
4. Virtual tour	1
5. Instruction	1
6. Tutorial	1
7. Lecture notes	1

Note: n = 3

Question 2a: Did perceiving the *relative advantage* influence your decision to adopt the use of web media objects? Why or why not?

Table G3 Question 2a Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Natural progression	1
2. [Yes] Saves time	1
3. Class preparation for students	1
4. Adjustability	1
5. [No] No influence	1
6. [Yes] Efficient delivery method for non-textual information	1

Note: n = 4

Question 2b: Did perceiving the *complexity* influence your decision to adopt the use of web media objects? Why or why not?

Table G4 Question 2b Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Administrative complexity	1
2. [No] Easy task	2

Note: n = 3

Question 2c: Did perceiving the *observability* influence your decision to adopt the use of web media objects? Why or why not?

Table G5 Question 2c Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No one to observe	2
2. [Yes] Reminder of alternatives	1

Note: n = 3

Question 2d: Did receiving *faculty support* influence your decision to adopt the use of web media objects? Why or why not?

Table G6 Question 2d Interview Response Code and Frequency

Code	Frequency
Referential	
1. [Yes] College of architecture webmaster	1
2. [Yes] Provide computer	1
Thematic	
3. [No] Inadequate funds	1
4. [No] Not utilizing faculty support	1
5. [Yes] Provided experience	1

Note: n = 3

Question 2e: Did receiving *institutional support* influence your decision to adopt web media objects? Why or why not?

Table G7 Question 2e Interview Response Code and Frequency

Code	Frequency
Thematic	
1. [No] Hindered adoption	1
Referential	
2. [Yes] Departmental server provided	2
3. [Yes] Computer	1

Note: n = 3

Question 3a: Please describe the impact of time on your decision to adopt the use of web media objects (i.e. the time it would take to create and implement web media objects into your course instruction).

Table G8 Question 3 Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. Time consuming personnel coordination	1
2. Too time consuming	1
3. Saves class time	2
4. Desire increased utilization	2
5. Steep learning curve	1
6. Constrained by other responsibilities	3
7. No great impact	1

Note: n = 3

Question 3b: If you spent the time creating and implementing web media objects, what other things would be traded-off?

Table G9 Question 3b Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. Home life	1
2. Tenure requirements	2
3. Research development	1
4. Pedagogy development	1
5. Teaching	1
6. Doctoral student advising	1
7. Writing	1
8. Administrative responsibilities	1
9. Committee work	1

Note: n = 4

Open/Additional Comment: One assistant (non-tenured) professor mentioned the need to apply for a grant and/or release time to in order to focus on web media object development.

Pedagogy

Question 1: When you used web media objects, did you alter your pedagogy? If so, how and how much?

Table G10 Question 1 Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Added student interaction to lecture	3
2. Added student practice	2

Note: n = 3

Question 2a: Did perceiving the *compatibility* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

Table G11 Question 2a Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Natural progression	2
2. [No] No pre-knowledge of pedagogy change	1

Note: n = 3

Question 2b: Did perceiving the *complexity* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

Table G12 Question 2b Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No pre-knowledge of pedagogy change	2

Note: n = 2

Question 2c: Did perceiving the *trialability* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

Table G13 Question 2c Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Provided assurance/confidence	2
2. [No] No other alternative	1

Note: n = 3

Question 2d: Did perceiving the *observability* of reconsidering your pedagogy influence your decision to change your pedagogy? Why or why not?

Table G14 Question 2d Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No one to observe	1
2. [Yes] Provides assurance/confidence	2

Note: n = 3

Question 2e: Did receiving *faculty support (*for changing your pedagogy) influence your decision to change your pedagogy? Why or why not?

Table G15 Question 2e Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] None available (faculty support)	1
2. [Yes] Provided example alternatives	1

Note: n = 2

Question 2f: Did receiving *institutional support* (for changing your pedagogy) influence your decision to change your pedagogy? Why or why not?

Table G16 Question 2f Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No pre-knowledge of pedagogy change	1
2. [No] Unnecessary	1

Note: n = 2

Question 3: Please describe the impact of time on your decision to alter your pedagogy (i.e. the time it would take to integrate a new or modified pedagogy into your course).

Table G17 Question 3 Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. Saves class time	2
2. Time consuming development	1

Note: n = 3

Presentation Style

Question 1: When you used web media objects, did you alter your presentation style? If so, how and how much?

Table G18 Question 1 Interview Response Code and Frequency

Code (Referential)	**Frequency**
1. [Yes] Microsoft PowerPoint™	1
2. [Yes] Computer	1
3. [Yes] Computer projection	2
4. Overhead projector	1
5. [Yes] Computer lab	2

Note: n = 3

Question 2a: Did perceiving the *compatibility* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G19 Question 2a Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Similarity	1
2. [Yes] Compatible with teaching goals	1
3. [Yes] Compatibility prompted change	1

Note: n = 3

Question 2b: Did perceiving the *complexity* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G20 Question 2b Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Computer administration difficulties	1
2. [No] Difficulties worked out over time	1
3. [No] Not difficult	1

Note: n = 3

Question 2c: Did perceiving the *trialability* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G21 Question 2c Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [Yes] Provided assurance/confidence	1
2. [No] No other alternatives	1
3. [No] No pre-knowledge of presentation style change	1

Note: n = 3

Question 2d: Did perceiving the *observability* (of altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G22 Question 2d Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No one to observe	2

Note: n = 2

Question 2e: Did receiving *faculty support (*for altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G23 Question 2e Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] No adequate support available	3

Note: n = 3

Question 2f: Did receiving *institutional support (*for altering your presentation style) influence your decision to change your presentation style? Why or why not?

Table G24 Question 2f Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. [No] no adequate support available	2
2. [Yes] Laptop (referential)	1
3. [Yes] Computer projector (referential)	1

Note: n = 3

Question 3: Please describe the impact of time on your decision to alter your presentation style (i.e. the time it would take to integrate a new or modified presentation style into your course).

Table G25 Question 3 Interview Response Code and Frequency

Code (Thematic)	**Frequency**
1. Lack of time	2
2. Saves class time	2
3. Some preparation time needed	1

Note: n = 3

VITA

KAYENDA T. JOHNSON

EDUCATION:

Batchelor's Degree **Industrial Engineering**
May 1999 Morgan State University, Baltimore, MD

GRADUATE RESEARCH EXPERIENCE:

6/00 to 8/01 (seasonal) **Army Research Laboratory Human Research Engineering Directorate**
Research Assistant in Soldier Performance Division
Cognitive Readiness In Stressful Environments Research Team
Duties: Supported Engineering Psychologists with a research project concerned with the effects of stress on soldier attrition. Primary duty was to analyze data results, provide an interpretation, and prepare presentation materials for those results. A secondary duty was to begin the development of an intranet website for the research division.

UNDERGRADUATE RESEARCH EXPERIENCE:

6/96 to 8/97 (seasonal) **High Performance Computing Summer Institute**
Duties: Assisted with Industrial Engineering research at Morgan State University.

INTERNSHIPS:

5/99 to 8/99 **Walt Disney World**
Duties: Supported Industrial Engineers with client-based work for the Disney Cruise Line. The focus of work for the Disney Cruise Line included studying and assessing business related shipboard operations (existing and pre-existing), and developing recommendations which would support continuous improvement. Related projects involved: ship labor deployment and development of Disney Cruise Line Industrial Engineering intranet website.

6/98 to 8/98 **Federal Aviation Administration**
Duties: Assisted Aviation Safety Inspectors. Also reviewed procedures/systems related to computer based information flow and made recommendations for more standardized management/worker communication.

LEADERSHIP:

1999 to 2000 **Treasurer of Human Factors and Ergonomic Society** (Virginia Tech Student Chapter)

2000 to 2001 **Treasurer of the Black Graduate Student Organization** (Virginia Tech Student Chapter)

2000 to 2001 **Fundraising Chairperson of the Black Graduate Student Organization** (Virginia Tech Student Chapter)

HONORS & AWARDS:

Tau Beta Pi National Engineering Honor Society

David & Lucile Packard Graduate Scholar & Fellow

John Lee Pratt Fellow