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The role of narrative in multimedia learning

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THE ROLE OF NARRATIVE IN

MULTIMEDIA LEARNING

By

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ABSTRACT

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This descriptive case study investigated the role of narrative in multimedia learning and teaching and observed how teachers applied their understanding of narrative, and new constructivist technologies, to design multimedia presentations for instruction. The study looked specifically at the cognitive strategies, visual narrative concepts, and techniques of representation three teachers used in the course of learning how to design a multimedia instructional presentation. The context of the study was a university graduate instructional design of educational software course. Data sources included visual and verbal elicitation techniques, participant observations, document collection, semi-structured interviews, and videotapes in the graduate classroom. Data were analyzed using concurrent and retrospective protocol analyses of design tasks, network graphs of design reasoning, and ethnographic document analyses of storyboard scenes, montage sequences, and narrative instructional presentations.

The findings of this study suggest the value of using visual narrative concepts and techniques of representation to support teachers in their approach to the design of a multimedia instructional presentation. The protocol data indicated that when the teachers

actively engaged in design problem solving, they used their new knowledge of narrative to read, select, and combine digital media according to the formal elements, symbolic relationships, and the ways in which their students might perceive them. This is further discussed in relation to constructivist frameworks for understanding the functions of language and symbol systems in the construction of knowledge and meaning.

The network graph data of design reasoning identified technical issues such as difficulties in controlling the media and interacting with constructivist technologies that occasionally affected the three teachers' cognitive processing. This is discussed in relation to the traits of novice designers, the functions of novel representations (Ainsworth, 2006), and cognitive dissonance. The ethnographic document data were to a large extent determined by the three teachers' individual approaches to design practice and the particularities of their instructional presentations for their respective disciplines and student populations.

The findings of this study have implications for both the fields of multimedia learning research and teacher education in terms of learning how to design multimedia instructional presentations effectively. Professional development in learning how to design with computer graphics and new constructivist technologies is suggested.

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DEDICATION

This dissertation is dedicated to the memory of my father, Juris Doctor Harry Greenberg, whose wisdom, unfailing guidance, encouragement, and kindness reached and affected all who had the privilege of knowing him.

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CHAPTER 1

INTRODUCTION

"Different kinds of experience lead to different meanings, which, in turn, make different forms of understanding possible" (Eisner, 1993, p. 6). "In the case of representations, this includes specific symbolic features and their arrangement and relationships within and across multiple forms or expressions" (Kozma, 2003, p. 206). "The main design consideration therefore becomes one of selecting appropriate representations for the situation and the learners, rather than supporting learners in mastering the complex task of relating representations" (Ainsworth, 2006, p. 195).

These statements correspond to some of the design considerations and challenges that have comprised both "artistic and scientific" thought about the nature and value of representing information to support learning and human understanding (Eisner, 1993, p. 9). These statements also account for recent interests in multimedia learning, a field of educational scholarship, centered on how people learn from representations and how to design learning environments (Mayer, 2005).

The intent of this study was to extend recent interests that have begun to recognize the potential of different forms of representation, in different contexts, as potential sources of knowledge. Specifically, narrative forms of representation were considered in relation to multimedia learning and teaching, and the innovation of some of the new constructivist technologies.

In this research, new constructivist technologies were defined as open-ended digital environments, consisting of interactive digital tools and resources that allow people to create and share information (Hsu, 2007). Examples include (a) video-editing

software that allow people to create and distribute movies, and (b) online social media networks that allow people to engage in various forms of discourse.

Whereas “well-established” areas of multimedia learning research have concentrated on static images, text and, two-dimensional animations in an attempt to affect memory and influence learning (Reimann, 2003; Ainsworth, 2006), an emerging area has begun to call for studies to concentrate on different approaches to learning with representations (e.g., expressive and perceptual approaches) (Ainsworth, 2008; Ainsworth, 2006; De Vries, 2006; Kozma, 2003) and multi-representational systems (e.g., multimodal and multimedia environments) in which the effects on learning and learning processes remain unknown (Ainsworth, 2006: Nakamura & Lajoie, 2005; Reimann, 2003).

In the classroom, and other contexts, the introduction of new constructivist technologies has challenged teachers to acquire the theoretical knowledge and practical skills necessary to design, code, and communicate with multimedia for instruction Kjeldsen (2006). It is a situation that has proposed to extend thinking about learning with representations and multi-representational systems within this context as well. One relevant and corresponding representational format that has received little attention in multimedia-learning literature is narrative, and it has the potential to foster the kinds of active thinking the new technologies provide.

Narrative provides a means to examine how people exchange stories, account for their actions, and construct meaning in a contextualized setting (Bruner, 1990; Ewick & Selby, 1995). People are using these constructivist tools to plan, create, share, and preserve their own content (Hsu, 2007).

Although some of the empirical research has addressed the effectiveness of narrations in multimedia learning environments (Mayer, 2005; Campbell, Farmer, Fennell, & Mayer, 2004; Mayer, Sobko, & Mautone, 2003) none of the research has addressed storied approaches to narrative or the design and development of narrative as a form of educational practice. This study used these approaches to introduce the descriptive qualities of narrative as another form of representation in multimedia learning and implemented some of the constructivist technologies as another way to further support current research interests.

The Role of Narrative

As a form of communication that touches upon so many areas of educational scholarship, narrative demonstrates the depth and breadth of its range to create meaning. From the standpoint of the aesthetic domains of art, drama, film, and literature it remains open for interpretation (Abbott, 2004; Mitchell, 1981). "In philosophy, sociology, and psychology, much has been written about how people explain their actions to themselves and to others through stories" (Mishler, 1986; Bruner, 1986, 1990; Sarbin, 1986; Pillemer, 1992, Pillemer et al., 1995, p. 198 as cited in Ewick & Silbey, 1997). Narrative forms of representation (NFR) have been described as complex social structures, consisting of actions, codes, story elements, stylistic requirements, techniques, and temporal orders (e.g., sequence of action) (Arnheim, 1957; Bordwell & Thompson, 2004; Metz, 1991).

Narrative plays a role in human thinking by providing a way for people to share their experiences directly with others (Dettori, Giannetti, Paiva, & Vaz, 2006), or indirectly through the use of inert objects (Bal, 2004) such as digital devices and other

kinds of artifacts. It is out of this form of consciousness that people construct representations of their world to tell stories (Bruner, 1990; Ewick & Silbey, 1997; Merrill, 2007).

Narratives are also reflective of the different " . . . learning theories that circulate in educational technology scholarship while providing designers with more sophisticated conceptual tools to create culturally relevant educational experiences" (Voithofer, 2003, p. 48). Because narrative is culturally and socially constructed (Reissman, 1993), and subsumes aesthetic as well as "social and psychological formations" (Mitchell, 1981), the perception of what narrative is, or what it can be or how it can be used, continuously surrounds narrative scholarship (Bruner, 1990; Ewick & Silbey, 1997; Merrill, 2007).

Merrill (2007) conducted an inductive analysis of empirical studies, based on various disciplines in the social sciences, and located three common themes of narrative including: (a) The general use of narrative in the social construction of self and reality; (b) functions and forms and; (c) methodologies of social science research. The first theme describes narrative communication and how it affects the way in which human beings organize their experiences through individual or situated activities that are mutually constructed (Bruner, 1990; Merrill, 2007). The second theme describes the activity of narrative production and the social interactions that result from these processes. The third theme describes narrative as a form of research that is used to analyze, investigate, interpret, and validate stories and their meanings through an exchange of human discourse (Reissman, 1993).

It is beyond the scope of this paper to describe all aspects of narrative. Clearly, some are more relevant to multimedia learning than others. As such, the subsequent

sections of this chapter are centered on the first two themes and are framed within the context of the different learning theories and scholarly research that have been important for their identification and development. In light of the recent research on external and internal representations in multimedia learning, and current interests that are focused on design issues, including social and technical affordances (Reimann, 2003; Kozma, 2003) and semiotics, the following discussion presents an overview of representations and demonstrates its connection to narrative.

This chapter concludes with an overview of narrative forms of representation, a statement of the research questions and educational significance of this study. Accordingly, this chapter presents an introduction to the *Review of Literature* and *Methodology* sections of this paper.

Representations

External Representations

In multimedia learning, the term *representation* refers to the external, multimedia artifacts that are used for instructional presentations and serves as an "information source" for learners to make connections between new information and prior knowledge (Mayer, 2005). Some cognitive psychologists propose the external representations are processed into different sensory modalities (e.g., visual and verbal) for the purpose of constructing an internal representation that is referred to as a mental model (Schnotz, 2005).

Visual representations consists of both written text and images and can be presented in different multimedia formats, such as animations, film, photography, still images, typography, and videography. Verbal representations consist of different auditory formats

such as narrations, music, and sound effects. The objective of multimedia learning is to link visual and verbal representations in a meaningful way to promote knowledge construction (Mayer, 2001). Currently, there are different theories and models to suggest how learners interpret external visual and verbal representations (Schnotz & Bannert, 2003; Mayer, 2005).

Multimedia Learning Research and Multiple Representations

Mayer (2005) articulated the distinction between the presentation of multimedia instructional materials and the knowledge-construction processes that are involved in multimedia learning. From this perspective, the instructional materials are defined as the presentation of one or more forms of verbal or visual representations. Whereas, the learning is defined as the knowledge construction processes that are performed by learners as they build mental models from representations. The subsequent section of this paper extends an earlier discussion about the focus of multimedia learning research and attempts to provide a current summary of what has been observed in the literature.

In recent years, advancements in multimedia technology have challenged scholarly approaches to multimedia learning and have extended the practice of "building mental representations from words and pictures" (Mayer, 2005, p. 2). Some current research interests have been centered on understanding the cognitive and social affordances of representations in different settings and the semiotic influences, design dimensions and functions involved in linking multiple external representations (Ainsworth, 2006; Ainsworth, 1999; Lajoie & Nakamura, 2005; Schnotz, 2005) to promote "dynamic relationships" (Goldman, 2003, p. 239), between learners and their technical devices, when representations are presented in " . . . multiple formats via

multiple sensory modalities" (Schnotz & Lowe, 2003, p. 117).

Research has shown when learners are given the opportunity to manipulate the content of a multimedia presentation it can sometimes result in negative learning effects (Moreno & Valdez, 2005; Schnotz & Rasch, 2005). Even when learners are introduced to metacognitive strategies to assist them in monitoring and modifying their cognitive processes during a multimedia lesson, it does not always improve learning outcomes (Lewalter, 2003).

Lajoie and Nakamura (2005) have provided further examples of past multimedia learning research that has been inconsistent in demonstrating the positive effects of using multiple external representations to improve learning. The researchers have called for an extension of visual and verbal studies to include more complex instructional designs. This includes interactive problem solving environments in which multimodal and multimedia environments are considered.

Lajoie and Nakamura (2005) proposed that multimedia tools have become sophisticated and the social features of the technology should be used to extend the learning beyond the multimedia learning practice of pure observation. Learners need to be given the opportunity to construct their own presentations and to interact with multimedia tools to learn from their experiences.

To date, few attempts have been made to study "design-based learning situations" in which learners are engaged in the construction of their own representations (De Vries, 2006) or the use multiple external representations as tools to solve problems (Ainsworth, 2006; Nakumura & Lajoie, 2005; Reimann, 2003; Kozma, Chin, Russell & Marx, 2000).

Semiotic Representations

The interest in the social-learning effects and interpretive qualities of multiple representations, in multimedia learning, can be evidenced by the inclusion and recognition of the interpretive and communicative functions of semiotics. “Semiotics is an inter-disciplinary field of studies that examines how meaning is made through signs of all kinds—pictures, gestures, music—not just words” (Siegel, 2006, p. 65). Semiotic signs operate through codes and acquire their meaning through the social practices of a culture (Chandler, 2007). The “semiotic turn” in multimedia learning has challenged preconceived notions of truth by discarding all claims that representations are detached from social or cultural meanings (Chandler, 2007).

Schnotz and Bannert (2003) developed an integrated text and picture comprehension model (ITPC) to demonstrate the cognitive learning effects of semiotic representations. The model addresses the multiple sensory modalities of learners by distinguishing between descriptive and depictive representations and the cognitive and perceptual level of the learner when they are learning from multiple representations (Schnotz, 2005).

Descriptions are an outcome of symbol processing and include written text, mathematical expressions and symbols. Symbols infer relationships between what is recognized, visually or verbally, and what is accepted and learned through intellectual skills. Examples of symbols include “ . . . (specific languages, alphabetical letters, punctuation marks, words, phrases and sentences) numbers, morse code, traffic lights, national flags” (Chandler, 2007).

Depictions are an outcome of “analogical structure mapping” and include visual

images such as graphs, maps, paintings, photographs, and three-dimensional models. Analogical structure mapping is only advantageous if the visualizations are complementary to a given learning task (Schnotz & Lowe, 2003). "Depictive representations consist of icons. Icons are signs that are associated with their referent by similarity or another structural commonality" (p. 52).

Signs are also recognized as acts, words, sounds, and objects. If something can be interpreted, related to, or substituted for a "familiar system of conventions," it is recognized as a sign (Chandler, 2007).

Narrative Forms of Representation

According to Abbott (2002), narrative is a representation of actions, also referred to as events. Plato proposed two major ways to represent narrative is through mimesis and diegesis. Mimesis is a representation of an action through a performance and diegesis is a representation of an action by telling.

Narrative acquires its form and structure from the traditions of drama that are most commonly attributed to Aristotle's *Poetics* and the concept of mimetic representation (Bruner, 1990). To Aristotle, mimesis included both types of representation that is, mimesis and diegesis (Abbott, 2004).

Mimesis has been referred to as a form of *showing* that is tied to narrative events (Chatman, 1978). Examples include main characters or nonhuman, lifelike objects, also known as *existents*, that perform certain actions or display certain emotions in a narrative context (Pearson, Barr, & Kamil, 2000). The characters are represented in relation to the action, which is considered to be the primary object of narrative representation.

Contemporary theories suggest mimesis is an artistic representation of life, an imitation that can be real or imagined and does not have to have a relationship with a "real-world referent" (Laurel, 1993, p. 42). To some extent, whether mimesis is carried out through a real-life event or through dramatic events, our understanding of the context of these existents helps to advance their meaning (Bal. 2004). "Through characterization, main characters may be elaborated with a rich configuration of goals, motives, traits, beliefs, attitudes, and emotions" (Pearson et al., 2000, p. 175).

Diegesis is a form of telling; a representation of dialog. It is the "preeminent enactment" as opposed to the "narration proper" (Chatman, 1978, p. 32). In other words, it is the great performance as opposed to a suitable recounting of a script. The purpose of both types of dialog is to represent the speech acts of the character(s) as opposed to the utterances of the narrator (Bal, 2004). The interactions of the actors' dialog gives meaning to the text and when a dialog is performed between two actors, and remains uninterrupted by a narrator, it is considered to be more dramatic. Dramatic representations of narrative recounts have a positive effect on the audience because it is less mindful of the embedded dialog (Bal, 2004).

Content and form are perceived of as ways to project the totality of a story by providing a sense of order and consistency to narrative (Rowe, 1994). The rhetorical forms of narrative representation are used to construct realities and to demonstrate how "Content and form are inseparable" (Chandler, 2007, p. 124). Everything is connected in a narrative. This includes, the audience, cultural context, narrative forms of representation, information, and the media. All of the variables interact and are arranged to affect the audience's interpretation of narrative.

In dramatic narratives, the plot is considered to be of primary importance because it is the representation of actions or events not characters that promote the tragic effects. The temporal linking of plots accentuates the sum of events (Ochs & Capps, 1996) and gives meaning to these events by revealing, in the end, the underlying structure that was actually suggested all along (White, 1980). Aristotle proposed, plot depicts human actions and existents are purposefully used as representations of these actions to define the “mimetic whole” (Laurel,1993).

How Can NFR Be Used to Affect Multimedia Learning Cognitively?

The interactive and social features of new computer technologies have extended the research in multimedia learning to include not only the cognitive effects of using external representations to construct knowledge, but also the social affordances (Kozma, 2003, p. 206) that are possible when external representations are combined with new technologies and are used as cognitive tools (Reimann, 2003). Currently, the role of external representations, in multimedia learning, is approached from three different perspectives (Reimann, 2003). This includes (a) a cognitivistic view; (b) a mentalistic view and; (c) most recently, a situated, activity-oriented view (Reimann, 2003).

According to Reimann (2003) the cognitivistic view analyzes how external representations can be transformed to construct mental models (e.g., Schnotz & Bannert, 2003; Moreno & Valdez, 2005; Mayer, 2005). The mentalistic view analyzes how multiple external representations can be arranged to complement an instructional task (e.g., Ainsworth, 1999; Lewalter, 2003). The situated, activity-oriented view analyzes how different types of constructivist activities can be implemented when external

representations are used as cognitive tools to promote learner interactions (e.g., Kozma, 2003; Stern, Aprea, & Ebner, 2003).

In general, a majority of multimedia learning research has concentrated on the cognitive effects of technology (Ainsworth, 2006). That is, the knowledge-building interactions that can occur between the learner and the technology as well as the "cognitive residue" that can occur at the conclusion of a productive learning task. Cognitive residue is defined as the "mastery of skills and strategies" that can be applied to future tasks (Salomon, Perkins, & Globerson, 1991, p. 4). Whereas the mentalistic view has also concentrated on the cognitive residue, the situated, activity-oriented view has concentrated on constructivist problem-solving tasks and activities that provide learners with the opportunity to construct their own representations and solve problems (Reimann, 2003, as cited in Lajoie & Nakamura, 2005).

When NFR are approached from a cognivistic view it is centered on how learners formulate mental models to connect visual and verbal information in working memory. The objective is to eliminate extraneous information and reduce cognitive load to make tasks more manageable (Mayer, 2001). Scholarly studies on television and film have developed similar theories to understand the actions of viewers as they construct "hypotheses and inferences" from narrative text (Buckland, 2000, p. 29). The viewers use temporal information in a narrative to construct a mental model to assist them as they attempt to process, interpret, and organize the segments of a narrative film. The process corresponds to the types of narrative editing techniques that can be used to construct videocasts (e.g., Internet-oriented stories) with constructivist software.

Narrative cinematic framing techniques have been used to mediate filmic editing codes from film segments and facilitate the learner's ability to connect information (Chandler, 2007) and construct mental models. In multimedia learning, filmic editing codes can be applied to an instructional presentation by implementing a variety of camera shot compositions (e.g., close-up) to promote audience interest. Additionally, intellectual montage techniques can be used to connect film segments according to their implicit messages (Bordwell & Thompson, 2004; Gillette, 2005).

When NFR are approached from a mentalistic view, learning is centered on the use of linking conventions and other support systems to connect and constrain information. Van Leeuwen (2005) proposed information becomes more relevant when causal or temporal relationships can be established. Linking is a fundamental part of the cause-and-effect relationships that are consistently used in narrative. Cause-and-effect can be applied directly in the presentation of a plot or it can be applied indirectly in the "active construction of a story" whereas, the effect may be evident, but the cause is concealed for the purpose of gaining the interest of an audience (Bordwell & Thompson, 2004).

In multimedia learning, metaphor has been used to incorporate semiotic representations of knowledge. Bal (2004) proposed metaphors as mini-narratives that provide insight into the interpretive practices of a social group. Metaphor creates parallel associations that link objects, tools, and artificial environments (Ainsworth, 1999; Lajoie & Nakamura, 2005) to promote knowledge construction processes (Lajoie & Nakamura, 2005). Virtual environments can be designed to contain features such as icons, tools, and interactive conditions to provide learners with opportunities for narrative interactions.

When NFR are approached from a situated view, learning is centered on the cognitive and social affordances of what Kozma (2003) described as the "physical and social systems" that support learning activities (p. 206), and complement the theoretical framework that Hirumi (2002) called social forms of constructivism. Consequently, learners perform as active agents who not only experience the world, they participate in its construction (Eisner, 1993) by negotiating shared meanings through language, symbols, and other forms of communication (Schensul, LeCompte, Nastasi, & Borgatti, 1999). This active construction of knowledge involves interactions with the technology, artifacts, and other resources in a contextualized setting (Decortis, 2004, p. 83). Conversely, learners socially construct knowledge by engaging in different processes that elicit participatory forms of "inquiry and discourse" (Kozma, 2003, p. 206). Presentation strategies may incorporate multiple representations of knowledge or characters and metaphors to suggest a particular point of view (Don, 1990).

These constructivist opinions may vary, but in general, learning results in a "constructed" product and knowledge is acquired contextually through interactions that combine prior knowledge with new experiences (Dick & Carey, 2005) to promote cognitive effects.

How Can NFR Be Used to Affect Multimedia Learning Culturally?

Bruner (1990) proposed all cultures have a folk psychology, " . . . a system by which people organize their experience in, knowledge about, and transactions within the social world" (p. 35). Folk psychology presupposes people have a world knowledge, one that represents their beliefs and how they perceive of their environment. There is a relationship between world knowledge and the achievement of human desires.

Cultural narratives are carried out through human actions and life events. They are used to express a community's cultural beliefs, judgments, and thoughts (Bruner, 1990; Ochs & Capps, 1996). Actions define human experiences and are also used to negotiate meaning. Our actions and thoughts are influenced within the social circumstance of conventions and the symbolic traditions that define and shape human logic and forms of communication (Bruner, 1990).

When constructivist theory is used as a theoretical framework, it positions human action at the center of the learning process and it also positions the utility of the tools as an important resource for the mediation of an activity within a specific cultural context. Vygotsky (1978) believed culture represented semiotic systems, such as symbols and signs that are mediated through human involvement with psychological tools (i.e., cultural tools). The tools are the products of socio-culture discourse (Decortis, 2004) and are adopted by an individual or a group to the support their mental processes. Additionally, the tools play an important role in the development of knowledge construction processes (Daniel, 1996).

In the classroom, and other contexts, constructivist technologies can be used as tools to promote knowledge creation, knowledge building, and knowledge distribution activities centered on the production of visual and verbal cultural narratives to promote socio-cultural forms of multimedia learning. The tools embody what Bruner (1990) called one of cultures' "prosthetic devices," for giving "meaning to action"—for organizing our experiences (p. 34). For example, in a study on on-line image sharing networks, Davies (2007) observed that a resource such as Flickr produces cultural narratives by calling into question art's definitions and limits and also leaves open for interpretation the

involvement and conviction of its members. Decortis (2004) proposed other tools that play an important role in a socio-cultural discourse and are fundamental to the development of knowledge construction through representational means.

How Can NFR Be Used to Affect Multimedia Learning Historically?

Narratives are fragmented representations of the world. They are points of view, contextualized in place and time, capturing the essence of a culture through human expression and interpretation (Bruner, 1990; Ochs & Capps, 1996; Merrill, 2007). Narrative is one of the oldest forms of human communication (Mallon & Webb, 2000) and throughout history, its forms of representation have been used to present information chronologically, dramatically, and/or through means of signification.

Historical narratives represent the human experience of the world and the history of oral literature has demonstrated how stories can be used " . . . to explain natural phenomena, to encode history of tribes and cultures, as well as to entertain" (Mallon & Webb, 2000, p. 271). Classical narratives incorporate dramatic theories such as, Aristotle's elements of tragedy and include "psychologically well-defined characters," that perform problem-solving actions, such as engaging in conflict with others or setting goals that may or may not conclude with a clear resolution. A causal agent is used as the protagonists to drive the action of the narrative (Decortis, 2004, p. 47), whereas a temporal order is used maintain the "thematically coherent structure," that defines its beginning, middle, and end (Ochs & Capps, 1996).

In the fourth century B.C., "Aristotle defined all the arts—verbal, visual, and musical—as modes of representation, and went even further to make representation the definitively human activity" (Mitchell, 1995, p 11). At the turn of the twenty-first

century, the interest in Aristotle's Poetics of drama and poetry remains a source of inspiration and guidance for numerous disciplines. In fact, Laurel (1993) developed an entire framework of dramatic theory based on Aristotle's Poetics for the development of computer related dramatic representations.

Laurel (1993) suggested although there are other theories of narrative and some are quite recent (Martin, 1987), no one has developed " . . . a theory of drama that is as comprehensive as Aristotle's; no one has needed to" (p. 36). The Aristotelian model consists of six qualitative elements of structure in drama and human-computer activity. These include: (a) action, (b) character, (c) thought, (d) language, (e) melody, and (f) spectacle (Laurel, 1993). The objective of using the model is to inform the construction of representations for the computer and, at the same time, promote the critical thinking and abstract reasoning skills that are a part of problem-based learning.

The Aristotelian model is the application of dramatic principles and it is centered on the agency of real-life events. The model can be used as a resource in the development of storyboards, scripts, and also to capture video segments. Simple stories can be exemplified through the use of video editing techniques and special effects. Additionally, visual, structural, and character attributes can be used to promote audience attention. The classical principles of drama can applied through the use of camera shots, sound effects, textual metaphors, and live-characters (Grabe & Zhou, 2003).

Purpose of the Study

The purpose of this study was to describe the role of narrative in multimedia learning and teaching and to observe how teachers applied their understanding of narrative, and new constructivist technologies, to design multimedia presentations for instruction.

Research Questions

The following research questions were used to guide the direction of this study:

1. What role does narrative play in multimedia learning?
2. How does an understanding of narrative forms of representation and constructivist technologies affect the way in which teachers design instructional presentations?
3. How do teachers describe their approach to the design of narrative instructional presentations for their content area and what evidence exist to support the processes they describe?
4. How are the features and forms of narrative expressed in the teachers' designs?

Educational Significance of the Study

This study aimed to introduce the theoretical and practical applications of implementing narrative forms of representation, and new constructivist technologies, as tools and resources for teachers to use for learning and instruction. It also proposed a new area of multimedia learning research concerned with placing teachers at the center of the development process. To begin to provide a description of the role of narrative in multimedia learning and teaching, and its corresponding issues and effects, a greater

understanding of its proposed practices were required. Accordingly, the educational significance of this study includes a description and analysis that was focused on the firsthand accounts of teachers in addition to the work they produced.

From another perspective, the extension of narrative concepts, such as those attributed to the aesthetic domains of fine art and film, have the potential to inform the judicious use of some of the new constructivist technologies in relation to the organization and display of content. At the present time, little research exists to guide the design and development of narrative instructional presentations or the artistic, educational, and technical contributions of these constructivist tools. Thus, this research should be useful in this regard for teachers or researchers who are interested in developing instruction from this standpoint. Further, understanding the different factors that influenced this form of instruction could give way to new methods of representing information. Thus, this research was significant in that, as a whole, none of these aspects have been addressed in the multimedia learning literature.

Definition of Terms

Cause-and-effect relationships are the expressive properties and arrangements of representations that help to convey a " . . . chain of events . . . in time and space" and guides the audience during a viewing activity (Bordwell & Thompson, 2004, p. 69).

Cinematic framing is also referred to as camera distance, camera shots and shot scale. It is used to convey information within a frame and to connect the grammar of one frame to another.

Cognitive residue is defined as the "mastery of skills and strategies" that can be applied to future, multimedia tasks (Salomon, Perkins, & Globerson, 1991, p. 4).

Connotation is a representation of a symbolic image or linguistic message that is subject to interpretation (Barthes, 1977).

Denotation is a representation of an image or a linguistic message that requires little interpretation because the form is immediately recognized (Schneeweis, 2005).

Depictions are an outcome of "analogical structure mapping" and include visual images such as graphs, maps, paintings, photographs and three-dimensional models.

Descriptions are an outcome of symbol processing and include written text, mathematical expressions and symbols.

Diegesis is a representation of an action by telling.

Iconic legisigns are realistic images that resemble an actual thing such as a photograph or painting.

Iconic sinsigns are diagrams or cartoons that have been abstracted from real life, but still resemble the original form.

Logo is a graphic that is used to represent a person, place or thing.

Mimesis is a representation of an action through a performance.

Montage is another term for a type of editing that "...emphasizes dynamic, often discontinuous, relationships between shots and the juxtaposition of images to create ideas not present in either shot by itself" (Bordwell & Thompson, 2004, p. 504).

Narrative, for the purpose of multimedia learning, is defined as a representation of events that maintain causal, spatial and temporal orders. The distinctive features of narrative is the way in which "The story is always mediated — by a voice, a style of writing, camera angles, actor's interpretations — so that what we call the story is really something we construct" (Abbott, 2004, p. 17).

Narrative forms of representation (NFR), for the purpose of a multimedia presentation, may include the artwork, actors, auditory effects, editing and framing effects, props, typography and ". . . stylistic elements: the way the camera moves, the patterns of color in the frame, the use of music and other devices" (Bordwell & Thompson, 2004, p. 49).

Narrative instructional presentation, for the purpose of multimedia learning, is defined as a multimedia format that includes the configuration of storytelling structures in addition to representational techniques and methods. The content includes the subject matter and instructional material that operates within the form. Another dimension of a narrative instructional presentation is multimedia technology that has in its turn introduced constructivist tools and resources that allow for mainstream narrative productions. Examples include: (a) streaming video that can be accessed from a social network, and (b) enhanced podcasts or videocasts that can be accessed from online directories and viewed on a computer or wireless device.

New constructivist technologies are defined as open-ended digital environments, consisting of interactive digital tools and resources that allow people to create and share information (Hsu, 2007). Examples include: (a) video-editing software that allow people to create and distribute movies, and (b) online social media networks that allow people to engage in various forms of discourse.

Spatial orders are used to identify the setting of the narrative and may contain referential meanings that require the viewer to attend to cues such as corresponding events, situations and other significant features.

S*toryboard* is a blueprint of main events. It includes the (a) planning of shots, (b) movements within a frame, (c) special effects and, (d) annotations to identify the types of shots, effects, dialogues and time durations.

Symbols infer relationships between what is recognized, visually or verbally, and what is accepted and learned through intellectual skills. Examples of symbols include "(. . . specific languages, alphabetical letters, punctuation marks, words, phrases and sentences), numbers, morse code, traffic lights, national flags" (Chandler, 2007, p. 36).

Temporal orders refer to the linear or nonlinear organization of events within a time frame. It is the "transition from one state of affairs to another," and it is used to provide the viewer with a sense of order and coherence as a story unfolds (Ochs and Capps, 1996, p. 23). Aristotle's *Poetics* distinguished this temporal order by suggesting narrative contains a beginning, middle, and end (Ochs & Capps, 1996).

CHAPTER 2

LITERATURE REVIEW

Overview of the Current State of Multimedia Learning Research

The following summary presents an overview of the current state of multimedia learning research and discusses two of the multimedia learning paradigms that have emerged over time and currently coexist in practice. Each generation of multimedia learning has been perceived as a result of advancements in multimedia technology and has led to the development of new multimedia theories of learning and cognition (Lajoie & Nakamura, 2005). Currently, three paradigms have been identified in multimedia learning literature. This includes a behavioral paradigm, cognitive constructivist paradigm, and situated constructivist paradigm (Reimann, 2003; Lajoie & Nakamura, 2005; Samaras, Giouvanakis, Bousiou, & Tarabanis, 2006).

Given the focus on the role of representations throughout the multimedia learning literature and the understanding that design paradigms exist for different purposes, none of which are well-matched for understanding how to design in all situations (McDonnell, et al., 2004), it seems appropriate to start out by first providing some background information on the differences between the multimedia learning paradigms that have developed over time. Thus, the following section of this paper presents a comparative overview of the way in which these paradigms function within different multimedia learning environments. Subsequently, multimedia learning theories are discussed to assist in placing the research in context.

The Behavioral Paradigm

The first generation of multimedia learning is defined as the behavioral paradigm and it is centered on learning through media and its effect on memory (Samaras et al., 2006). Learning activities involve lower-level learning tasks such as reading and obtaining information (Samaras et al., 2006). Additionally, instruction is computer-centered as opposed to learner-centered.

The Cognitive Constructivist Paradigm

The second generation of multimedia learning is defined as the cognitive constructivist paradigm and it carries with it some lingering first generation interests that are centered on behavioral approaches to knowledge acquisition through the transmission of information (Applefield, et al., 2001; Du & Wagner, 2007; Samaras, et al., 2006). Most recently, however, cognitive constructivist practices have been focused on knowledge construction processes involving multimedia lessons that have been designed to encourage problem-solving and the active participation of the learner.

In general, the cognitive constructivist approach subscribes to the multimedia learning theories that are centered on human cognitive architecture (van Merriënboer & Sweller, 2005) and instructional message design principles. Human cognitive architecture refers to the way in which the human brain processes and retrieves information in the multimedia learning environment. Studies have shown meaningful learning occurs when the brain can actively process and integrate external representations to construct mental models (Mayer, 2002). The paradigm emphasizes the importance of prior knowledge, prerequisite learning, and the necessity of scaffolding to foster learning and enhance instruction (Lajoie & Nakamura, 2005; Winn, 2002).

The Situated Constructivist Paradigm

The third generation of multimedia learning research is defined as the situated constructivist paradigm and it is centered on engaging learners in interactions that address the different modalities (Schnotz & Banner, 2003) to achieve knowledge construction. Complex problem-solving environments are designed with constraints and affordances to provide learners with opportunities to construct their own representations and/or solve problems (Reimann, 2003). Additionally, computer learning environments are used to provide the tools needed to construct and interpret information as well as to engage learners in social practices with others " . . . such as patterns of turn-taking in conversation" and "appropriate ways to interact conversationally when working together on a task" (Kozma, 2003, p. 206). Because it is difficult to determine how learners will interpret text and picture information, the research tends to investigate the differences between the use of multiple representations, their semiotic readings, and how information might be constrained by taking advantage of the social affordances of the media (Lewalter, 2003; Schnotz & Banner, 2003). The objective is to facilitate advanced mental models and have students reflect on their ideas to externalize their "internal representations" (Lajoie & Nakamura, 2005).

External representations are recognized as "intellectual tools" (Rogoff, 1990, as cited in Andersson & Andersson, 2005, p. 422) that can be used to reason, communicate and perform certain actions within a contextualized setting (Kozma, 2003). The situated constructivist paradigm proposes human understanding and learning are characterized according to the learner's " . . .participation in practices of inquiry and discourse" (Kozma, 2003, p. 206). Situated multimedia learning presupposes knowledge is " . . .

shaped but not determined by the constraints and affordances" of the contextualized setting (Kozma, 2003, p. 206). The paradigm also emphasizes the importance of prior knowledge, scaffolding and self-regulated learning, in particular, to promote learner engagement (Lajoie & Nakamura, 2005; Winn, 2002).

Collecting the Research

The research for this paper began by identifying and reviewing the multimedia learning literature that had been published since 1998. The goal was to locate the most authoritative and reputable sources of scientific knowledge. Correspondingly, empirical studies, literature reviews, and theoretical articles were accessed to locate peer-reviewed journals. The use of electronic databases included the ACM Digital Library, Academic Search Premiere, Communications Studies, Communication and Mass Media, DAAI: Design and Applied Arts Index, Eric, Film Literature Index, the Professional Development Collection, PsycARTICLES, Sage Journals Online, Science Direct, and Wilson Web (Art Full Text). The information from these primary sources served to formulate the foundation of this review by identifying the significant qualitative and quantitative studies related to multimedia. Similarly, additional perspectives on the meaning of the term *multimedia* revealed its connection to the study of instructional design, learning and memory, visual and verbal modalities and the cognitive and social affordances of multimedia. Thus, search phrases such as *multimedia instructional design, multimedia learning, narrative multimedia learning, multimedia and memory, multimedia and modality and situated multimedia learning* were used.

In addition to the use of electronic libraries, Internet searches were performed through the Google interface and manual and online library searches were used to locate

the journal articles and books relating to the theoretical framework of constructivism as well as multimedia and narrative. The reading of literature pointed to more selective keywords and equivalent phrases that were used in the search. This included *audience awareness, audience driven, blogs, constructivism, cueing, critical inquiry, cultural narratives, drama, dual-coding theory, film, film narratives, film semiotics, e-learning, event indexing, experience design, game culture, hypertext narratives, interactive, interactivity, interactive games, modality, mobile learning, montage sequence, montage editing, multimedia, multimedia environments, persuasion, podcasts, narrative, narrativity, narrative intelligence, non-linearity, representations, RSS (i.e., really simple syndication), semiotics, situation model, split attention, social networks, verbal redundancy, video, visual representations and Weblogs*.

Framework

The aim of this chapter is to contextualize the review of literature in relation to the study by providing a description of the current state of multimedia learning; identifying the different factors that have influenced or constrained the use of narrative multimedia; demonstrating the connection between narrative and multimedia learning and teaching, and proposing the potential of using constructivist technologies to construct narratives. To achieve this aim, this chapter is presented in three parts. Part I, concentrates on two of the multimedia learning paradigms, mentioned previously in this chapter. Part II, concentrates on the way in which interdisciplinary narratives function and its connection to multimedia learning and teaching. Part III, concentrates on the recent innovations attributed to Web 2.0 technology, in particular, constructivist technologies and their connection to teaching and learning. To begin this discussion, the

theoretical framework is presented. This is followed by an overview of cognitive architecture and technology-mediated learning.

Theoretical Framework

The theoretical framework of this study is focused on a constructivist approach to learning. Constructivism is a branch of cognitive psychology that is centered on how people actively construct knowledge to make sense of the world (Ackerman, 2004). Constructivism is a broad theory and a number of constructivist traditions have stemmed from its practice (Hirumi, 2002), including Seymour Papert's constructionism, Jerome Bruner's discovery learning, and Brown, Collins, and Duguid's views on situated cognition (Applefield, Huber, & Moallem, 2001). Although, each of these constructivist practices are comprised of notable differences, they all recognize the learner as a meaning maker and represent a departure from the practice of objectivism (Applefield, et al., 2001) that is centered on the transmission of knowledge from the teacher to the learner (Jonassen, 2008).

Constructivism is most commonly associated with the behavioral theories of the Swiss psychologist, Jean Piaget who believed knowledge comes from within the individual and it ". . . is acquired through interactions with the world, people and things" (Ackerman, 2008, p. 3). Piaget's successive stages of intellectual development are centered on the belief that a child's perceptions, adaptation, and knowledge of the world result from their interactions within it.

"Psychologists and pedagogues like Piaget, Papert, but also Dewey, Freynet, Freire and others from the open school movement" proposed constructivist views that place an emphasis on knowledge construction as opposed to knowledge acquisition

practices (Ackerman (2008, p. 2). Knowledge construction is acquired through the learner's active engagement in an activity as opposed to knowledge acquisition that is transmitted through a lecture style format (Applefield, et al., 2001; Du & Wagner, 2007).

Piaget's theories did not address the social learning theories that are associated with Vygotsky in respect to a learning community nor did they address how learning occurs through practice (Machanick, 2007; Schön, 1987). Conversely, constructivist views such as, those of Bruner and Vygotsky proposed the intellectual development of the learner could only be understood by observing them within the socio-cultural context of their development (Hirumi, 2002).

Currently, constructivism comprises both a cognitive (i.e., developmental) and social perspective " . . . that is not mutually exclusive; distinctions are more a matter of emphasis than beliefs" (Hirumi, 2002, p. 501). Differences exist between how knowledge is acquired and knowledge construction processes (Applefield, et. al., 2001). Whereas cognitive constructivists tend to concentrate on individuals and their interactions within the environment, constructivists focus on groups and their sociocultural contexts" (Hirumi, 2002, p. 501). The multimedia learning paradigms represent both the cognitive and social forms of constructivism.

Cognitive constructivism places an emphasis on the individual and the processes involved in learning. Essentially, learning is perceived of as the individual act of building mental models to connect new information with prior knowledge, stored in long-term memory (Du & Wagner, 2007). A mental representation that is propagated from the outside world is considered to be the "constructive act of the individual" (Decortis, 2004, p. 82).

Cognitive constructivism compliments the cognitivistic view of multimedia learning and the narrative activities that involve mentally interpreting information (e.g., video montage segments) (Gillette, 2005; Larsen, Wright, & Hergert, 2004). Cognitive constructivism proposes " . . . the mind is in the head" whereas the constructivist proposes the mind is situated in the social setting and develops within ". . . an established community of practice" (Hirumi 2002, p. 502).

Social constructivism proposes human meaning is mutually constructed through human interactions that occur in a socio-cultural setting (Sivan, 1986). Learning is recognized as a socialization process whereby the learner acquires the "skills, knowledge," and character that is needed to participate in shared interactions and negotiations with other members of the community (Sivan, 1986). It is through these interactions that cognitive activity is attained.

The socio-cultural knowledge derived from social constructivism demonstrates an understanding of the use and meanings of the "tools and signs of the culture" and how they come to be understood through human assistance (Sivan, 1986, p. 211). Cultural knowledge connects the propositions proposed by Bruner (1990) who recognized that human action and understanding is situated, continuous and distributed within the social world and does not necessarily occur in the mind or exist priori. Similarly, Vygotsky's concept of the *zone of proximal development (ZPD)* suggests levels of intellectual development are achieved through human interaction (Decortis, 2004).

The *ZPD* includes the distance between the level of learning that is centered on individual problem solving and the level of learning that is supported through the guidance of an adult mentor or a peer who has a greater understanding of the concepts

and or processes. The focus of ZPD is to develop learner independence through the social cooperation and support of other members of the community (Decortis, 2004).

Social constructivism is particularly well suited to narrative multimedia learning because human understanding naturally acquires meaning through narratives interactions. Constructivist tools such as video editing software and Weblogs can be used to promote social dialogues (Hsu, 2007; Ractham & Zhang, 2006) as well as other narrative forms of expression (e.g., multimedia tutorials) that represent the experiential and personalized forms of learning. Real and virtual pedagogical agents (Grabe & Zhou, 2003; Campbell et al., 2004; Mayer, 2005; Mayer & Moreno, 2005; Bishop et al., 2004-2005) can also be used to personalize narrative instructional designs.

Constructivist learning theory compliments the critical and narrative stages of content creation that are centered on strategic and conceptual tasks (Kim, 2005). Active, intellectual engagement in activities such as the development of animatics, scripts, storyboards, cinematic framing techniques and editing demonstrate how learning is constructed and contextualized through the learning experience.

Notwithstanding the epistemological differences between them, constructivists, generally, distinguish human learning and understanding according to the following principles: (a) instruction is learner-centered (Hirumi, 2002); (b) prior knowledge and experience is important to extend learning (Dick & Carey, 2005; Hirumi, 2002); (c) problem-solving tasks are centered on an authentic context and consist of multiple solutions to a problem (Reimann, 2003); (d) learners construct their own knowledge (Bruner, 1990) and, (e) learning ". . . is acquired through interactions with the world, people and things" (Ackerman, 2008, p. 3).

Cognitive Architecture and Technology-Mediated Learning

Cognitive architecture makes use of two forms of knowledge acquisition. One based on human communication and the other on problem-solving tasks that are tied to procedures to promote retention and recall. van Merriënboer and Sweller (2005) proposed in much the same way as the human genome is understood to be a complex structure of distributed information, so too is human cognitive architecture. The researchers proposed the information stored in long-term memory is an accumulation of human sensory responses that function from a *central executive* to guide the learning. The central executive is continually editing, processing and updating information as it is acquired. van Merriënboer and Sweller (2005) compared this process to the Droste effect. That is, a visual consequence of images that repeat the same properties within other images. An example is the visual work of the Dutch artist, M.C. Escher (Merriënboer & Sweller, 2005).

Cognitive Load Theory

One potential problem of combining different media, into an instructional presentation, is referred to as *cognitive load*. The theory is based on the research of human cognitive architecture and recognizes the extensive capacity of long-term memory as opposed to the limited capacity of working memory (Brünken, Plass & Leuter, 2003). According to van Merriënboer and Sweller (2005) working memory can only store seven elements of new information at any one time. Moreover, it can only process the information related to two out of four of these elements. Studies have shown that new information can only be retained for a few seconds unless some type of reinforcement is provided. Cognitive load theory is only applicable to working memory and the effects of

learning new information. When working memory can make connections with existing schemas (i.e., what has been learned and stored in long-term memory), processing capabilities are enhanced.

The Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning applies to the multi-sensory components that are employed to facilitate learning in multimedia environments. The theory asserts higher-order learning is achieved when learners are given the opportunity to formulate mental connections between images and verbal representations (Mayer, 2005). The concept works with a few other theories that attend to working memory. For example, *Pavio's dual coding theory* has been used to guide much of the instructional message design research (Schnotz & Bannert, 2003). The theory proposes verbal media, primarily text, spoken words, and images are perceived and interpreted by the human brain and the information is cognitively delineated into two independent, but adjoining systems (Paivio, 1986, as cited in Brünken, Plass & Leutner, 2003).

The two compatible channels operate concurrently to facilitate mental representations. When learners actively select the relevant external resources the information is organized into the two separate channels of working memory (Brünken, Plass & Leutner, 2003). "Words and sentences are usually processed and encoded in the verbal system, whereas pictures are processed and encoded both in the imagery system and in the verbal system" (Schnotz & Bannert, 2003, p. 142). In other words, in the imagery (i.e., visual) system the information is coded twice.

Brünken et al. (2003) claimed that one of the objectives of instructional design is to find ways to manage cognitive load so it can benefit the individual learner. The three

kinds of cognitive load are extraneous, intrinsic, and germane. Extraneous cognitive load is caused by the unnecessary use of external representations that overburden working memory and make it more difficult to complete an instructional activity. The design of a presentation must limit extraneous detail so the information can be processed (Gellevij, Van Der Meij, De Jong, & Pieters, 2002). By decreasing extraneous cognitive load, the learner is better able to achieve “schema construction” (van Merriënboer & Sweller, 2005, p. 151).

Intrinsic cognitive load cannot be adjusted by instructional means. It is experienced through the intrinsic nature (i.e., difficulty) of the content (e.g., differential equation) (Cooper, 1998). The instructional material and the skillfulness of the learner will determine the amount of mental resources that are available to process the intrinsic information in working memory (van Merriënboer & Sweller, 2005). Conversely, germane load can be controlled through the instructional design and is often associated with the learner’s motivation and interest in the instructional material. The goal is to design instruction to promote low levels of extraneous cognitive load and enhance the productivity of germane load that is self-induced by the learner. Multimedia-based, instructional presentations are only capable of addressing working memory. Therefore, it is necessary for information to be constructed with the most essential combination of sensory information so that learning can occur.

Multimedia Learning and Instructional Message Design

In this theoretical framework, the multimedia principles associated with cognitive load theory, and multimedia learning, are examined in relation to task-oriented multimedia-based research that promotes knowledge construction. Each of the studies, in

this section, identifies one or more the instructional design principles. Given the participatory role of the student in comprehending an interactive, multimedia lesson, cognitive load theory served to guide the material to maintain engagement, intelligibility, and organization.

The Principles of Modality, Continuity, Personalization, and Voice

Mayer, Fennell, Farmer, and Campbell (2004) proposed, design principles that are centered on the reduction of cognitive load could be used to extend the learner's cognitive capacity and foster active cognitive processing and more meaningful learning. The following reduction techniques (i.e., principles) were proposed as a way to reduce cognitive load, promote knowledge transfer and foster deeper learning. The *modality principle* refers to using words in the form of narrations as opposed to using words in the form of on-screen text. The *spatial continuity principle* refers to placing on-screen text and on-screen images close together as opposed to further apart. The *temporal continuity principle* refers to implementing narrations in conjunction with an animation as opposed to implementing narrations successively. Mayer et al. (2004) also proposed, social cues that are centered on "Using the self as a reference point increases learner interest" (p. 391). An example is the *personalization principle* that emphasizes converting words from a formal style to a conversational style (Mayer et al., 2004).

Mayer et al. (2004) conducted a series of experiments with college students to determine if meaningful learning could be achieved by implementing social cues into a multimedia lesson. The researchers predicted that social cues could foster learner response and promote deeper cognitive processing due to the reference of self. Two groups of students were presented with two different versions of an animation on the human respiratory system. In the nonpersonalized version, the information was presented

in a formal style. In the personalized version the information was presented in a conversation style and the word *the* was replaced with the word *your* in twelve places.

Results on transfer tests indicated students performed significantly better on problem-solving tasks when the multimedia lesson included the personalized version in comparison to students who received the same material without the personalization. The findings supported the personalization principle and proposed a simple measure such as changing a third-person construction could result in deeper cognitive processing and more meaningful learning.

Mayer et al. (2002) conducted a second experiment, comprised of the same group conditions. The researchers predicted smiling could be used to measure personal interest and learner involvement. Digital cameras were used to record the number of times learners smiled as they viewed an animation on the human respiratory system. Similar to the previous experiment, the results on transfer tests were significant for the personalized group. However, the prediction of smiling as a "measure of interest" was not observed. Accordingly, the researchers concluded it was not an adequate measure of learner interest.

Although the personalization group outperformed the nonpersonalized group on transfer tests, in both experiments, the retention tests showed no difference between the two groups. The researchers surmised although the same amount of effort was exerted on the retention tests, the transfer test required the students to relate the material to prior knowledge. The fact that the personalized animation had addressed the self made it more relevant for the students and, as a result, fostered a deeper level of cognitive processing.

The Voice Principle

The *voice principle* states deeper learning can occur when a narrated voice maintains a standard accent (Mayer, 2005). Mayer, Sobko, and Mautone (2003) conducted a study to determine if a speaker's voice promoted social cues that could influence the process and outcome of a multimedia learning experience for college students.

A computer-based, animated lesson was presented on the properties of lightning effects and based on whether an accented voice affects the retention, transfer, and social ratings of the speaker. The results indicated those who received the animated lesson with the accented voice performed as well as those who received the animated lesson with the standard accent. Interestingly, transfer tests indicated students who received the narrated lesson without an accent performed significantly better on problem-solving tasks compared to students who received the lesson with the accented narration. Findings supported the premise of the social agency and cognitive load theory of multimedia learning, suggesting social signals are embedded into animated instructional messages.

The interactions, between the students and the computer, initiated a social conversation of schemas that are similar to those that are found in standard human conversations. The study suggests that once the social conversation schemas were initiated, the students reacted by exerting more effort into their interpretations of the information. The research also supported the premise of the *media equation.* That is media can produce experiences that are similar to real life situations.

Personalization, Voice, and Image Principles and the Social Agency Theory

The *image principle* states that people learn more deeply from a multimedia lesson when the speaker's image is added to the screen. The *social agency theory* proposes social signals are embedded in multimedia instructional messages.

In a review of literature, centered on social cues, involving personalization, voice, and image principles, Mayer (2005) proposed, the design of instructional messages could be used to foster deeper learning when it includes reduction techniques and social conditions to affect motivation. In general, the implications of the research for instructional design proposed (a) presenting messages in a conversation style and eliminating extraneous conversations that could distract the learner; (b) presenting messages in a standard accent. Mayer cautioned, however, this condition may change over time as students become more accustomed to a particular voice, and (c) the use of on-screen agents does not necessarily foster social engagement, but may serve as a good cognitive aid (e.g., to point or gesture).

The Principles of Cueing and Modality

Tabbers, Martens, and van Merriënboer (2004) studied students to test the effects of the principles of cueing and modality. Cueing refers to the use of directional devices, such as arrows and color-coding systems, to indicate the relationship between text and images. According to the *modality principle*, meaningful learning occurs when visual text is replaced with spoken text. The experiment consisted of four different presentation formats: "(visual text, no cues in diagram) . . . (visual text, cues in diagram) . . . (audio text, no cues in diagram) . . . (audio, cues in diagram)" (Tabbers et al., 2004, p. 74).

Findings indicated, students who received the visual text formats performed significantly better than those who received the spoken text formats on both retention and

transfer tests. The results contradicted previous research on the positive effects of modality and cueing that had been consistent with cognitive load theory and multimedia learning research (Tabbers et al., 2004). The effects of cues in diagrams were also significant on the retention test, but not the transfer test. The researchers concluded the generalized nature of the study in an authentic, classroom context, produced a new set of conditions that were not fully appreciated in earlier studies. Additionally, the content of the lesson was delivered over the Internet, requiring the students to download material. This extra step added to the instructional time. The nature of the content, the pacing of the lesson, and the student-controlled navigation system introduced a new set of conditions that were not present in previous studies.

The Principle of Multimedia

According to the *multimedia principle*, meaningful learning occurs from the use of text and images as opposed to text alone. Schnotz and Rasch (2005) conducted a study to determine if different kinds of animations and learning prerequisites could influence the processing capabilities of college students as they performed learning tasks based on the earth’s rotation.

The researchers found the use of different animation formats produced different learning results. Learners with high prerequisite knowledge performed significantly better on time-difference questions after learning from manipulation pictures compared to other students who learned from simulation pictures. Interestingly, low prerequisite learners had lower time-difference scores after learning the material from the manipulation pictures compared to students who learned the material from the simulation pictures. Although the use of simulation pictures resulted in a facilitating effect on the low

prerequisite learners, it impeded their performance on circumnavigational questions. Consequently, there was a reduction in germane load, resulting in little opportunity for higher level, cognitive processing.

The Principles of Multimedia and Dual Coding Theory

The dual coding theory states that verbal media, primarily text, spoken words, and images can be seen and understood by the brain and cognitively delineated into two independent, but adjoining systems discussed in Paivio's research (as cited in Brünken, Plass, & Leutner, 2003). The two, compatible channels operate concurrently to facilitate mental representations. Learners actively select relevant visual and verbal information that is organized into the two separate channels of working memory (Brünken, et al., 2003).

Inconsistencies and similarities emerged between the findings of the Schnotz and Rasch (2005) experiment and the research of Gellevij, van Der Meij, De Jong, and Pieters (2002) as to the effects of low cognitive load and facilitating pictures. Gellevij et al. (2002) questioned whether multimodal learning could hold any value for self-instruction and whether the use of screen captures could optimize learning on multimodal tasks. Gellevij et al. (2002) suggested the context of multimodal instruction operated from the dual coding theory as opposed to the multimedia learning principles that are associated with cognitive load theory.

Gellevij et al. (2002) conducted a study of teacher education majors. Findings were consistent with the research of Schnotz & Rasch (2005) on the effects of facilitating images. Gellevij et al. (2002) found the validity of screen captures, as learning facilitators, produced no difference in student learning. However, in contrast to Schnotz

and Rasch (2005), the findings indicated the effects of low cognitive load could be productive when the instruction is multimodal. The students who were guided by a visual instruction manual experienced lower levels of cognitive load in comparison to the students who were guided by a text-based instruction manual. The application of the visual manual over the text-based manual was essential to a significant increase in learning effects and decrease in training time. The implementation of a multimodal system of instruction, over a unimodal format, confirmed the effectiveness of the *dual coding theory*. Furthermore, Gellevij et al. (2002) claimed their findings counteracted cognitive load theory since the participants did not experience any difficulty in interpreting the information. The use of the visual manual in conjunction with the images, on the computer screen, enhanced simultaneous processing. The students were able to build mental models from the verbal and nonverbal systems of instruction.

The Principle of Interactivity and the Dual Coding Theory

According to the *interactivity principle*, meaningful learning occurs when end-users have control over the presentation rate of multimedia information. Moreno and Valdez (2005) conducted a study to determine if student comprehension and scientific understanding could be improved when the instructional material is distributed as two representational codes, visual and verbal.

Six groups of students were formed, consisting of the following criteria: interactive picture (IP), interactive word (IW), interactive word and picture (IW-P), no interactive picture (NI-P), no interactive word (NI-W) and no interactive words or pictures (NI-WP). Findings indicated when words and pictures were used in a consistent and complimentary style, as opposed to a redundant style; learning was more efficient

and could be better supported. Student learning improved when instructional materials were distributed as two representational codes (visual and verbal) as opposed to one. The results of the study indicated higher student performance and lower cognitive load. Conversely, providing students with the ability to manipulate the content, in the multimedia lesson, resulted in a negative effect. The interactive conditions did not benefit instruction. Instead, it reduced performance and increased cognitive load.

Moreno and Valdez's (2005) findings were consistent with those of Gellevij et al. (2002). Novice learners need to be provided with the opportunity to develop schemas that address a two-channel system of sensory information in the multimedia environment.

The Signaling Principle

According to the signaling principle, meaningful learning occurs when the important steps of a narration are signaled. Moreno and Mayer (2005) studied the role of guidance, interactivity, and reflection as a way to promote student understanding in a scientific game. The researchers proposed college students could learn more deeply from guided discovery as opposed to pure discovery.

The students were randomly assigned to four different treatment groups that included: (a) guidance, reflection and interactivity, (b) guidance and interactivity without reflection, (c) no guidance along with reflection and interactivity, and (d) no guidance and no reflection with interactivity. All of the groups were compared on measures of retention, transfer and program ratings.

Findings indicated the guidance and non-guidance groups scored significantly higher on dependent measures. The groups who received guided explanations were able to retain more information compared to those who worked without agent clarification and

feedback. The groups who were presented with agent feedback were able to respond with significantly more correct answers on transfer tests compared to those who received information on the correctness of their answers.

In summary, when the students were required to make decisions during the process of knowledge construction, they engaged in active cognitive processing. Reflection in an interactive environment does not significantly improve student learning, because interactivity already primes the cognitive processes of organizing and integrating information. The far-transfer scores of the group of students who learned with reflection and no interactivity were significantly superior to the group of students who learned with reflection and interactivity.

The Coherence Principle and Complex Learning

The *coherence principle* states meaningful learning occurs through the reduction of extraneous text, audio, and images. In a review of the literature on cognitive load theory, van Merriënboer and Sweller (2005) speculated new instructional design systems could extend the parameters of multimedia learning to the study of complex learning tasks. The past emphasis, on novice learning, had not translated well to higher-level learning environments. In fact, many of the variables that have controlled cognitive load theory for novice learners were found to have a reverse effect on expert learners because the current forms of measurement do not take into account problem-based learning that is centered on authentic, problem-solving tasks.

The research of Kirschner, Nadolski, and van Merriënboer (2005) contributed to analyzing the effects of cognitive load theory in relation to the performance of complex skills. The researchers proposed a relationship existed between the number of steps in a

task and the mental processing required to solve abstract problems. The participants consisted of law students who were assigned into three group conditions: No steps, intermediate steps and a high number of steps. Findings indicated the coherence of the compulsory learning tasks, between each of the groups, were significant. The students who received the optimized, intermediate number of steps outperformed the other two groups. Additionally, they performed better on compulsory tasks. The study demonstrated the benefits of an instructional design model that employed multimedia-based learning to teach whole and complex tasks by controlling the number of steps to improve student performance.

Multimedia Learning and Situated Constructivist Learning

The prospect of social learning through representational means extends the research focus on visual and verbal studies to incorporate more complex instructional designs that are situated within problem solving activities (Lajoie & Nakamura, 2005) and proposes opportunities for learners to construct representations " . . . through the process of acquiring culture" (Vygotsky, 1978, as cited in Andersson & Andersson, 2005, p. 421).

In the midst of these changes, some scholars have suggested representations are cognitive tools that can be used to extend the skills and abilities of learners (Kozma, 2003; Lajoie & Nakamura, 2005; Salomon et al., 1991). To date, few studies have examined the cognitive and social learning affordances of representations in this way. Within this context, representations have come to signify conditions, processes and strategies by which learners construct meaning.

Kozma, Chin, Russell, and Marx (2000) conducted an observational study to determine how experts use scientific representations as tools to inform scientific practice

and the extent to which representations are used to assist in the interpretation of information and processes. The goal of the study was to understand how cultural activities and representations support scientists in their work and how similar practices could be used to support chemistry students in their work and inform academic and national interests in science education.

The settings for the study included an academic laboratory with chemistry students performing basic science research and a pharmaceutical company with chemists performing bench work. Representations were identified as the deictic gestures of the chemists, structural diagrams, manual sketches and tracings from technical instruments and analytical tools. The features of the representations were examined within the context of social conversations centered on reflections, rhetorical context, supporting arguments, and references to other representations.

Findings indicated scientists apply "representational skills or competencies" to support their understanding of scientific phenomena and their ability to manage information and express ideas (Kozma et al., 2000, p. 136). Recommendations were made for similar representational practices to be applied to science education including (a) the application of scaffolding, (b) teacher involvement, and (c) the use of symbol systems, tools and tasks for representational learning and understanding.

The research of Kozma et al. (2000) extended multimedia learning by demonstrating how the manipulation of representations is an important activity, particularly for scientific learning and understanding. When representations are used as reasoning tools, within an authentic, real-world contexts, tasks become more manageable because the resources are constrained and supported by complementary affordances

including the artifacts, technology, and human social interactions (Kozma, 2003). Conversely, challenges come into play when multiple external representations (MERs) are introduced within the context of technological environments that lack these types of structural support systems.

According to Schnotz and Lowe (2003), multimedia instructional presentations that make use of (MERs) and multiple modalities have been inconsistent in producing positive learning effects. Many researchers now believe the successful integration of MERs can only lead to knowledge construction processes when the patterns, relationships and functions of MERs are designed to complement all of the variables in a given learning situation (Goldman, 2003; Ainsworth, 2006). This includes the learner, lesson, technology and MERs (Ainsworth, 1999). Although, one of the main objectives of instructional design is to be cognizant of the architecture of a lesson, so it satisfies the goals and objectives of a particular problem, the use of MERs has introduced confounding conditions, making it difficult to promote knowledge construction processes. Some scholarly research has been particularly focused on these kinds of instructional design issues.

Recently, researchers have begun to incorporate the logic of linking (Van Leeuwen, 2005) for the purpose of examining productive uses of MERs in multimedia learning (Lajoie & Nakamura, 2005; Lewalter, 2003; Schnotz, 2005). The objective of linking is to make connections between all of the variables in a given instructional presentation including MERs. “If there is a relation or extension between two items of information, the second item will add new information, and the link between the two items will be temporal, logical or additive” (Van Leeuwen, 2005, p. 222).

Semiotic representations consist of codes, functions, and denotative or connotative levels of signification, each with its own divisions and associations (Barthes, 1975). The interest in how these semiotic representations function as a whole, in a multimedia presentation, have led to studies that are centered on determining its thematic applications (Lowe, 2003), functional arrangements (Ainsworth, 1999; Magliano, Miller & Zwaan, 2001) and constructivist possibilities (Lajoie & Nakamura, 2005).

Ainsworth (1999) developed a taxonomy, based on a conceptual analysis of multimedia learning environments, to determine the effective use of MERs. This researcher identified three main functions of MERs, referred to as "complement, constrain and construct" (Ainsworth, 1999, p. 134).

Complement refers to the use of complementary representations that are designed to complement the desired cognitive processes of learners as they interact with MERs. An example is the depictive use of tables to support the descriptive use of numeric equations.

Constraint refers to the use of a recognizable representation to clarify the content contained within an ambiguous representation. An example is the depictive use of an animation, displaying sound waves, to support the depictive use of a graph, displaying decibel levels.

Construct refers to the learners' interactions with MERs to construct new knowledge based upon abstract concepts. An example is the physical manipulation of objects such a building blocks to support the descriptive use of mathematical equations.

The features of MERs need to be arranged to establish complementary connections between all of the variables of a given situation (Kozma, 2003). Socially, situated learning assists in this effort by providing opportunities for learners to "construct

knowledge" within an authentic setting, consisting of "constraints and affordances of the physical and social systems in which people interact" (Kozma, 2003, p. 206).

The implementation of dynamic MERs can introduce additional confounding factors for learners. Lewalter (2003) conducted a study to analyze the kinds of cognitive and metacognitive strategies learners use to interpret information from different kinds of representations such as dynamic visuals, static visuals and text. The goal was to understand the extent to which strategies are used and how they affect learning outcomes. The participants consisted of sixty undergraduate students who were assigned to three group conditions: a control group with text, an experimental group with dynamic visuals and an experimental group with static visuals. To gain insight into the participants' cognitive and metacognitive strategies a think-aloud protocol was applied and the participants' statements were recorded as they engaged in a lesson on an astrophysical topic.

Findings indicated dynamic visuals do not support learning any better than static visuals of the same astrophysical topic (Lewalter, 2003). Data from the lesson showed rehearsal strategies were regularly used by all the groups, but more often by the static group. Elaboration strategies were rarely used by any of the groups and it was surmised this might have been due to the participants' lack of prior knowledge. Control strategies showed no significant differences between the experimental and control groups. The results suggest more research is needed in order to understand how learners process dynamic visuals in a multimedia lesson. Additionally, Lewalter (2003) suggested other support systems should be in place to assist learners in the effective application of learning strategies that make use of dynamic visuals.

Technology cannot affect thinking, but it can offer the learner the possibility of an intellectual partnership (Solomon et al., 1991) when the instructional design is coordinated with social affordances to "complement, constrain and construct" knowledge (Ainsworth, 1999; Ainsworth, 2006). Stern, Aprea, and Ebner (2003) demonstrated the potential of using multimedia learning to support novices in this way. The researchers conducted two studies to determine the conditions in which learners from different academic backgrounds could benefit by using graphs, as reasoning and transfer tools, during the performance of problem-solving tasks on stockkeeping. Four groups were selected, consisting of the following criteria: (a) business education students with an understanding of graphs and content, (b) computer science and mathematics students with an understanding of graphs but not content, (c) vocational students with and understanding of content but not graphs, and (d) humanities students without and understanding of graphs or content. The participants were randomly assigned to three different conditions: Passive graph/different content area; active graph/different content area, including instructions to construct a graph and passive graph/same content area.

Findings indicated students in the business and mathematics groups benefited more from the active construction of graphs than from the passive use of graphs. The active construction of graphs fostered "cross-content transfer" and an understanding of how to map content information into representations. The second study maintained the same conditions only it specifically targeted the vocational students who were given visual aids, containing a "coordinate system with labeled axes" in addition to practice opportunities and transfer hints (Stern et al., 2003, p. 200). Findings indicated vocational students benefited from the active construction of graphs when affordances were

provided. The passive use of graphs by the vocational group showed no difference, indicating it was less effectiveness as a reasoning tool for this particular content area.

Multimedia Learning and Interdisciplinary Narratives

How Do Different Types of Narrative Multimedia Function?

In recent years, the definition of multimedia learning has expanded to include other kinds of representation that support learning and promote knowledge construction processes. Within this context, narrative is proposed as an effective instructional design tool that can be used to provide learner support and give meaning to new experiences (Dettori, Giannetti, Paiva, & Vaz, 2006). The corresponding value of narrative, in educational practice, is its array of functions and forms some of which are identified in the following sections of this chapter. First, however, a brief introduction is set forth to describe some of narrative's essential qualities.

What is at work in narrative is another form of representation, one that is distinguished by its capacity to convey information over time (Eisner, 1993). Narrative enactments have the potential to imitate life and to present information in iconic or symbolic ways that might otherwise remain hidden or obscure (Eisner, 1993). To a certain extent then, the expressive features of narrative provide us with an unlimited resource in which to construct meaning. Further, the potential of narrative for learning and instruction is the way in which it touches upon all cultures. Barthes (1975), for example, proposed " . . . in its infinite variety of forms, it is present at all times, in all places, in all societies . . . there has never been anywhere, any people without narrative; all classes, all human groups, have their stories" (p. 237).

In general, narrative functions by fulfilling our human expectations through social conventions and traditional practices, such as canonical knowledge (Bruner, 1990) and/or mutually constructed and negotiated forms of knowledge sharing practice (Lange, 2007; Du & Wagner, 2007; Abbott, 2004; McDonnell et al., 2004). The dramatic qualities of narrative attend to our understanding of its underlying structure; satisfying our anticipation of the order of events, recognition of masterplots and other forms of rhetoric from which we derive meaning.

In areas of computer science and cognitive psychology different approaches to narrative have been explored. For example, Blythe et al. (2006) observed, cognitive scientists have attempted to devise a framework to advance the human experience, whereas the narrative approach to multimedia has tended to explore the utilitarian or circumstantial aspects of the technology.

With the foregoing discussion in mind, the following review of literature is presented to demonstrate how the aesthetic conventions of narrative have been applied and translated through different forms of multimedia technology to convey information and advance human understanding. Specifically, narrative is recognized as a performance force that functions by initiating user engagement. It is also recognized as a tool that can be used to guide events, express ideas, communicate, inform, entertain and promote meaning through diverse forms of media and multi-representational systems. Accordingly, the studies discussed in this section concentrate on narrative expressed through film, live-theater, game design, museum studies, television studies, and the Internet.

Narrative in Technology-Mediated Instruction

Sundermeier, Van Den Broek, and Zwaan (2005) conducted a series of experiments to determine whether spatial information could affect the accessibility of previously revealed locations and objects in text. The researchers questioned whether locations and objects were encoded, in narrative text, and if the reader could access the information, as needed, at a particular point in time. They were also interested in examining the order of events to determine whether it influenced the reader's ability to denote spatial relationships between an object and its location. Two versions of a story were divided between two groups of students: causally relevant (experimental group) and non-causal (control group). In the causal group, the object, preposition and location were causally connected to the conclusion. In the non-causal group the object and location were not causally connected to the conclusion.

Findings indicated the ability to recognize the object at a critical point of the text was greater in the causal group. This suggested spatial relationships exist in narrative text and could be reactivated, as needed, in order to provide coherence to the narrative. The information is available and can be accessed at anytime. Depending on the causal relevance, spatial information is encoded. When spatial information is thoughtfully constructed, the reader is able to keep track of the information.

Laurillard (1998) also examined how narrative structures operate within a technology-mediated learning environment. This researcher examined whether interactive media could be designed to promote explorative techniques to enable students to achieve higher-level learning. An interactive interface was designed and included: textual sub-goals to foster the narrative content, search and notepad features, a feedback section and

tools to guide the learning. The research was initially implemented to evaluate the comprehensive nature of text-based instruction in comparison to technology-mediated learning.

One finding indicated the effectiveness of the instructional design was inconclusive in some areas. The research question had not been answered because the study did not resolve the explorative techniques that students needed to acquire in order to respond productively within a resource-based learning environment. However, the students were able to determine the validity of their responses by having access to model answers and reference materials. Additionally, they were able to construct a more unified understanding of the material in comparison to the text-based group.

The use of a theme was taken one step further in a study by Bishop, Cates, and Hung (2004-2005). The researchers used a metaphorical design as a methodology to communicate the content of a multimedia lesson based on the information-processing model. They proposed that individual voice monologues, of animated characters, could promote student retention.

Findings indicated the ability to recall the content, following the lesson, produced no significant differences between the characterization and narration treatment groups. The individual voice monologues of animated characters did not facilitate the retention of the content. Equivalent patterns emerged between the abilities of both groups with no notable differences found in relation to retention and recall.

In a follow-up investigation, drama was compared to the thematic metaphor of the interface. The metaphor, like drama, is composed of subordinate parts and functions like acts and scenes of a play to create meaning. The researchers concluded if drama and

metaphorical design are comparable, their use of characterization had been unsuccessful because it had only focused on one aspect of the dynamics of the user experience. If the use of symbolic sounds had followed the principles of Aristotelian drama, it would have taken the language of dramatic representation to another level. The message would have been encoded in small samples and would have enriched the learning experience. The subsequent findings of the narration and characterization treatment groups helped the researchers establish a new line of questioning that attended to the cognitive processes associated with narrative multimedia.

Narrative in Artificial Worlds (Film and Games)

Film and games promote artificial worlds that employ a range of strategies to construct and maintain an active discourse between the media, viewer, and interacter. Each participant negotiates, organizes and contributes to the resources. By convention, film relies on human intuition and linear thinking to promote the storyline and development of a character. Rowe (1994) argued the intent of the film narrative is to use the interpretive properties of visual representations to convey information. Conversely, a multimedia game is nonlinear, but it operates in a similar fashion by establishing a genre to convey the narrative. In areas of education genre is used to encourage and facilitate learning.

Magliano, Miller, and Zwaan (2001) conducted an experiment to determine if there was a connection between the *event indexing* (EI) model of narrative text and the perceptual constructs of narrative film. They were also interested in knowing whether the situation model of events that occur in text and film could signal the continuity of the storyline.

Three groups of college students were randomly assigned to view films of a particular genre: action adventure, science fiction and western drama. The researchers analyzed the shots before the experiment to determine if fractured information was present that could hinder the continuity of time, movement and spatial regions.

Findings were significant, indicating the variables did affect one another. There were main effects in all areas. The interaction, between time and movement were significant and an interaction was found between time, and region. The results suggested the EI model could be generalized from narrative text to narrative film. The findings also suggested the construction of the storyline, in a film, is as important for narrative understanding as the construction of grammar is to text. The message of the work took on different meanings when the segments were displayed in alternating patterns.

Mallon and Webb (2000) conducted a study to determine if they could locate narrative propositions, in multimedia-based games, for the purpose of establishing a set of standards that could be applied to analyze and evaluate the "experiential impact of a design" (p. 269). The researchers claimed the problem with interactive narrative research is the way it has proposed to analyze the outcomes of the media without providing a set of guidelines to advise its development or some other means to evaluate it. Through a phenomenological data analysis, that included a focus group of 12 computer science students, the researchers found they were able to locate the mediating elements of narrative multimedia design that could be used as a strategy to promote "cognitive, emotive and sensory engagement" (p. 269).

Findings located six principles of narrative theory that could be applied to multimedia-based games. The principles were referred to as propositions because of its

potential to address the structure, causality, visibility, and interaction of a multimedia narrative.

Narrative in Experiential Landscapes (Mobile, Museum, Television, and Internet)

Narrative interactions rely on audience intuition and their ability to formulate an arrangement of the distributed information (Ben-Shaul, 2004). Kim (2005) conducted a study on the formative process of the construction of an educational, narrative multimedia show.

Fifty participants were selected for the study to watch an interactive show designed to be projected onto a planetarium dome of a science museum. The educational value of the show had to be far-reaching for a diverse audience and the construction of visual narratives had to be capable of illustrating the concepts of neuroscience in exact detail. Findings indicated 81% of the participants had a comprehensive understanding of the show's content. Further, over 54% of the participants used design elements such as color and pattern matching as cues when faced with unfamiliar context. Usability studies demonstrated the effectiveness of the show's design to transcend populations. The participants' ability to interpret confusing information through the use of color and pattern matching, demonstrated the instructional potential of the visual properties of narrative in an interactive environment. The elements of design helped to convey the information and promoted the recall and transfer of information.

Grabe and Zhou (2003) demonstrated the pervasiveness of narrative to arouse audience attention and promote coherence. The classical principles of drama were identified in a contemporary news program that made use of camera shots, sound effects,

textual metaphors and live-characters such as reporters and the interview sources to suggest the ethos, logos, and pathos of Aristotelian drama.

Using a pre-post design, three participants were selected for the study based on their prerequisite knowledge of drama and work experience in the field of broadcasting and journalism. Findings indicated the use of dramatic story elements that included: conflicting elements (23.40%), human interactions (58.90%), and individuals sharing views and experiences (62.60%). This indicated the existence of logos and pathos in narrative content.

One of the benefits of the Grabe and Zhou (2003) study is the way in which it attended to many of the same causal, spatial and temporal scales that were noted in the other studies of this paper (Bishop et al., 2003-2004; Blythe et al., 2006; Kim, 2005; Laurillard, 1998; Mallon & Webb, 2000). The research also supported the discussion of Mallon and Webb (2000) by providing successful examples of audience engagement. In general, the researchers demonstrated how the semantics of certain kinds of media could be used to arouse attention. Thus, this study offered a starting point for understanding how dramatic elements can be applied to different forms of multimedia that incorporate audio, video and textual content.

Blythe, Reid, Wright, and Gellhoed (2006) conducted a study to examine the conditions that affected the user's experience during a live interactive, mobile, media show that recounted the historical events of a riot that occurred in Queen's Square, Bristol, England in 1831. Five hundred and sixty-three participants were asked to complete a survey-questionnaire. Findings were significant and reflected the age of the participants and their enjoyment of the interactive experience. Younger and older

participants tended to give the show a higher rating compared to adolescents and middle-aged adults.

The researchers also analyzed the data from four ethnographic case studies, in relation to the distinctiveness of the participants (i.e., their habitus, defined as their tastes and social values) and their understanding of “the city, the arts and technology” (Blythe et al., 2006, p. 133). Only one of the participants had a positive reaction to the show and the researchers surmised that this reflected her habitus. She was middle-class, educated, attended plays regularly, and read classic books.

The enculturation of the narrative pervaded many of the participants’ expectations. The researchers noted that although the schema contained all of the elements that are consistent with a linear narrative, and although the structure was consistent with these expectations, the interactive qualities of the media itself did not contain any unifying elements to make the show coherent.

The focus of the research on the habitus of the individual rendered an important point of change compared to other studies in this review and introduced another important variable. That is, attending to individual preferences of the audience to advance the personal experience. This concept is extended in the following study that emphasizes the cultural and social potential of the narrative experience.

Voithofer (2003) conducted a study that centered on a virtual, Internet expedition (i.e., Quests) to demonstrate how information, consisting of narrative data, could be systematically collected and analyzed. The expeditions were viewed by a diverse population of learners (i.e., 4000-5000 K-12 classrooms, consisting of 80,000-100,000 students) from different regions of the world. The narrative instructional design

incorporated the concepts of power and voice to encourage interactions between experts, students and teachers. The team members communicated with the students through email, sent through laptop computers that made use of satellite connections to connect to the Internet. Their "archeological evidence" was uploaded to an online archive for students to access.

One finding suggested the interdisciplinary influences of narrative theory could provide numerous ways to design and critique online, educational narratives that make use of multimedia learning. Voithofer (2003) proposed narrative theory opened up the possibilities of combining learning theories, instructional design objectives, and cultural theories directed towards human diversity and relationships. Additionally, it introduced the semiotic potential of multiple representations.

The Relationship Between Narrative and the Situated Constructivist Paradigm

A functional system is one in which representations are used to mediate the actions of learners as they share ideas, interact and organize their activities (Alterman, 2007). The interactive, conversational, and social features of new computer technologies have allowed for new forms of communication, centered on personal and collaborative forms of expression, and has extended the way in which people actively construct knowledge and make sense of their world (Hirumi, 2002; Ackerman, 2004). The way in which the situated constructivist paradigm attends to these communicative features reflects the social dimensions of narrative scholarship. Thus, it bears a direct connection that is more distinct compared to the cognitive paradigm that is associated with multimedia learning.

Similar to the contextual aims of the situated constructivist paradigm, the conditions of narrative are centered on the social construction of meaning and knowledge building practices (Blythe et al., 2006; Kim, 2005; McDonnell et al., 2004; Voithofer, 2003). Additionally, narrative and the situated constructivist paradigm address the role of representations as objects of "inquiry and discourse" (Bruner, 1990; Kozma, 2003, p. 206). Representations are used to probe ideas and assign meanings (Kozma et al., 2000). External multiple representations are used to promote social interactions by addressing the constraints and affordances (Bruner, 1990; Kozma, 2003) needed to construct knowledge (McDonnell, 2004; Stern et al., 2003; De Vries, 2006).

Throughout the review of literature, the use of representations, in both areas, has been compared to the socio-cultural theories of Vygotsky (Solomon et al., 1991; Decortis, 2004). In this way, representations have been recognized as tools and symbols for both learning and understanding (Decortis, 2004).

The semiotic features of representations are also addressed in both narrative and the situated constructivist paradigm. The social meaning of these signs are proposed as a way for people to access or uncover what Bruner (1990) referred to as canonical and sociocultural meanings through real-word interactions or through different forms of multimedia technology (Siegel, 2006). Representational meaning connects narrative to social forms of multimedia learning and as both areas propose, meaning is " . . . fluid and contextual, not fixed and universal" (Reissman, 1993, p. 15).

The Recent Innovations Attributed to Web 2.0 Technologies

The advancements that have been afforded through a second generation of Internet technology known as Web 2.0, "the participatory web," has introduced the possibility of

using what Land (2000) called open-ended learning environments (OELE), to support student centered constructivist activities, through collaborative and individual problem-solving experiences. Within this context, innovations such as aggregators (i.e., software used to distribute content), Weblogs, social networks, and video-editing software to construct movies such as podcasts, have been defined as some of the new constructivist technologies, designed to promote social conversations and social learning opportunities (Hsu, 2007; Laurillard, 2002; Taylor, Sharples, O'Malley, Vavoula, & Waycottt, 2006).

Unlike the interactivity found in self-contained, software-driven computer environments (Winn, 2002), the Web 2.0 environment encourages knowledge socialization through the acquisition, construction, and distribution of media resources. The technology operates through the use of *really simple syndication* (RSS) content distribution (Geoghegan & Klass, 2005) to notify users of updated content as it becomes available. In areas of teaching and learning, audio, video, and text files are often distributed through Weblogs that include integrated comment features to promote social networking opportunities such as "… class discussions, conference announcements and on-campus activities" (Ractham & Zhang, 2006, p. 316).

Podcasting

A podcast is an audio clip, text document, or video that uses aggregator computer software to inform the user of new content as it becomes available. The associated file downloads to the computer and can be transferred to a mobile media player to make it portable for general distribution or mobile learning (i.e., m-learning). One of the obvious benefits of m-learning is the way in which it allows instructors and students to distance

themselves from the computer desktop and interact with subject matter content on their mobile devices in other settings (Walton, Childs, & Blenkinsopp, 2005).

Lee, McLoughlin, and Chan (2007) conducted a study to analyze the "sociocognitive dynamics and knowledge building processes" (p. 5) involved in the development and construction of a "talkback radio-style" program, produced by eight college students for a peer audience. The researchers proposed the affordances of Web 2.0 technology, specifically the audio features of podcasting, could be used to produce appreciable learning outcomes when distribution methods were in place to extend beyond knowledge acquisition practices.

The objective of the talkback radio program was to use podcasting technology as a learning tool to strengthen the students' prior disciplinary knowledge of information technology (IT) by producing instructional presentations, based on the material, for novice IT students. Additionally, the researchers proposed the students would acquire a practical skill through their social and technological interactions with the technology based on a situated, discovery-oriented approach to learning. The formative stages of the production process involved scriptwriting, editing, recording and the distribution of the instructional podcasts.

Findings indicated the application of a high level of social knowledge-building principles, including collaborative learning, focused on progressive problem solving (van Aalst & Chan, 2001, as cited in Lee et al., 2007) and "epistemic agency" focused on the expression of ideas, divergent thinking and self-regulated learning. The researchers proposed the collective activities fostered the sociocognitive dynamics of the group and

an understanding of podcasting as a learning tool through their knowledge sharing efforts.

Video Social Networks

Social networks are defined as " . . . as relations among people who deem other network members to be important or relevant to them in some way" (Wellman, 1996, as cited in Lange, 2007, p. 16). In addition to the manipulation of media, social networking is mutually constructed through practices that may include "linking and viewing profiles" of others that have been initiated through invitations of friendships. The process entails establishing a public or private profile whereas some group members may share their identities others may not.

Lange (2007) conducted a study to analyze the dynamics of human involvement that can occur through social networks (SN) such as *YouTube* and the kinds of video sharing and socialization practices that take place through mutual interactions and negotiations with friends, or others, in the process of acquiring access or membership. Additionally, Lange (2007) was interested in understanding how different social groups use the features of the YouTube SN to establish identities and engage in private and/or public video sharing practices.

The ethnographic study entailed observations and interviews through face-to-face or telephone communications. The participants ranged in age between nine and forty-three years old, but most were young adults ranging in age between twenty and twenty-five years old.

Finding indicated video production and sharing practices are not a passive experience. The process "involves active interpretations that shape reception of media

messages" (Friedman, 2006, as cited in Lange, 2007, p. 13). There are differences in the kinds of videos that are created and how they are shared between friends. There are also differences in the kinds of social networks that are developed and maintained through YouTube. For example some social networks maintain familial connections whereas others are rooted in real-world friendships and eventually extended to online connections. Further, some participants develop partnerships with others by constructing videos only after they had shared ideas or developed friendships offline. Role-playing is an example of how social participation and partnerships occur between SN friends. In these social situations, some friends act out parts whereas others film the interactions.

The motivation to construct quality videos is not shared by all social groups nor are videos always exchanged for knowledge acquisition purposes. Private video sharing could be motivated by the need to advance "the self" and "protect the integrity of relationships" or it could be motivated by the need to establish a form of companionship (Lange, 2007, p. 12). Public video sharing and postings may also include openly sharing identities and constructing well-crafted content for group feedback. Private sharing can be protected through the use of tags that may only be known to other members of the SN.

Online Image Sharing Networks

Similar to *YouTube*, online image-sharing networks such as *Flickr* are also centered on the concept of group activities through the social participation of its membership and knowledge acquisition and construction practices. However, whereas the YouTube network is focused on the casual uses of videos, the Flickr network is focused on the aesthetics of photographic images.

Davies (2007) conducted an ethnographic study on the Flickr network to examine the different kinds of group activities that occur through image-sharing practices. Findings indicated members do not have to be encouraged to participate as they actively engage in online discussions and critiques to offer other group members suggestions and feedback. Activities include the display and sharing of photographs, techniques and or effects. Members can revisit locations edit, reproduce and share their work with others by posting it to the website. Discussions include decision-making practices that involve the use of titles, labels and tags for identification purposes (Davies, 2007).

Weblogs

Weblogs are another knowledge sharing constructivist tool that has been afforded through Web 2.0 technology. It is an online diary that can be used to post information publicly with others or it can be used privately and secured with a password. Most Weblogs include " . . . linking, replying, storing and tracking features" (Du & Wagner, 2007, p. 2). A comment field is a common feature for posting opinions and other information.

Du and Wagner (2007) conducted a study to analyze the connection between the student use of Weblogs and student learning outcomes. The researchers proposed Weblogs are a cognitive learning tool that could provide students with continuous access to content and the ability to share and construct knowledge.

Thirty-one college students who were enrolled in an information systems course participated in the study. All of the students had a prior knowledge of web page design and basic programming skills. Students kept weekly logs, using Blogger software (www.blogger.com), to document the previous week's course requirements. The logs

included reading reflections, opinions and comments. Weblog usage entailed nine weekly posts including frequent visits to the other students' logs, linking resources and research. An assessment criterion was used to determine both individual and collaborative efforts of Weblog use.

Findings indicated Weblog performance is a significant predictor of student learning outcomes. Additionally, Du and Wagner (2007) proposed the results suggest Weblogs are representative of the students' knowledge construction efforts. The use of the Weblogs improved student performance by providing opportunities for them to practice and reinforce concepts. It also provided socialization opportunities, through content sharing practices, with other members of the learning community.

Video Authoring

Over the past few years, video authoring has become a form of design practice, in its own right, involving the stages of content creation and the same kinds of higher-ordered, critical thinking skills attributed to the performance of design experts (McDonnell, Lloyd, & Valkenburg, 2004; De Vries, 2006). The process includes "metarepresentational thinking" about the integration of different forms of multimedia and "metarelational thinking" about the construction and relationships that exists among multimedia elements (Carver, Lehrer, Connell, & Erikson, 1992, p. 388). In professional fields of design practice, this type of critical reflection is spontaneous. It is a form of "knowing-in-action," a fluent and a tacit form of knowledge (Schön, 1984, p. 1).

McDonnell et al. (2004) demonstrated how college students, enrolled in their final year in an instructional design program, were able to achieve a level of critical reflection equivalent to the skills and competencies associated with design experts. An important

aspect of the design process involved an understanding of the role of narrative in the "creation and communication of knowledge" (p. 513).

The researchers proposed the story-making qualities, attributed to narrative, could be used as an "intellectual device" to foster student understanding of the critical reflection levels that are involved in the stages of content creation (McDonnell, et. al., 2004, p. 514). Accordingly, students used digital video cameras to record their actions during a design-based task and subsequently planned and edited the prerecorded material to construct video stories based on the stages of the design process. Findings indicated through the process of "Video Assisted Learning Design (VALiD)," that involved authoring through video-storytelling, the students were able to achieve the highest level of critical reflection needed to think like a design expert (McDonnell et al., 2004, p. 510).

What Educators Need to Know About Narrative

Earlier, in this paper, the cultural conventions and features and forms of narrative were introduced (Bruner, 1990; Chatman, 1978; Ewick & Silbey, 1995; Merrill, 2007). They were described as the narrative communications, representational forms and the strategies people use to construct meaning (Ewick & Silbey, 1995). These concepts and features are now proposed as what educators need to know about narrative. However, equally important, are two other conditions that include an understanding of the stages of content creation and the features and functions of one or more of the constructivist technologies.

Through situated learning, knowledge sharing and other social networking experiences, authoring, podcasts, social networks and or Weblogs can be used to support narrative activities. Further, these types of interactions propose to introduce the social and

intellectual partnerships Vygotsky had in mind (Solomon et al., 1991), suggesting the technology and different forms of representation (Decortis, 2004) could be used as a means to promote knowledge construction processes (Solomon et al., 1991).

When narrative presentations are developed within the context of multimedia learning, its resources can be regulated to either an individual or group orientation. The former is centered on individual productions that are designed to be shared with an audience (Decortis, 2004); the latter proposes similar aims only the processes are centered on situated interactions between individual group members who fulfill or share roles as part of a design team effort. These roles include: actor, animator, cameraperson, director, editor (e.g., video or sound), researcher, storyboard artist, and scriptwriter. Further, both orientations propose narrative can be designed as either a production, along the lines of a linear story, or an instructional presentation, consisting of linear or nonlinear information and or interactions that may include a navigational system.

When narrative productions and presentations make use of constructivist technologies such as digital editing software for the production of podcasts that are focused on the use of static images, or video segments, an understanding of the different stages of content creation is needed. This includes an understanding of storyboards (see Table 1), cinematic framing concepts and montage editing techniques. The *storyboard* is a blueprint of main events. It includes the (a) planning of shots, (b) movements within a frame, (c) special effects and, (d) annotations to identify the types of shots, effects, dialogues and time durations.

Cinematic framing, also referred to as camera distance or camera shots, helps to convey narrative information, within a frame, and can be used to connect one frame to

another. The standard measure is based on the dimensions of human anatomy (Bordwell & Thompson, 2004). Different camera shots signify different messages. For example, a close-up (CU) may be used to suggest intimacy or to show visual details whereas an establishing wide-shot (EWS) may be used to suggest the context of narrative interactions. The divergence of a character from large to small scale can also be used to convey power relationships.

Montage editing techniques are used to convey ideas or messages (Gillette, 2005). Its purpose is to compel the viewer to reflect upon the presented material. For example, intellectual montage juxtaposes different types of representations to convey a message.

In the subsequent tables of this chapter, a general overview of what educators need to know about narrative is presented. This includes (a) the four stages of content creation along with activities and objectives (see Tables 1-4), (b) narrative instructional presentation formats, constructed with constructivist technologies (see Table 5) and, (c) the editing and graphic software programs that are required to construct the content as well as the constructivist tools needed to distribute the narrative information (see Table 6).

Table 1

The Stages of Content Creation: Stage One, Preliminary Work

Preliminary work topics	Narrative activities and objectives
Specifications and interpretation (Kim, 2005)	• Explain the purpose of the narrative • Identify the needs of the audience based on features of the cultural setting and subject matter of the lesson • Identify the resources and supplies needed to produce the narrative • Gather the information • Establish a timeline for the different stages of content creation (Carver et al., 1992).
Assigning roles	Actors, animator, director, editor (e.g., video or sound), cameraperson, researcher, storyboard artist and scriptwriter (Carver et al., 1992)
Research	• Select the reference material for the development of a script and or storyboard • Select artifacts to embed and reference for the script and or storyboard visualizations
Script preparation	• Outline the plan of approach for composing a script based upon narrative specifications • Compose a rough draft for any narrations, including the identification of actors, pauses, intro, outro, cues for effects (i.e., fade-in, fade-out etc.), jingles, and music and auditory effects • Review the script outline with other team members • Prepare a final script
Plot construction	• Apply the causal, temporal and spatial orders (Bordwell & Thompson, 2004, p. 49).
Annotations and rough sketch visualizations	• Outline a plan of approach for the visual composition of shots based on narrative specifications, research and script

(table continues)

Table 1 *(continued)*.

Preliminary work topics	Narrative activities and objectives
Annotations and rough sketch visualizations	• Document the composition of each shot on a storyboard • Indicate the tempo of each frame for future narrative direction • Present ideas to team members and answer questions • Make appropriate revisions according to team members' suggestions
Rehearsal methods	• Practice performing and speaking in public • Moderate vocal volume levels to accentuate key words • Apply breathing techniques to extend the range of voice narrations (e.g., vocals released from chest wall) • Attend to the kinetic motion and or facial expressions of actors

Note. The narrative elements are those listed by Bordwell & Thompson, 2004; Carver et al., 1992; Dettori et al. 2006; Gillette, 2005; Grabe & Zhou, 2003; Kim, 2005.

Table 2

The Stages of Content Creation: Stage Two, Production

Production Topics	Narrative activities and objectives
Personalization Principles	Aristotelian Principles (Grabe & Zhou, 2003. p. 316). • Logos: The ability to communicate the consistency and credibility of the message to an audience. • Ethos: The trustworthiness of the speaker and their reputation, experience and integrity. • Pathos: The emotional appeal of the message. The objective of each of these principles is to provide a way for the audience to live vicariously through a character and come to appreciate their point of view. Personalization Principles (Mayer, 2005) • Convert words from a formal style to a conversation style • Use words such as "You" and "I" instead of third-person constructions. • Personalize a script by making comments to the learner Image Principles • Use an animated pedagogical agent to direct the learner
Dramatic stylistic effects	Apply to camera moves, design elements such as patterns of color and music (Bordwell & Thompson, 2004, p. 49; Kim, 2005).
Cinematic framing	Apply to the visual composition of shots, within the frame, to convey ideas, create variety and promote interest • Establishing Shot: Entry shot to orient the viewer. • Close-up • Extreme Close-up: Zoom in (texture or object) • Midshot: ¾ body or ¾ scene • Wideshot: Full body or entire scene

(table continues)

Table 2 *(continued)*.

Production topics	Narrative activities and objectives
Cinematic framing	• Extreme Wideshot • Bird's Eye view: Aerial View • Worm's eye view: Earth bound, ground's eye view
Communication	• POV: Point of View • OTS: Over the Shoulder • Cross cutting conversations • Forms of visual conflict (texture)
Spatial orientation	• Indicate what is close and what is further way. • Guide the viewer through the frames and structure the information. • Provide a sense of direction at a specific point in time • Persuade the viewer to "recalculate where the frame "is" inside any field sequence; forcing the viewer to imagine what is just past the frame, what is about to appear from the left, right, above and below and what is about to vanish from view (Reise & Zapp's study, as cited in Gillette, 2005).
Media techniques	• Capture sound and video

Note. The narrative elements are those listed by Bordwell & Thompson, 2004; Carver et al., 1992; Dettori et al., 2006; Gillette, 2005; Grabe & Zhou, 2003; Kim, 2005.

Table 3

The Stages of Content Creation: Stage Three, Post Production

Post production topics	Narrative activities and objectives
Editing conventions	Determine the need for editing conventions such as ducking audio, fade-in and fade-out of images and other effects, adjusting the tempo and volume levels.
Montage techniques	Determine editing for emotional impact and narrative conveyance. • Metric • Rhythmic • Tonal • Overtonal • Intellectual
Narrative critiques	• Critically analyze the confusing points of a narrative that could result in the misinterpretation of content. • Judge the craftsmanship of the work. • Judge the effectiveness of narrative conveyance based on narrative theories. • Judge the creativity of the work based on concepts associated with cinematic framing and montage techniques.

Table 4

The Stages of Content Creation: Stage Four, Publishing

Publishing topics	Narrative activities and objectives
Saving and distributing content	• Saving in the correct file formats • Uploading to a web server • Embedding tags • Viewing on a computer screen or downloading to a mobile device when applicable.
Role of learners (Dettori et al., 2006)	• Producers, receivers, participants, performing with other learners or with pedagogical agents.

Note. The narrative elements are those listed by Bordwell & Thompson, 2004; Carver et al., 1992; Dettori et al., 2006; Gillette, 2005; Grabe & Zhou, 2003; Kim, 2005.

Table 5

Narrative Instructional Design Formats

Presentation format	SCT	Descriptions and Examples
Aristotelian model	P, V, VSN	Promotes audience engagement through action, character, thought, language (e.g., semiotics), melody (i.e., pattern) and spectacle (i.e., enactment) (Laurel, 1993).
Cultural/Transactional communications	PSN, VSN, WB, WK	Involves the construction of narratives through various media to promote discussion, the sharing of resources and viewing. Uses web based social networks such as Flickr (Davies, 2007) and YouTube (Lange, 2007) and other forms of web-based representations to promote interactions that are culturally bound and defined by the actors, genre, and setting including those occurring between experts, students and teachers (Voithofer, 2003).
Dramatic Performances	P, V, VSN	• News and special topics (Grabe & Zhou, 2003; Lee, 2007). • Role-play (Lange, 2007).
Formal	V, VSN	Animatics are animated rough drafts of static frames that are designed to test the action before the final production stage begins. Masterplots are underlying plots that can be reused. The plots are told in different ways such as the cultural versions of the Cinderella story (Abbott, 2004; Herrnstein Smith, 1980).
Games	CP, V, VSN	Interactions based on plot(s) and finding solutions to problems (Mallon & Webb, 2000).
Metaphor	WB, WK	Interface designs containing parallel associations that link objects, tools and artificial environments (Ainsworth, 2003; Lajoie & Nakamura, 2005).

(table continues)

Table 5 *(continued)*.

Presentation format	SCT	Descriptions and Examples
Physical environments	CP, P, V	Walking tours of historical sites, museums or may be centered on careers or environmental issues (Blythe, 2006; Kim, 2005; Walker, 2004).

WEB 2.0, SCT CODES: CP (Cellphones), P (Podcast), PSN (Photo-sharing social network), V (Videocast), VSN (Video social network), WB (Weblog), WK (Wiki).

Table 6

Editing, Graphic Software and Web 2.0, Constructivist Technologies

Web 2.0 CT and Software	Editing Programs	Graphics Programs
Podcasts	AU, AG, QT	
Videocasts	AU, AG, QT, WMM, AiM	AS, AI
Screencasts	CS, SPX	AS, AI
Weblogs	AU, AG, QT, WMM, AiM	AS, AI
Wikis	AU, AG, QT, WMM, AiM	AS, AI
Video social networks	AU, AG, QT, WMM, AiM	AS, AI, PPT

EDITING SOFTWARE CODES: AU (Audacity, audio), AG (Apple, GarageBand, audio), QT (Quicktime Pro, audio), WMM (Windows Movie Maker, images, video and audio), AiM (Apple, iMovie, images, video and audio), CS (Camtasia Studio, screen capture), SPX (Snapz Pro X, Mac and screen capture). GRAPHICS SOFTWARE CODES: AS (Adobe Photoshop, image edits), AI (Adobe Illustrator, line art), PPT (MicroSoft PowerPoint).

The Impact of Constructivist Technologies in Relation to Narrative

As the innovations of Web 2.0 technology continue to evolve and constructivist technologies become more widespread, and are integrated into everyday practice in society, a greater understanding of their narrative functions and resources will become known. Currently, the pervasiveness of constructive tools for the construction of podcasts and videocasts, and interactions on social networks and Weblogs have introduced new narrative forms of representation that can be used to extend cultural and social communications through online networks and wireless devices.

Some of the studies discussed in this paper have been focused on the cultural and critical attributes of narrative through constructivist technologies such as the Davies (2007) study on image-sharing practices and the McDonnell et al. (2004) study on the critical thinking skills, required to construct video stories. In both studies the affordances of the technology were used to promote the active, social engagement of its community members through knowledge sharing practices.

The Du and Wagner (2007) study, made use of Weblogs to demonstrate the way in which the interactive features of RSS technology could be used to distribute up-to-date content to students. The researchers proposed the features of the technology eliminated the problem of "free riding" that could occur in traditional forms of collaborative instruction. Additionally, the personalized features of the Weblog required the students to create identities that fostered "individual accountability" within their social learning community (p. 6).

The Lee et al. (2007) study on podcasting, demonstrated the way in which authentic problem-solving tasks could be designed to take advantage of the technology in

combination with the subject matter (i.e., IT). Different forms of self-expression and critical thinking skills were required for students to develop solutions to a given problem (Stern, 2003).

The Lange (2007) study on the YouTube, video social network, demonstrated the far-reaching appeal and social learning possibilities of knowledge sharing practices. Video in combination with the Weblog features of the website promoted personal forms of communication and social learning experiences. For example, Lange (2007) demonstrated the way in which community members employed "technical and symbolic mechanisms" to construct products, maintain friendships and "negotiate membership" within their community (p. 13).

In each of these studies knowledge was shared, applied and mutually constructed through narrative interactions and collaborative practices that made use of constructivist technologies. The practices complimented constructivist principles and multimedia learning by demonstrating the ways, in which knowledge can be acquired through a meaningful, connected relationship.

CHAPTER 3

METHODOLOGY

Procedures

Purpose of the Study

The purpose of this study was to describe the role of narrative in multimedia learning and teaching and to observe how teachers applied their understanding of narrative, and new constructivist technologies, to design multimedia presentations for instruction. The teachers in this study were graduate students enrolled in an *Instructional Design of Educational Software* course at a large urban university in the southwestern United States.

The following research questions were used to guide the direction of this study:

1. What role does narrative play in multimedia learning?
2. How does an understanding of narrative forms of representation and constructivist technologies affect the way in which teachers design instructional presentations?
3. How do teachers describe their approach to the design of narrative instructional presentations for their content area and what evidence exist to support the processes they describe?
4. How are the features and forms of narrative expressed in the teachers' designs?

New Constructivist Technologies

In this research, new constructivist technologies were defined as open-ended multimedia environments, consisting of interactive digital tools and resources that allow

people to create and share information (Hsu, 2007). Examples include (a) video-editing software that allow people to create and distribute movies, and (b) online social media networks that allow people to engage in various forms of discourse. One of the factors that motivated this study was the recognition of the potential of new constructivist technologies to support the construction of visual narratives in ways that correspond with the techniques of representation found in film and television. This study used (a) podcasts, (b) video social networks, and (c) image sharing networks in an attempt to demonstrate the practical functions of new constructivist technologies in relation to the design of narrative instructional presentations, and also to encourage the design and reporting tasks of teachers.

Podcasts. A podcast (i.e., podcast, document file, enhanced podcast and videocast) is an audio file, text document, image or video file that uses aggregator computer software (i.e., podcatcher and directory) to inform the user of new content as it becomes available. A podcast file downloads to the computer and can be transferred to an MP3 device (e.g., iPod), to make it portable for general distribution or mobile learning. Podcasting is the production process and a podcast is the audio, text document, or video file that can be created with podcasting software.

Video social networks. Video social networks provide the resources and tools needed to manipulate media, search for content and engage in social networking practices that involve the "linking and viewing profiles" of other network members (Donath & Boyd, 2004; Gross & Acquisti, 2005 as cited in Lange, 2007, p. 362). Video social networks also include a vast array of videos centered on different topics that have been produced by amateur and professional videographers.

Image sharing networks. Similar to video social networks, image-sharing networks also provide the resources and tools needed to manipulate media, search for content and engage in social networking practices. Additionally, some of the images are copyright free and can be used to develop visual narratives.

Setting

This study was conducted in a computerized classroom at a large urban university in the southwestern United States. The classroom contained the basic equipment necessary to conduct this study. This included both desktop and laptop computers, Internet access, a projector system, and a white board. The setting was selected because it is centrally located, providing students with convenient access to on-campus instruction. Further, the university's location made it possible to attract graduate, technology education students who were recruited as participants for this study.

Participants

Three graduate students, one female and two males, participated in this study on a voluntary basis. The participants were of Caucasion background and ranged in age from 24 to 32 years old. They represented a unique group because they are professional educators who have a prior background in instructional technology, but had no previous experience designing narrative multimedia presentations for instruction.

Sampling Plan

The sampling plan for this study was criterion-based. In order to begin to develop the criterion for participant inclusion, an initial meeting was arranged with the course professor of educational computing and technology to inquire about the teachers enrolled in a graduate instructional design of educational software course.

Selecting the participants. The first criterion for participant inclusion in this study was for the teachers to have a current educational background in instructional technology. The second criterion was for the teachers to have implemented instructional technology into their own teaching and respective content areas. The last criterion was for the teachers to preferably come from different schools and organizations so that different perspectives could inform this study. The students' prior educational background was to ensure computer literacy was not a factor and thus, provide the time necessary for their interactions to be observed with the subject matter, resource materials, and technology in the classroom setting.

Procedures for selecting the participants. The first class meeting, as it related to this study, entailed observations and informal discussions with all of the students in order to determine who should be interviewed (Merriam, 1998). The students were given a general questionnaire (see Appendix A) and were asked to write about their educational background based on the three criterion for selecting the participants. The student investigator subsequently collected the questionnaires and entered the students' responses into a criterion scale sheet (see Appendix B). A continuum was then used to array each of the students responses from those who met the highest level of characteristics to those who did not meet any if the criterion and thus, had the lowest level of characteristics (Schensul, Schensul, & LeCompte, 1999). After the data were reviewed and discussed with the course professor, three participants were selected to participate in this study.

As part of the recruitment process, an email invitation was sent out to each of the participants, requesting their voluntary participation. Accordingly, one art and two elementary school teachers agreed to participate in this study.

Informed consent form. The three participants were given an informed consent form to sign during the third class meeting (see Appendix C). They were also given the time necessary to read the consent form and to ask the researchers any questions they had about the research and their participation in it. After the consent forms were signed, the initial background interviews were scheduled.

Researcher's Role

The student investigator for this study was a full participant observer who entered the educational setting with four distinct purposes: (a) to collaboratively engage in activities with the participants by using the same available resources, (b) to observe the participants as they engaged in activities, (c) to observe the physical aspects of the site (Spradley, 1980), and (d) to inform the participants of the role of the student investigator. This included:

1. Providing an explanation of what the student investigator was interested in learning from the study.
2. Explaining how the data might be used.
3. Informing the students of how long the student investigator planned to be involved in the participants' activities.
4. Introducing narrative projects and providing scaffolding support as needed to assist the students in problem solving as well as to promote class discussions.

According to Merriam (1998) in a qualitative case study, the researcher's role is similar to that of a detective who examines the setting and all of the artifacts, activities, participant behaviors and biases that can sway the investigation and could provide clues for putting "the puzzle together" (p. 20). As the *"research instrument"* the objective of

the student investigator was to collect and analyze data during this investigation (Marshall & Rossman, 2006, p. 72). Research design strategies included time set aside to leave the educational setting whenever it was necessary to document findings and reflect on the general direction of the research. Depending upon the complexity of certain tasks such as interviewing, recording, conducting analyses and teaching, the course professor assisted in the data collection of this study.

Methodologies

Rationale for Qualitative, Ethnographic, Case Study Research

Currently, the significance of using constructivist technologies and narrative forms of representation, in the design of teacher-constructed instructional presentations, has not been addressed in the multimedia learning literature. Although, a relationship has been identified between semiotics and narrative (Chandler, 2007) and cognitive and or situated forms of multimedia learning that address narrations (e.g., conversations, personalization effects and social cues) (Kozma et al., 2000; Mayer, 2005; Campbell, Farmer, Fennell, & Mayer, 2004; Mayer, Sobko, & Mautone, 2003), no single study has probed the role of narrative in multimedia learning as a mode of representation in storied form (e.g., biographies, documentaries, and myths), nor has the design and development of narrative been used as a form of educational practice.

Narrative offers a variety of ways to design instructional presentations with constructivist tools, but little is known about its effects on learning. The field is relatively new and there has not been enough research to support conducting a study that makes use of quantifiable measures (Creswell, 2007). Quantitative modes of inquiry address what is known and can be deductively and objectively detached from the subject matter (Siegle,

2008). The quantitative methodology is limited for understanding the role of narrative within this situated classroom setting.

Qualitative research is centered on interpretation, the intricacies of procedures and the human interactions that are involved in bringing forth “multiple constructed realities” (Marshall and Rossman, 1999, p. 53) within a socio-cultural context. Merriam (1998) claims qualitative research does not test theory nor does it make use of experiments or measurements. The mode of inquiry is centered on the human experience as well as on other factors that differentiate one group from another.

The qualitative methodology involves interviews, observations and a review of documents including representations from a culture. The research is focused on how meaning is socially constructed and how people make sense of their experiences through interactions with others, resources and tools (Merriam, 1998). Thus, the research objective of this study was to employ a qualitative methodology.

Descriptive Qualitative, Ethnographic, Multiple Case Study

The form of inquiry was ethnographic and the procedures were framed within the context of a descriptive, multiple case study that was intrinsically bound by the narrative-design activities of three teachers enrolled in an instructional design of educational software course. The goal of this study was to describe the narrative design activities and products of all three teachers for the purpose of gaining a general understanding of the effects and issues surrounding their narrative multimedia instructional presentations. Additionally, this inquiry proposed to determine the role narrative played within this situated, multimodal learning context.

Case study procedures were selected because a "holistic description" was needed in order to uncover insights, interpretations and important features of narrative's role in multimedia learning and teaching that could otherwise have been impossible to separate from this context (Merriam, 1998, p. 29). For example, through the development of cross-case comparisons (e.g., see data analysis), rich descriptions (e.g., vignettes that are common to case studies), and the triangulation of data, certain aspects became apparent that might otherwise have remained hidden through the implementation of other methods. The value of an ethnography is it provides a description of a culture. "It consists of a body of knowledge that includes research techniques, ethnographic theory, and hundreds of cultural descriptions" (Spradley, 1980, p. 13). The ethnographic record served to reveal some of the "cultural complexities" based on some of the narrative communications and constructivist interactions that had occurred among the participants (Spradley, 1980, p. 101).

Data Collection Methods

The data collection for this study entailed the following multiple methods:

1. One semi-structured background interview and two retrospective interviews (i.e., discussion meetings) that included the student investigator's direct involvement with the participants.
2. Observations field notes of the participants during learning activities.
3. Observation field notes of the participants involved in the protocol analyses (Marshall & Rossman, 2006).

4. Document analyses, including a review of each of the participants' narrative projects, in addition to other findings, as they became known during this inquiry.

Additionally, the theoretical framework of constructivism was used to guide the concepts and models used in the data collection and data analysis (Marshall & Rossman, 2006).

Interviews

"Good use of theory will help delimit a case study inquiry to its most effective design: theory is also essential for generalizing the subsequent results" (Yin, 2003, p. 6). Thus, in preparation of the questions for the initial background interviews, the theoretical framework, literature review, field notes and curriculum (see Appendix D) were analyzed and referenced in order to develop descriptive, hypothetical, devil's advocate and interpretive types of questions (Merriam, 1998; Spradley, 1980; Yin, 2003) (see Appendix E).

One semi-structured background interview and two retrospective interviews (e.g., based on the two protocol analyses: (a) *think aloud (TA),* and (b) *retrospective (RA*) were conducted on an individual basis with each of the three participants over the 14 week timeframe of this study. The duration of each interview was approximately 30 minutes. Subsequent interviews were scheduled only when it became necessary to clarify certain concepts, participant statements or findings. The interviews were conducted at an agreed upon time and location. Data from the three participants' interviews were digitally recorded, transcribed and stored on a computer.

The first interview was conducted in a semi-structured style and questions were focused on the participants' educational background, content area and experience with technology in general (see Appendix E). The second and third retrospective interviews were focused on knowledge elicitation procedures, as it related to the two protocol analyses. Details of the protocol analyses are further discussed under the data analysis section of this chapter.

Transferability was proposed as the rationale for interviewing the participants as there was the potential that certain patterns could become evident that could make the data useful for others who may have similar research questions or who may find themselves in similar situations. "For case studies, 'listening' means receiving information through multiple modalities—for example, making keen observations or sensing what might be going on—not just using the aural modality" (Yin, 2003, p. 60). Accordingly, to help ensure construct validity, the three participants had the opportunity to review the drafts of their interview transcripts, and to clarify their statements, ask questions and provide further insight into their narrative design solutions.

Five tenets were discussed with each of participants at the beginning of the protocol sessions. This included: (a) the aim and motive of the study, (b) the intention to protect the identity of the participants through the use of pseudonyms, (c) determining who had "final say over the study's content," (d) compensation (if any), and (e) logistics such as time, location, and the number of interviews to be conducted (Taylor & Bogdan, 1984, as cited in Merriam, 1998, p. 84).

The aim and motive of the study was to provide an accurate description of the three participants' design and reporting tasks and to observe and document the features of

the narrative products they produced. Details of these procedures had been discussed with each of the participants during the first class session and they were given informed consent forms to sign listing the aims of this study.

In order to protect the identity of the participants, an anonymous coding scheme was applied to all of the data. None of the participants' names were used in any reports. Instead, pseudonyms were used in association with all data collection and data analysis practices.

On the subject of final say, a clear distinction was made to avoid confusion. For example, the participants were informed of their role in the study and were given an informed consent form that outlined the details of their participation (see Appendix C). Additionally, because their insights were deemed to have played an important and necessary role in this study, they were given every opportunity to ask questions, express ideas, and review the interview drafts for the duration of the research. Equally important, the participants had the opportunity to request certain content be omitted from the interviews transcripts. However, the principal investigator and student investigator had final say over all of the other admissible interview content as well as the related literature, analyses, and general format and content of this study.

There was no compensation for participation in this study. However, there were benefits of participation (see Appendix C). Logistics were arranged with each of the participants on an individual basis. This is further discussed under the interview section of this chapter.

Observations and Field Notes

For the observations, audio and video recordings were used and supplemented with field notes. Observations were conducted once a week for 14 weeks, during the class period, and were focused on the students' social interactions, conversations and involvement in narrative lessons, and problem-solving tasks related to the design of instruction and the curriculum (see Appendix D and Appendix F). The audio and/or video were sampled for content that was relevant to the study. These associated segments were observed and recorded as condensed field notes in a journal, including the date, and then entered into a computer for further analysis using a qualitative research software program. As the need arose, the principal investigator of this study assisted with the observation field notes.

Expanded field notes were developed to identify common themes and specific issues of interest to the students and were also be used to develop the vignettes that are commonly used in case study research in order to attract readers to the case (Creswell, 2007). Additionally, the use of relevant words and phrases, interview notes, narrative documents and products were referenced. The observations were used to triangulate findings with the information collected from the interviews and document data (Merriam, 1998).

Coding

Coding was sorted according to the nine dimensions of social situations "... space, object, act, activity, event, time, actor, goal, feeling" (Spradely, 1980, p. Document102). A cross-referral was used, following each interview, and common themes and patterns were identified. An anonymous coding scheme was devised and applied to

the data prior to its analysis in order to ensure the confidentiality of the participants. Similarly, pseudonyms were used in place of names in all reports, including field notes, and transcripts to identify the participants and their statements. The coded information was referenced during the development of the cross-case synthesis, domain analysis, taxonomies, and componential analysis. The protocol analysis contained its own unique coding scheme. This is further discussed under the analysis section of this chapter.

Document Observation

The study included an examination of artifacts including the narrative products, created by the participants such as written scripts, storyboards, audio tracks, and movies. Physical materials from the cultural setting were also considered such as the technology tools and examples of professional narratives that had been captured from analog, digital and online sources for class discussion. In general, the collection of document data was determined according to questions asked and findings as they arose during the study.

By distinguishing the cultural and social forms of evidence from different document sources, it was presupposed, the narrative dimensions of the documents could be further analyzed and compared. Merriam (1998) observed, documents can " . . . contain clues, even startling insights into the phenomenon under study" (p. 119). To articulate such details, document field notes were manually transcribed in journal form and then composed on a computer.

Data Analysis

The analyses of this ethnographic, multiple-case study further expanded upon the data collection practices in order to (a) organize the data; (b) develop additional codes; (c) apply descriptions; (d) detail collection procedures; (e) identify "themes or patterns;"

and (f) interpret, develop, and represent the data in tables and or figures (Creswell, 2007). The analyses were referenced in relation to a review of the literature, theoretical framework, interview transcripts, observation field notes, and documents from the social setting. The collection of data analyses included (a) a cross-case synthesis, common to case studies; (b) componential analysis, domain analysis, and taxonomic analysis, common to ethnographies; and (c) protocol analyses consisting of concurrent and a retrospective protocol reports, and corresponding network graphs, common to design studies.

Cross-case Synthesis

This study included a “cross-case synthesis as an analytic technique” in order to identify any emerging patterns or relationships as they occurred (Yin, 2003, as cited in Creswell, 2007, p. 163). The replication logic was focused on illuminating the theoretical framework that supported the data collection practices for all three cases and the pertinent outcomes (Yin, 2003), related to the participants’ narrative instructional designs and social interactions. The data was displayed in table form in order to show the connections between the three cases, similar to the examples (see Tables 7 and 8). These examples function only to convey some of the topics that were identified during the study and were further developed during the research.

The rationale of conducting a cross-case synthesis was to locate “correspondence between two or more categories” to identify any similarities or differences that might help to establish “naturalistic generalizations” that can be reviewed by others who are interested in learning about the case (Creswell, 2007, p. 163). When a “study’s findings

are generalizable beyond the immediate case study" the external validity of the case is further supported (Yin, 2003, p. 37).

Table 7

Cross-case Synthesis Examples: Associated Theoretical Outcomes

Case	Effects on Instructional Designs		
	Participant Goals	Approaches to Content Creation	Narrative Treatments
F1	Web display	Prior knowledge of reading	Show and tell format
M1	Wiki	Prior knowledge of music	Polyptyph format
M2	Multimodal performance	Prior knowledge of art	Picture book format

Table 8

Cross-case Synthesis Examples: Associated Theoretical Outcomes

Case	Effects on Social Interactions		
	Tool Use	Cultural Perspectives	Forms of Meaning Making
F1	iMovie/iPhoto	"Another toolbox for teachers"	Iconography
M1	iMovie/iPhoto	"Reusable product"	Metaphors
M2	iMovie/iPhoto	"Develop a critical eye"	Metaphors

Protocol Analysis

Although external activities such as the participants' information gathering and design creation practices were observed for documentation (e.g., sorting and coding)

(Pedgley, 1997), the ability to account for their internal thoughts was better accomplished through the practice of knowledge elicitation, also referred to as a protocol analysis. The aim of this type of analysis was to provide a first-hand account of the different design factors and conditions that were responsible for influencing a participant's decision-making processes during a design activity (Pedgley, 1997).

Two different kinds of protocol analyses were used in this study in an attempt to provide a more in-depth description and analysis of the participants' content and process thinking and also to gain some insight into any of the corresponding and imperceptible issues and effects. Accordingly, a concurrent *think-aloud* (TA) and *retrospective* protocol analysis were conducted. In each instance, the analyses were videotaped and consisted of two parts: (a) a design task, and (b) a reporting task (i.e., discussion interview).

For the concurrent *think-aloud* protocols, the participants were asked to verbalize reflectively on the composing process (Smagorinsky, 1989; Fonteyn, Kuipers and Grobe, 1993). For the *retrospective* protocols, the participants were asked to verbalize reflectively on the composing process by recalling events from an earlier point in time (Smagorinsky, 1989). Subsequent retrospective interviews involved the participants, and the student investigator, viewing the pre-recorded video of the protocols on an individual basis. The participants were also asked to comment on their content and process thinking, including their design ideas, perceptions, and reasoning strategies in relation to the composing process.

Protocol Analysis Procedures

The schedule of events for the initial interviews and protocol sessions began during the sixth and eighth week of classes, respectively. Subsequent protocol sessions were

conducted at different times during the semester in order to accommodate the participants' schedule or when changes were necessary due to unforeseen course scheduling or technical problems (see Appendix F).

Week six. A semi-structured interview was initially scheduled with each of the participants at an agreed upon time in the seminar room adjoining the regular classroom. During that time, the participants were also given instructions to research the static images they might need for the concurrent, TA protocol session.

Week eight. A concurrent, TA protocol session based on level III verbalizations were conducted with each of the participants. Level III entails the knowledge construction processes attributed to linking information in short-term memory with long-term memory (Ericsson & Simon, 1993). By week eight, each of the participants had acquired the theoretical knowledge and practical skills necessary to construct a visual narrative based on the topic of intellectual montage using digital media and new constructivist technologies.

Montage is another term for a type of editing that " . . . emphasizes dynamic, often discontinuous, relationships between shots and the juxtaposition of images to create ideas not present in either shot by itself" (Bordwell & Thompson, 2004). A shot was defined as the composition of an image in this study. The standard measurement is based on human anatomy. Examples include CU for close-up and WS for a wide shot.

Previous class sessions had been used to introduce the participants to a series of cinematic framing techniques based on the conception of intellectual montage. During these class sessions, the participants analyzed a sequence of shots and made judgments about their meaning. Visual examples were also presented in a lecture in an attempt to

demonstrate the rhetorical potential of this technique. This included a slide show that was comprised of intellectual montage equations. For example, " . . . White Bird + Mouth = Sing" (Shaw, 2006).

For the TA protocol sessions, video was used to capture 15 minutes of a design task. All of the participants were given instructions to construct a montage equation and to think about the steps involved as they work their way through the task. Each of the participants used their own static images as they assembled and edited the montage equations, using the iMovie program, developed by Apple Computer. Additionally, they were instructed to verbalize their thoughts for 15 minutes.

The three participants performed the montage equation design task individually, whereas the rest of the class performed the design task collaboratively in dyads. The student investigator gave prompts whenever a participant paused for a few seconds in order to encourage them to continue to verbalize their thoughts for the duration of the TA protocol session (Fonteyn, et al., 1993). The student investigator (i.e., participant observer) also took notes on the corresponding areas of the TA that required further clarification. These notes were briefly discussed with each of the participants, on an individual basis, at the end of the TA protocol session (Fonteyn, et al., 1993).

Week nine. Following the montage equation design task, the TA, retrospective interviews (i.e., reporting session) were conducted. Accordingly, each of the participants viewed the pre-recorded videotapes of the TA session with the student investigator for 30 minutes. The five tenets, discussed previously under the interview section of this chapter were reviewed with each of the participants at the beginning of the reporting session. They were also asked to comment on their content and process thinking in relation to the

composing process as they viewed the TA videotapes. This included commenting on their design ideas, perceptions and reasoning strategies.

Week ten. For another concurrent protocol session, videotape was used to capture 30 minutes of an in-class, narrative design task without verbal protocols. By week ten, each of the participants had acquired the theoretical knowledge and practical skills necessary to construct a part of a narrative instructional presentation using digital media and constructivist technologies.

Previous class sessions had been used to introduce the participants to some of the design theories and techniques that are associated with film narratives. This included the protocols associated with narrative form (e.g., cross-cutting and point of view), visual grammar (i.e., shot scale) and other design configurations. Visual examples of narrative instructional presentations were presented in the form of video clips and enhanced podcasts. The participants were also given the initial instructions for the narrative design task in order to provide them with the time necessary to develop a plan of approach.

During the narrative design task, each of the participants constructed a small part of their narrative instructional presentation based on a topic related to Yellowstone National Park. For example, one of the participants constructed a narrative sequence based on the topic of park safety and park responsibility. The participants were also asked to think about the steps involved in the narrative design task as they imported and edited audio, static images and video into the iMovie program, developed by Apple Computer, or another authoring program containing similar features.

Following the narrative design task, a second retrospective interview (i.e., discussion meeting) was arranged with each of the participants on an individual basis in order to further discuss their content and process thinking.

Week twelve. For the second retrospective interview (i.e., discussion meeting), each of the participants met on an individual basis with the student investigator. The procedures were similar to the former TA retrospective interview. Accordingly, each of the participants viewed the pre-recorded video of the concurrent, narrative design task with the student investigator for 30 minutes. The five tenets were discussed and the participants were asked to comment on their content and process thinking. Once again, they reported on their design ideas, perceptions and reasoning strategies.

Protocol Analysis Transcriptions

Video recordings of the TA and retrospective protocol reports focused on delimiting the corresponding transcriptions. Pedgley (2007) proposed subject delimitation minimizes the possibility of data dilution as a result of irrelevant information. The researcher recommended attending to areas of the video that compliment the key features of the research. Similarly, Schensul, LeCompte, Nastasi, and Borgatti (1999) suggested transcribing segments of video recorded material only when it is complimentary to the research questions. Thus, similar to the delimiting process associated with the observation videos, the videotapes of the TA and retrospective protocol analyses focused on delimiting the video for transcriptions.

Transcription Codes

Encoding of the TA protocols and retrospective protocols included references to the participants' verbal utterances such as words, phrases and sentences, and physical

gestures such as pointing and facial expressions. Additionally, encoding included such details as the participants' roles and content and process thinking. A table identifying these types of codes was developed, similar to the example in this chapter (see Table 9). This example functions only to convey some of the topics that were identified during the study and were further developed during the research.

Names were not used in any of the protocol transcripts. Pseudonyms were used in all of the reports in order to identify the participants and their statements. The codes listed in the table are some of the related narrative design categories that were identified in the literature (see Table 9). Additional codes were further defined and developed by taking into account the participants' background knowledge, the affordances of the technology, narrative resources, content and process comments from the analyses and any other related design issues that were identified in relation to this study.

Table 9

Transcription Code Examples

	Expressions: Verbal and Gestures	Roles and Content-Process
CODE:	/ short pause	*E*: Interviewer.
	// long pause with reflection	S: Interviewee
	/// long pause (silence)	R: Role(s)
	[xx] Unclear or inaudible words	C: Content area thinking
	… marks a break	D: Design thinking
	) Smiling	N: Narrative thinking
	[ ) Laughing	P: Process thinking
	> Pointing	P: Problems
	^ Shoulder shrug	RA: References to audience
	[*] Crossed arms	RN: References to narrative
	÷÷ Finger Tapping	RR: References to representations
	¡¡¡Sitting up straight	RT: References to tools
	%% Leaning forward towards the	RS: References to social situations

Domain Analysis

Because this is an ethnographic, multiple case study, the research methods went through cycles ranging between the collection of data, inquiry, documentation, and data analysis (Spradley, 1980). The domain analysis was used as a starting point in order to make cross-case comparisons to identify patterns in the cultural scene by focusing on descriptions of artifacts, human behaviors, and knowledge representations (Spradley, 1980). The observation field notes were used to identify different aspects of the cultural domain and its semantic relationships.

Of equal importance, the domain analysis was used to penetrate the meaning of the narrative documents such as the participants' storyboards and in-class movies as well as the interview and discussion transcripts in an attempt to search for patterns and evidence of cultural meaning. The *storyboard* is a blueprint of main events. It includes the (a) planning of shots, (b) movements within a frame, (c) special effects, and (d) annotations to identify the types of shots, effects, dialogues, and time durations.

Initially, the domain analysis focused on *strict inclusion* (e.g., a director is a kind of composer) and *functions* (e.g., existents are characters that are used to convey action) (see Table 10). The coding schemes, discussed under the data collection section of this chapter, were used to sort out and identify the dimensions of the social situation. The storyboard document observations focused on the *sequence* (e.g., shot scale is a step in storyboard development). The subsequent data display was further defined, developed, and revised during the research.

Table 10

Domain Analysis Examples

Relationship	Cover Terms	Semantic Relationship	Included Terms
Strict inclusion	director	is a kind of	composer
Functions	existents	are used to	convey action
Sequence	shot scale	is a step (stage) in	storyboard development

Note. Spradley (1980).

Taxonomic Analysis

A taxonomic analysis was used to define categories that were centered on a single semantic relationship within the cultural domain; to further represent a connection between patterns and themes and to establish relationships (Spradley, 1980). Participant projects, amateur and professional educational narratives from online directories, and social networks, were referenced in order to make comparisons between the different kinds of features and forms of narrative. The subsequent data displays are examples that were further revised during the research.

Table 11

Taxonomy Example One

Kinds of Narratives Structures		
Cultural	Structuralist	Poststructuralist

Table 12

Taxonomy Example Two

Kinds of Representations		
External Representations	Affordance Representations	Designing Representations

Componential Analysis

The componential analysis was used to organize the cultural attributes of information defined in the domain analysis according to categories. This included " . . . the entire process of searching for contrasts, sorting them out, grouping them together as dimensions of contrast, and entering all of the information into a paradigm" (Spradley, 1980, p. 133).

Initially, the componential analysis was developed from the collection of data in order to contextualize the domain. Additional resources included the narrative activities associated with the curriculum such as the social negotiations that transpired among the teachers during problem solving tasks. An in-class discussion focused on the cinematic framing techniques of montage were used as a starting point in an effort to define, for example, the paradigm, *Ways to Transform Representations.* This paradigm was further developed by examining professional movie clips, containing these attributes, and also by searching for evidence of similar applications in the surface features of the participants' narrative products (see Table 13).

Table 13

Componential Analysis Example

Domain	Dimensions of Contrast					
Montage Sequence	Emotion	Beat	POV	Iconic	Diachronic	Synchronic
Intellectual	Yes	Yes	Yes	Yes	Yes	Yes
Tonal	Yes	Yes	No	Yes	Yes	Yes

Note. (Spradley,1980; Gillette, 2005).

Trustworthiness

Marshall and Rossman (1999) assert qualitative researchers must develop a logic to respond to the canons of quality. In other words, there must be a criteria for determining the trustworthiness of a project. Thus, the processes include questioning the credibility of the findings, determining its transferability to other groups or settings, emphasizing the reliability of findings and reflecting on the inquiry and the participants.

Reliability and validity tests were used to judge the quality of this research design (Yin, 2003). Reliability, in qualitative research proposes " . . . given the data collected, the results make sense—they are consistent and dependable. The question then is not whether the findings will be found again but whether the results are consistent with the data collected" (Merriam, 1998, p. 206).

Validity tests were used to demonstrate the credibility and trustworthiness of the findings. For example, the principal investigator was consulted and asked to comment on the findings as they arose and the participants were asked to review interpretations, during the study, in order to determine whether the findings were plausible (Merriam, 1998). Additionally, the findings were further supported by explanations based on the

“assumptions and theory” used throughout the study, the triangulation of data and detailed methods of documentation were used to enable audit trails to be conducted and to understand the way in which the research was collected (Merriam, 1998, p. 206).

Ethics

As proposed under the trustworthiness of this study, the research attended to reliability and validity tests. Additionally, codes and pseudonyms were used to protect both the teachers’ and schools’ identity.

Limitations

As in all case studies, this was one researcher’s interpretation, based on one multiple case study. Thus, it offered a personal perspective, based on the data collection practices, consistent with qualitative research, and offered some evidence of the participants’ experiences within this setting and the role narrative plays in multimedia learning.

CHAPTER 4

RESULTS

Introduction

This study investigated the role of narrative in multimedia learning and teaching and observed how teachers applied their understanding of narrative, and new constructivist technologies, to design multimedia presentations for instruction. The constructivist theories informing this study were drawn from several representational domains such as (a) multimedia learning, (b) design studies, (c) narrative, and (d) semiotics in an attempt to establish an understanding of how three teachers actively reasoned and constructed knowledge and meaning in different design situations.

Using a descriptive case study methodology and ethnographic observations, data collection methods for this study included (a) participant observations, (b) semi-structured interviews, (c) retrospective discussion meetings, (d) field notes, (e) protocol reports, (f) document analyses, (g) videotapes, and (h) literature reflecting epistemological, historical, practical, and theoretical interests relating to narrative, multimedia learning and teaching. Data analysis methods included (a) concurrent and retrospective protocol analyses; (b) network graph analyses, (c) domain, taxonomic and componential analyses; and (c) a cross-case synthesis.

The general structure of this chapter is organized into two parts. Part I of this chapter provides an overview of the research including a description of the classroom setting, demographics and background information about the three teacher-participants.

Part II of this chapter begins with a summary of the narrative curriculum, focusing on the manner in which it was designed and presented within the context of a university

graduate instructional design of educational software class. Subsequently, the results are reported, drawing on protocol reports, network graph data, documents and interview transcripts that were relevant to each of the teacher-participants. In order to effectively communicate the extent of the analytic work, each study has been positioned chronologically in the same manner the data were collected and presented in the classroom.

To begin this report, the subsequent section of this chapter provides a description of how this study was socially constructed and the events that led to its inception. It should also be noted, the narration mode of the three teachers, and occasionally this researcher, are offered from a first-person perspective in an attempt to convey a thought more effectively.

An Ethnographic Overview

When the graduate-level course, *Instructional Design of Educational Software* first appeared in the fall 2008 schedule, it proposed to explore the connection between "theories of learning and design." What distinguished it from the other course offerings, in the Department of Curriculum and Instruction, was its focus on design communication in the service of learning and technology. Instructional design of educational software, emphasized design activities that pointed towards empowering teachers to become conceptually skilled decision-makers and practicing instructional designers. "We do a lot more in this course than just talk about designing educational software," remarked the course professor of educational computing and technology. "There is the technology and something that's bigger. Yet we use technology as a tool for achieving those things."

The instructional design of educational software course was a blend of "ten separate design areas," based on a particular learning theory and emphasizing design-based guidelines and strategies. Points of comparison with the narrative content included accessibility, attention to compositional considerations, diachronic sequencing, perceptional participation, and the use of e-learning principles. On the whole, each of these design areas, including narrative, promoted representational learning and the practice of functional design.

Although, the multimedia learning research community had cultivated the cognitive potential of multimedia technology, the conception of "design-based learning," was still in its infancy (De Vries, 2006, p. 214). Equally important, multimedia technology, during this time, had entered into a new stage of development—elevating mainstream authoring from its characteristically text-based, web orientation to a new level focused on graphic communications. It was described this way:

> On the one hand, the multimedia learning research community had been calling for an insider's perspective (e.g., novice or professional multimedia designer), and on the other hand, the inception of Web 2.0 had marked the start of a new phase of multimedia technology. In addition, innovations such as podcasting had extended the possibilities of authorship and it was hard to deny the format resembled the narrative representations and structures that are used in film and television.

Consequently, the decision was made to conduct classroom research, to determine the usefulness of narrative as both a form of representation for multimedia learning instruction and instructional design practice. Given all of the students were teachers, who

were majoring in either technology instruction or technology leadership, this approach made perfect sense because it offered a direct apprehension of narrative from those who were most likely to use it.

First Person Account of Classroom Life

As one of five design units that were often interlaced with other course content, the narrative curriculum was tied to both the social context of the classroom and activities that transpired within in it (see Table 15). Thus, in an effort to effectively communicate the cultural aspects that contributed to the results of this report, the subsequent section offers a brief account of classroom life based on the ethnographic practice of participant observation. Over the course of one semester, this practice was undertaken from various perspectives including my position as a student, researcher and visiting professor in this university graduate classroom.

From the outset, there were three instructors and nine students: two females and seven males, eight Caucasian and one Latino. The age range was between 24-50 years old. The teachers came from different content areas (i.e., academic fields of study) including art, K-12, elementary, middle and high school. The high school teachers specialized in different disciplines including journalism, psychology, and science education. In addition to the course professor and me, the third instructor was a male teaching assistant (TA), who was a doctoral student and trained computer programmer.

The structure of the course included reciprocal teaching that is a form of constructivist learning. Its application in the classroom resulted in a complex course schedule. Although it was intended to support student autonomy (Lebow, 1993), initially, the social context of the classroom appeared to be ambiguous and constrained. This was

not surprising considering each class was devoted to a blend of design topics in addition to a few different presentations and presenters.

At first glance, it appeared as though the teachers did nothing in particular. For example, they entered the classroom sporadically, hardly acknowledged each other, and then sat down alongside one of the two long grey conference tables, adjacent to the entranceway. Before the start of class, they devoted their time to individual activities such as working on a laptop, reading a textbook, writing annotations or sketching. Their reticence was later disclosed as a counterpart to other classes. “We’re quiet there too,” confided a teacher one evening.

As lead professor, the principal investigator planned the curriculum schedule including each of the main design topics that were to be presented by each of the instructors in addition to required readings and projects presentations that were to be presented by the teachers. Accordingly, throughout the semester, reciprocal teaching was regulated to either instructor-led multimedia presentations or teacher-led class discussions. Instructional design topics focused on both historical and contemporary concepts dealing with use and usability issues as well as experience design.

Reciprocal teaching was compelling because it held *everyone* accountable. Accordingly, the teachers synthesized the material, reflected on what they learned, collaborated, referenced their textbook, posed questions, heard each other’s point of view, and thought about using representations for learning and how to make design problematic.

Throughout the semester, some teachers found a need for a method; others did not. Some teachers found the environment stressful; others found it met their needs.

Ill-structured problem solving, another constructivist learning activity, challenged some of the teachers whose disciplines were rooted in formal operations. “It’s too hard,” remarked one teacher. A few others agreed. Some of these discoveries, uncertainties and corresponding conditions are further discussed later in this chapter.

From time to time, the older students in the course eagerly participated, but the younger students continued to remain quiet and withdrawn unless it was their turn to lead a discussion. “We all seem kind of tired when we get here and we’re not very talkative just in general,” remarked one of the younger teachers, one evening.

“This class always puts teachers through changes,” the course professor (i.e., lead professor) admitted. He was keenly aware of the teachers’ behaviors from past experience. “It requires a new way of thinking,” he said.

A teacher might be expected to have a rationale for enrolling in the instructional design of educational software course. When asked about this, the teachers stated different intentions including the desire to acquire a teaching endorsement, earn credits towards a degree, advance their level of expertise, learn something new or acquire a technology-related skill.

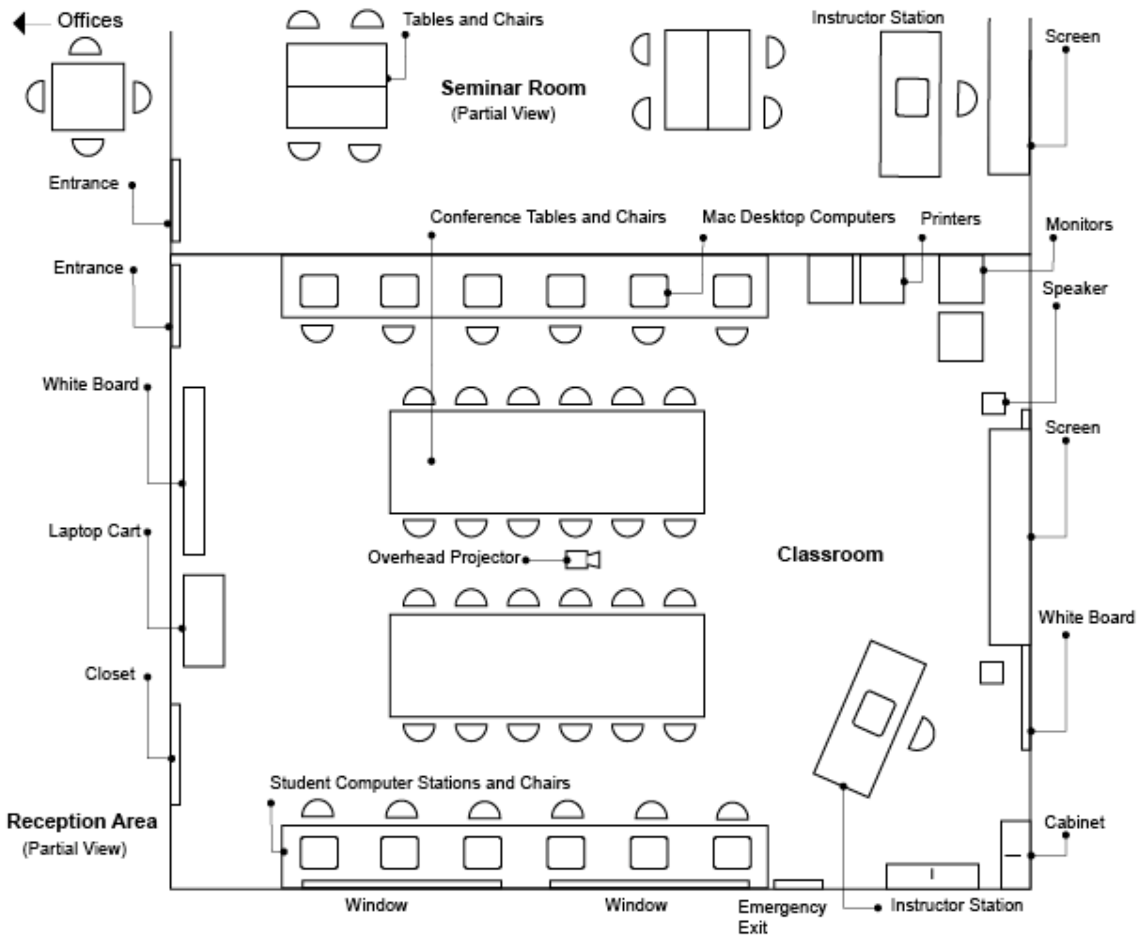


Figure 1. The Setting

The Three Teacher-Participants

The three teacher-participants of this study were selected through purposeful sampling. Before the study began, a student questionnaire, intended to address the research criteria, was distributed to nine, graduate-level students who were enrolled in an instructional design of educational software course (see Appendix A). The data were organized around a criterion scale sheet (see Appendix B) and a continuum was used to array each of the students' responses. The findings were reviewed and discussed with the

lead professor and, consequently, narrowed down to three participants who met the research criteria for this case study.

In terms of recruitment, an email invitation was sent out to each of the participants requesting their voluntary participation. Accordingly, one art and two elementary school teachers agreed to serve as participants.

None of the participants had any prior background or training in narrative structures, narrative representations or the design of narrative instructional presentations. All of the participants had experience constructing informational presentations with the PowerPoint application, developed by Microsoft.

In the subsequent section of this chapter, the participants are introduced. They are referred to as Participants F1, M1 and M2, respectively. Each one was interviewed according to their educational background; teaching experience, approach to technology integration and future goals. A summary of their education, technology, and teaching background is provided in this section (see Table 14) followed by comparisons that are rooted in both theory and practice.

Participant F1. F1 was the youngest of the three participants and had the least amount of teaching experience. As a fulltime graduate student and research graduate assistant, F1's goals had yet to be decided. When asked about her decision to study technology leadership, F1 responded by saying:

> I was drawn to it because it was the closest thing here that related to instructional design and I'm really interested in that. Before I got my assistantship, I was enrolled in a program tailored for training and instructional design in the corporate sector, in the corporate world.

F1 described herself as a novice teacher, noting the differences between her own teaching background and the other teachers who were enrolled in the course. “I’m a licensed teacher, but I’ve never been employed by a school district as a teacher. I’ve student taught and I’ve done observation experiences, obviously, but never have I had my own classroom,” she said.

On the student questionnaire that was distributed the first week of class, F1 wrote she had been trained by a private company to teach reading to various age groups. She had, for example, taught phonics and letter recognition to four and five year olds and speed-reading and comprehension techniques to adults. “I’m also a lifeguard instructor for the American Red Cross and I have taught various classes there, but mainly those classes have been focused on high school students and adults to become certified to perform CPR.”

For F1, technology integration meant both a practical and productive approach to teaching and learning. For utility she used a wiki to post information on the university’s curriculum and instruction website, specifically the technology pages. “I have a log in and my professor says, ‘Go on there and create this,’ so, that’s what I do. I’ve also created my own wiki. Like PB Wiki and I always have things on Google Docs,” she said.

Despite her self-assured manner, F1 recognized her inexperience as a teacher could affect her long-range plan to teach at a university. “I might have some limitations,” she said. “I guess, they would say, ‘You have a Ph.D. and you’ve never had a formal classroom of your own?’ So, I don’t want to limit myself.” F1 further explained:

> Ideally, after I’m done with school, I’d like to go and get some experience teaching for a while. I’m looking for jobs overseas, but a lot of those positions

> require three to five years' experience. So realistically, I'll probably teach stateside for a while, for a few years, and then pursue something like that. I'd like to work in the corporate sector doing instructional design or training, in that area, and then go back and get that Ph.D. and teach for a university. It is a rough plan with probable twists and turns along the way.

Participant M1. Four years ago, M1 left the Midwest, straight out of college, to begin his teaching career at a magnet school in the state of Nevada. He came almost immediately following a telephone interview and subsequent job offer just one week before the start of school. With such short notice, he recalled the dilemma he found himself in at the time:

> My first thought was, "What am I going to do? I guess I'll have to substitute teach." Then, I thought, 'I need this job to start paying back student loans.' It's been a big learning experience, but I know I am at one of the best schools in the district. It's a magnet school. It's empowerment."

The empowerment model promotes self-governance for administrators who are given the latitude to control the budget, plan the curriculum, hire staff and prepare schedules. Founded on the theme of mathematics and science through technology, few schools in the district could claim to offer such an objective alternative for both parents and students. For obvious reasons, M1 valued the school, identified with it and viewed its practices as important for learning and teaching. "It's great. But, there is a lot of pressure to perform. Some parents are on top of your grading and on top of what you are doing in the classroom, but it keeps you accountable," he said.

For M1, technology integration meant students working on computer skills, putting presentations together and constructing his own presentations. In general, his opinion of multimedia learning was positive, but he felt the production end should be regulated to teachers alone. He explained:

> For some third grade students, even to put a URL in place could take as much as ten minutes because they miss one dot or they miss one letter. I have some students that are still not able to do that. They'll say, "It's not going in the right spot," and I'll say, "Look you missed a letter here or you missed a dot there." I try to make everything linked so all they have to do is press a few buttons.

If invention was M1's strongpoint his students were his inspiration. He claimed he was interested in getting the kids excited about using interactive media. For example, M1 created a movie at the beginning of the school year. He described it this way:

> I introduced myself as Star Wars and I said, "Classroom Jobs," and I went through the classroom procedures. Then, I said, "This is Mr. C's classroom," and I showed them a picture of my face and went through and showed them all the different classroom jobs. I found it was good for ESL students to see those visuals of what's going on along with the words. The students loved to watch that movie, over and over again, even though it was just telling them how to do a procedure or how to do a job. They still wanted to listen.

During the study, M1 lamented, "I wish we had more freedom to do these neat ideas." On numerous occasions he pointed out how he had to contend with time constraints and how the primary goal of the school was to prepare students for standardized tests. Despite the value that was placed on technology, it was the high-test

scores that ultimately guaranteed the school's success. "It comes down to the teacher putting the technology into place so the students can learn," he said. When asked what his motivation was for returning to school to pursue a master's degree in technology leadership, M1 responded:

> I just wanted to further my knowledge of technology and hopefully use it in the classroom and, as you know, down the road, I always thought, "What if teaching gets old?" "What do I want?" "Do I have a back up plan?" So, it just gives me more opportunities really.

Participant M2. Despite his reticence, visual communication was M2's strong point and he demonstrated it on more than one occasion over the course of the semester. A talented artist, M2 routinely drew cartoon caricatures of other class members and they were more than receptive to his visual renditions.

Prior to obtaining a teaching endorsement for K-12 Art, M2 had been employed as a professional illustrator in the Midwest. "I worked for a whole bunch of textbook companies. Like Longman's, Global Learning Press, and Proctor Publication. A whole bunch of different publications that do textbooks and work sheets," he said. When asked why he gave it up, M2 admitted, "I got laid-off too many times."

M2 comes from a family of teachers. Both of his parents are college professors and he has an aunt who worked for 10 years as a commercial artist in a design house before entering the teaching profession. "She worked in advertising and then taught elementary and middle school art for 20 years. She got out of the ad business," he said.

After 4 years in education, M2 claimed he was happy with his decision to become a teacher. "I've been at three different schools now and its totally gone up hill." He explained it this way:

> I taught 1 year in South Carolina, in the swamps, outside of Savannah. The first day of school they passed out shoes because the kids didn't have them. Also, if it really rained hard, they had to cancel school because the buses went back on the dirt roads—back by the swamps. They couldn't get back to pick the kids up so, they just cancelled school. It was pretty rough there. Then, I taught at a school near an air force base. It was a little rough there too and now, I'm at this school and it's not so rough. It's pretty good.

For M2, technology integration is organized around the production and presentation of instructional materials to support student learning. The presentations are projected from a computer to a television screen. M2 further explained it this way:

> I use the Web to get pictures of artists, and topics, and use it to make PowerPoint presentations. I use Google Earth for geography. We start off with the location of the school and then, if we are talking about China, we zoom out and visit China. We did the Forbidden City today. We zoomed in and looked at it so the kids could get a sense of it. I have this inflatable globe, but they like Google Earth a lot better. It gives them more of an idea of where they are. If we're talking about artists, like if we're talking about Picasso, we'll go over to Spain to see where Spain is.

Most recently, M2 returned to school to pursue a master's degree in instructional technology. His decision was guided by the fact that he "liked technology" and claimed

he frequently used its resources in the art room. Further, he reasoned, he was already familiar with a few programs. “It seemed some of the choices I had were just a little too general and I thought, ‘This might be more useful.’ I don’t if I’m going to use it though,” he said. M2 was fully aware of how economic conditions were responsible for the reappraisal of art education in the public schools. When asked to comment on the matter, he responded, “I hope it stays there because that’s what I do. And, I hope they fund it more because that’s pretty hard to buy supplies without funds.”

Teacher Participant Comparisons

The subsequent table offers an interpretation based on data collected from each of the teacher participants’ interviews and student questionnaire (see Table 14). These comparisons are intended to underscore their shared knowledge, experience and differences that existed among them before the study began.

Table 14

A Summary of Each Teacher-Participant's Educational Training, Teaching and Technology Background

Teacher	F1	M1	M2
Age	24 years old	27 years old	32 years old
Teaching experience	1 year	4 years	4 years
Content area	Elementary education	Elementary education	Art education
Undergraduate education	BS in elementary education and reading	BS in elementary education and music	BFA in illustration and art K-12 certification
Graduate emphasis	Technology leadership	Technology leadership	Technology integration
Learning preference	Visual	Visual	Visual
Technology-related courses	2 practical 4 theory	1 theory	3 practical
Teaching style	Social constructivist Cognitive constructivist	Hands-on/ Kinetic Collaborative learning Multiple intelligences	Hands-on/Project based Cognitive constructivist Contextual learning
Career goals	Teach overseas Instructional designer Ph.D. University teaching	ESC certification Technology-related teaching	ECS certification Technology-related teaching Continue to teach art
Instructional technology goals	Classroom demonstrations Classroom projects	Classroom projects Multimedia club School broadcasting	Classroom demonstrations

Teacher Participant Comparisons

The foregoing table is an interpretation of data collected from each of the participant interviews and student questionnaire. As indicated previously, these comparisons are intended to underscore some of the shared knowledge and experiences that existed among the participants before this study began. In the text that follows, examples are offered as brief descriptions and dialogues in an attempt to further inform the analytic work that is presented in the subsequent sections of this report.

Educational background. As the literature indicates, representations for learning (i.e., both visual and or verbal in addition to external and internal) have been approached from behaviorist, cognitivist, and situated perspectives in an attempt to foster knowledge and human understanding (Samaras et al., 2006). For each of the participants, their undergraduate work demonstrates the extent to which they engaged in some form of representational learning prior to this investigation. This includes reading for Participant F1, music for Participant M1, and art for Participant M2. It should also be noted; each of the participants' graduate work has been oriented towards technology, and particularly various forms of multimedia, within a context that was conducive to their learning needs. Consequently, it is suggested the three participants were inclined towards learning situations that made use of representations and representational systems (Ainsworth, 2008). Further, they used these tools as resources (Dewey, 1938; Vygotsky, 1978, Bruner, 1993) to engage in instructional forms of practice because it offered them the autonomy they desired to conceptualize their ideas, communicate information and, as a result, construct knowledge.

Constructivist teaching. The construction of knowledge through a learner's active participation in an activity is a constructivist philosophy (Applefield, et al., 2001; Du & Wagner, 2007; Lebow, 1993). What initially began as an individual desire (Bruner, 1990) later extended to intrapersonal forms of meaning making that were informed and influenced according to the participants' educational training and philosophical beliefs about teaching. During an interview with each of the participants, they described how they promoted constructivist learning in their own classroom:

For Participant F1, teaching meant being a guide or a facilitator . . . "tailoring things to the way people learn. I like to send them [students] on a mission to see how they do and formatively evaluate them along the way," she said. "Complete discovery learning is just too free reign. I think."

For M1, teaching meant attending to student engagement and collaborations, particularly involving music. "The more variety I can get, the more creative it is . . . I like getting kids up and moving . . . talking with their peers." M1 explained. "I say, 'Ok, I'm not asking what you told them [referring to other students], what you said, I want to hear what your partner said. So they have to really work on their listening skills."

For M2 teaching meant project-based instruction; centered on the origin and production of art objects. "We usually have some final product and I'm concerned about what they learned along the way of course. We do a lot of art history and a lot about different cultures and projects that have to do with history," he said.

Visual learning. On different occasions, each of the participants stated they had a preference for visual learning. They explained how a visual approach helped them to reduce ambiguity and complexity and, in turn, construct their own knowledge. Similar to

their own teaching, Participants F1, M1 and M2 had different ideas, or methods, for achieving these ends. Hence, the following examples are offered to provide some insight into the kinds of reasoning and practical applications of their visual learning approach:

“As a learner, I’m a very visual person. I can just see it and then I can do it. Like if you were going to show me how to do something, not tell me anything, I could go back and I could do it,” stated Participant F1. In addition to applications and procedures, digital resources were also described as a way to achieve similar aims. “Hardly any teachers realize its out there [referring to an educational wiki], but I've gotten some ideas this year from just going and looking and I think that's one of the fastest ways to communicate ideas is through the visual way,” remarked Participant M1.

Another approach involved visual learning using physical forms. “I’m pretty visual and I like a lot of visual things. I like a lot of hands-on myself too and interacting with it. The lectures, I don’t think I get as much from. I can sit through many lectures, but if I’m doing something and seeing something, I’m going to work more,” admitted Participant M2.

If there is one point to be taken from this section, it is the importance of context for learning (Lebow, 1993). Indeed, Participants F1, M1, and M2 were able to situate their experience and apply their knowledge and reasoning in a meaningful way, both for themselves and their students, because the context offered them a means to achieve such ends.

Narrative as a Form of Multimedia Instruction and Practice

The form of this next section reflects some of the progressive stages involved in the narrative content creation process. These stages also correspond to the results of the

various elicitation and descriptive methodologies that are discussed in this report. For this reason, this section begins with an overview of the narrative curriculum as it was conceived and enacted in this university graduate classroom. Next, the subject matter descriptions that are based on each of the participants' written proposals are offered. Subsequently, the results of this analytic work is discussed in the following order: (a) storyboard, document analysis, (b) montage, concurrent protocol analysis, (c) montage, network graph analysis (d) montage, comparative concurrent-retrospective protocol analysis, (e) montage, document analysis, (f) narrative, retrospective protocol analysis, (c) narrative, network analysis, (f) overview of the domain analysis, (g) taxonomy, and (h) componential analysis. It should be noted the domain analysis is represented in part one of this chapter in addition to part two with the overview of the narrative curriculum and the last two componential analyses.

Overview of the Narrative Curriculum

The narrative curriculum was designed to promote an understanding of narrative for multimedia learning both as an interdisciplinary instructional presentation format and a design-based activity for learning and teaching. The overall intent was to develop a prerequisite knowledge of narrative by introducing its historical, practical, and theoretical dimensions. Hence, each presentation emphasized the ways in which narratives operate through representational forms such as comics, fine art, film, photographs, television, and multimedia text that has similar structures in place. The literatures on design methodologies, constructivist theory, multimedia learning, narrative representations and narrative structures informed this approach to instruction (Dorst & Dijkhuis, 1995;

Schön, 1984, Sivan, 1986; Hirumu, 2002; Ainsworth, 2006; De Vries, 2006, Mayer, 2005; Abbott, 2002; Metz, 1976).

The form of a narrative multimedia instructional presentation includes the configuration of storytelling structures in addition to representational techniques and methods. The content includes the instructional material that operates within this form. Another dimension of a narrative instructional presentation is multimedia technology that has, in its turn, introduced constructivist tools and resources that allow for mainstream productions.

For the classroom, the presentation media included audio files, graphics, movies, and Web pages. The presentation formats included streaming video from social networks, videocasts from online directories, and video clips from online repositories. Further, attention was given to both classic and contemporary examples of narrative.

The curriculum focused on how to construct, edit and gather multimedia resources to produce a narrative instructional presentation. For each stage of content creation, the teachers were introduced to an *ill-structured* design problem. This approach required them to actively construct a solution based on project specifications, media affordances, subject matter, instructional methods, and student needs.

Initially, each of the teachers wrote a proposal and script for their content area based on a topic related to Yellowstone National Park. The proposal was intended to provide direction for the formative stages of story development and also, to foster a vernacular for better communication in the classroom. The script included cue indications for voice recordings as well as direction for music and sound effects. The other stages of content creation included (a) storyboard development, (b) montage constructions, and (c)

a final narrative instructional presentation. Each of these stages is discussed in greater detail in the subsequent sections of this report.

Instructional materials included assignments, articles, templates, tutorials, and worked examples. These resources were distributed on a DVD, the first week of class. In addition, some of the instructional materials were posted to the course website and video demonstrations of software and project examples were posted to a Web log.

The narrative curriculum was designed to work with new constructivist technologies that were developed to produce movie formats such as an enhanced podcast or videocast, and streaming media. The premise was the instructional presentation could be delivered through online social networks or wireless devices in addition to multimodal environments to extend social forms of learning. The teachers were given the option, however, to use older constructivist tools to accommodate their needs. It should be noted, narrative represented one of five main design units in the course. Consequently, the material was presented in conjunction with other course content (see Table 15).

Table 15

Narrative Curriculum Schedule – Fall 2008

Date	Time	Topics	Projects	Due Date
Week 1	^ 2:45			
Week 2	# 30:00			
	+ 30:00			
	^ 1:15:00			
	* 15:00	Overview of projects (LD)	Narrative	
Week 3	# 45:00			
	* 45:00	Content and form (LD/VN)	Proposal/Script	
	30:00	Shot scale (LD/VN/P)		
	^ 45:00			
Week 4	# 30:00			
	+ 15:00			
	* 60:00	Narrative (LD/VN/P)		
	^ 45:00			
Week 5	# 30:00			
	*1:15:00 + 45:00	Shot scale 2 & closures (LD/VN)	Storyboards/ Montage	Proposal/ Script
Week 6	# 30:00			
	^ 1:45:00			
	* 15:00	Image, music and video sharing resources (ICD & WLD)		
Week 7	# 30:00			
	* 45:00	Montage (LD/ WLD/V)		
	45:00 45:00	Theatrical storyboard (LD/ DVD) iPhoto and iMovie (ICD) iMovie and iPhoto tutorials (IW)		Storyboards
Week 8	# 30:00		Comments (WL)	
	^ 1:00			
	+ 1:00			
Week 9	# 1:00			
	^ 1:30			
Week 10	^ 1:30:00			
	* 15:00	Multimedia learning and social media examples (ICD/VN/WLD)	Comments (WL)	Montage
Week 11	# 30:00			
	* 1:30:00	Narrative critique and discussion		Narrative

Note. The schedule reflects the narrative units as part of the course curriculum. CODES: Time Column indicates Instructors and Student Presentations and Critiques: Professor [^], Student Investigator [*], Teaching Assistant [+] and Student Presentations [#]. Media and presentations: DVD (Digital video disc), LD (Lecture and demonstration), ICD (In-class demonstration), IW (Instructor's website post), P (Podcast/Videocast), VN (Video network), WL (Web log comments), WLD (Web log demonstrations).

Interview schedule and protocol sessions. The following schedule of events for teacher-participant interviews and protocol sessions was arranged to work with the introduction of related content as outlined in the preceding narrative curriculum schedule (see Table 16).

Table 16

Schedule of Events For Teacher-Participant Interviews and Protocols Sessions in 2008

Teacher	M1	F1	M2
Interview 1	Week 6 Background Office area	Week 7 Background Office area	Week 7 Background Reception area
Think Aloud Protocol	Week 8 Montage Seminar room	Week 8 Montage Seminar room	Week 8 Montage Seminar room
Discussion Meeting 1	Week 9 Montage Seminar room	Week 9 Montage Seminar room	Week 9 Montage Seminar room
Retrospective Protocol	Week 10 Narrative Classroom	Week 10 Narrative Classroom	Week 11 Narrative Classroom
Discussion Meeting 2	Week 12 Narrative Seminar room	Week 12 Narrative Seminar room	Week 12 Narrative Classroom
Interview 2	Week 14 Follow-up Seminar room	Week 14 Follow-up Seminar room	Week 14 Follow-up Seminar room

Documents

According to Emmison and Smith (2002) researching visual data is not limited to one form of collection or analysis. Similar to other forms of inquiry, primary source documents can be appropriated in different ways. In this report, several visual elicitation techniques (Merriam, 1998) were implemented in order to guide the collection of data on the use of documents. Specifically, each approach was determined by the design objectives for a particular stage of the content creation process.

Subject Matter Descriptions

The following subject matter descriptions are excerpts taken from each of the teacher-participants' written proposals. These descriptions are offered to facilitate understanding the corresponding stages of content creation that are discussed in the subsequent sections of this report.

Participant F1: Know the Basics; Backcountry Camping in Yellowstone National Park. Yellowstone National Park offers a vast wilderness to experience and explore outside of the established campgrounds. The intent of this narrative presentation will be to educate individuals and/or groups about how to prepare for a backcountry camping trip including safety precautions and responsibilities of backcountry campers. The lesson is intended for individual or groups planning to take a backcountry camping trip.

Participant M1: Myth; Buffalo and Eagle Wing. This project will cover writing, reading, and social studies. Students will be exposed to the definition of a myth. This will be followed by a myth that comes from the Blackfoot Indian tribe of the Great Basin. For the writing assignment, students will create their own myth of Old Faithful

from Yellowstone National Park close to where the Blackfoot tribe lived. This lesson is geared toward students who are in intermediate grades in elementary school.

Participant M2: Overview of Yellowstone. The purpose of my multimedia project is to create a visual narrative for my art students. The higher-level students in my elementary art class will create a painting after viewing the media presentation. The watercolors will be distributed to the students after the completion of the drawing phase of the assignment. They will be asked to fill their pictures with the animals and the environments of Yellowstone National Park.

Storyboards Document Analysis

The task. For the storyboard task, paper templates were designed to correspond to the specifications used in the animation and film industry. The format of each template was divided into three main sections including: (a) a header to indicate the name of the artist, project title, scene and panel number, (b) three frames for hand sketching, and (c) three columns for annotations such as dialogues and frame time.

The participants were encouraged to develop hand sketches in order to conceptualize the different scenes of a storyboard including: (a) character actions and gestures, (b) indications of camera movements, (c) montage, (d) shot scale, (e) props, (f) representations, and (g) setting.

Project specifications included the following steps:

1. Illustrate10 pencil sketches indicating shot scale.
2. Underscore the key parts of the storyline/script in each scene.
3. Illustrate one intellectual or rhythmic montage sequence in 3 out of the 10 scenes.

4. Include a title and the artist's name on first scene of the storyboard.

5. Include credits in the last scene of the storyboard.

6. Include annotations such as the labeling of shots, special effects, action arrows, and time durations for each scene.

The process of this storyboard document analysis. The aim of the storyboard document analysis was to understand to what extent the participants used the format. Data collection and analysis of storyboards included the combined techniques of ethnographic document analysis (Althiede, 1996; Fields, 1988) and professional art criticism (Barrett, 1991). Some modifications were made to account for the generative nature of storyboarding and the characteristics of this visual analog format. The process of this storyboard document analysis involved six stages resulting in three documents:

Text description document

1. Observe storyboards
2. Develop descriptions of each storyboard scene
3. Identify and label any indications of meanings, patterns or themes (i.e., frames)

List of categories

4. Develop a generalized list of categories

Visual document

5. Develop a visual code sheet based on project specifications
6. Construct iconic representations of storyboards based on project specifications

The first stage of data analysis concentrated on data observations in an effort to describe the surface features of each storyboard scene. The protocol was based on a mode

of inquiry that is used in the field of professional art criticism to elaborate on the "formal arrangement" of artwork within the context of its connection to cultural and historical sources (Barrett (1991). Called *description*, the term is used in this study to suggest the process by which the storyboard representations were read and decoded across the individual cases. This included attending to the formal arrangement of storyboard scenes.

To begin to determine how each of the teacher-participants used the storyboard format to develop their ideas, the following questions were asked: What is the subject matter? What is the compositional arrangement? How is the multimedia text organized? What is the narrative flow and structure of the work?

The second stage of data analysis concentrated on coding and organization in order to develop a descriptive text document to represent each storyboard scene based on the observation questions. This approach demonstrates the descriptive details and limitations involved in attempting to translate visual information into a textual form. The aim was to eliminate the act of scanning the storyboard, as a provisional step, in order to concentrate on the details of the design.

The third stage of data analysis concentrated on coding and organization. Specifically, decomposing each of the text description documents in order to identify and label any parts of the text that indicated a meaning, pattern or theme. Also referred to as the *frame*, it is " . . . the perspective one uses to bracket or mark off something as one thing rather than another" (Altheide, 1993, p. 31).

Table 17 offers an example of the text descriptions based on a section of storyboard scenes constructed by Participant M2. In this display, certain areas of the text have been italicized and bracketed to demonstrate this procedure. The corresponding

storyboard images are also shown below this table (see Figure 2). Additional examples are offered in the appendix of this paper (see Appendix G).

Table 17

An Example of a Text Descriptive Document Based on a Storyboard Observation

Scene descriptions
Scene 20: A *wide shot* [shot scale], suggesting a menacing wolf, [meaning] stands in an *inclined position* [lines] towards the left side of the scene. The wolf is peering down on a small human figure dressed in a hooded robe. Reminiscent of the tale *Red Riding Hood* [theme]. *Wavy lines* [lines] are *positioned behind* [depth of space] the human figure to suggest trees and a wooded area. Is there a *double narrative* [meaning] here? The use of the *rule of thirds* [composition] also adds to this scene's complexity with its iconic suggestions of *power* [meaning]. For example, the wolf's eyes lines are aligned with the top left horizontal *rule of thirds* [composition] and the human figure's *eye lines* [lines] are aligned with the bottom, right horizontal *rule of thirds* [composition].
Scene 21: A *wide shot* [shot scale] of a bighorn sheep [wildlife theme] fills two-thirds of the scene. To the far right, *jagged lines* [lines] are used to suggest a series of mountains. Positioned the top right corner of the scene, a miniature image of the sun has been rendered as a circle with *short stroked lines* [lines] to indicate rays of light. A *wavy line* [line] has been used above it to indicate a cloud. The character has a *tranquil expression* [meaning]. Two dots are used to indicate the eyes and a *straight long line* [line] is used to indicate a grin.
Scene 22: A *wide shot* [shot scale] image of an elk [wildlife theme] is positioned 1/3 in from the edge of the scene. Its body faces towards the left and its head faces towards the right. The antlers spread across the top of the frame and are perfectly aligned with the top *rule of thirds* [composition]. In the background, positioned towards the left, short, *jagged lines* [lines] are used to suggest trees. A *horizon line* [lines] begins at one edge of the frame, along the top *rule of thirds* [composition], and slopes downwards towards the corresponding bottom edge.
Scene 23: A *wide shot* [shot scale] of a beaver [wildlife theme] is depicted on a *slight angle* [angle] from the center of the scene. Facing the viewer, this *portrait shot* [composition] makes direct eye contact with the viewer and creates another series of *psychic lines* [lines]. A branch of a tree is positioned at the far left of the frame and ends along the bottom middle area. The branch is used as a pointing device— an *indexical object* [iconic].

Scene 20 Scene 21 Scene 22 Scene 23

Figure 2. Storyboard images by Participant M2

The fourth stage of data analysis concentrated on additional coding and organization to develop of a list of categories based on sampling frames from each of the text description documents. This involved an iterative process of listing a particular meaning, pattern or theme alongside a participant’s name. If another participant used the same topic, their name was also included.

Table 18 offers an example of the list of categories based on hand-sketched representations of storyboard ideas. In this display, compositional features have been identified and labeled. Additional examples are offered in the appendix of this paper (see Appendix H).

Table 18

Categories Based on Hand-Sketched Representations of Storyboard Ideas

List of Categories
Hand-sketched representations of storyboard ideas
Balance
White/Negative space (F1)(M1)
Split screen (M1)
Angles
Inclined (M2)
Backward leaning (M2)
Slight angle (M2)
Cropped image
Image breaks out of the frame (M2)
Depth in space
Behind and beyond (F1)
Overlap (F1) (M2)
Staggering, overlapping perspectives (F1*)*
Atmospheric perspective (F1)

The list of categories from stage four of data analysis resulted in 104 patterns, 31 meanings and 12 themes (see Table 19 and Appendix H). To generalize the list of categories, each pattern was further sorted and refined resulting in four design features and four design forms that were observed, to varying degrees, in each of the teacher-participants' storyboard scenes.

Design features

1. *Compositional features* refer to the formal arrangement and spatial organization of visual design elements based on design and multimedia learning principles. Design elements include lines and shapes. Design principles include balance,

depth in space and unity. Multimedia learning principles included contiguity and personalization.

2. *Directive features* refer to design devices that are used to direct the viewer's attention within or across storyboard scenes: (a) implicit line directives connect characters or objects according to their compositional arrangement such as their eye direction or suggested physical position within a frame, (b) second person directives show or tell something to the viewer directly according to the narrator's point of view, and (c) notational directives indicate future plans for the subsequent stages of content creation.
3. *Implicit features* refer to indirect design devices that are used to signify a particular concept or message within or across storyboard scenes: (a) a visual analogy suggests a comparison between characters or objects; and (b) a character's physical appearance or gesture suggests an impending action or intention.
4. *Themes* refer to the subject matter intended to convey the story lesson. It also represents the format used to project the story lesson.

Design forms

1. *Distinctive representations* refer to idiosyncratic forms of expression intended to exaggerate the features of a character or object in order to convey a particular emotion or effect. Examples include a caricature depicted to suggest humor or a cartoon object rendered to suggest an exploding effect.
2. *Figurative representations* refer to characters or objects that are intended to resemble a real-world form such as a personified character.

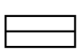
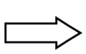
3. *Graphic representations* refer to a creative interpretation of the world. For example, an emblem, diagram, chart, logo or map (Emmison & Smith, 2002).
4. *Symbolic representations* are not tied to reality in any real-world form. Instead, they constitute arbitrary signs that have been influenced by cultural conventions (Emmison & Smith, 2002; Kibbey, 2005). Examples include typographic arrangements.

The fifth stage of data analysis concentrated developing a visual code sheet. The overall intent was to represent the project specifications for the design and development of a visual document in order to make visual cross-case comparisons possible (see Table 19). In addition to depicting the annotations and compositional elements, the visual grammars consistent with what Metz (1974) called "the semiotics of the cinema—montage, camera movements, scale of the shots, relationships between image and speech, sequences, and other large syntagmatic units . . ." (p. 94) were subsequently rendered as iconic representations.

The sixth stage of data analysis concentrated on constructing a visual document (see Figure 3) based on data collected from the visual code sheet. As mentioned previously, the visual document was intended to illustrate each of the participants' interpretation of project specifications in terms of its visual grammars. Any project specifications that were difficult to translate visually were added to the list of categories.

Table 19

Coding Scheme for Visual Cross-Case Comparisons of Storyboards

Codes	Topic	Indicated for
	Bracket sytagma	Connecting sytagmas through transitions such as dissolves, fades, swipes, and pans (Metz, 1974).
	Intellectual montage	Contrasting shots. The "...relationships *between* shots and the juxtaposition of images to create ideas that are not present in either shot by itself" (Bordwell & Thompson, 2004).
	Rule of thirds	Positioning subjects at the intersecting points of a grid "creates more tension, energy and interest" compared to centered images (Wikipedia). A well-composed shot requires less screen time for the viewer to absorb.
	Montage of attractions	The *surface features* of images are interpreted and put together like bricks (Kibbey, 2005).
C D G F S V	Representations	For storyboards, these are visual images indicated by first letter abbreviations: C for credits, D for distinctive representations, F for figurative representations, G for graphic representations, S for symbolic representations and V for future video.
CU, EC, WS, MS	Shot scale	The composition of a shot within a frame. The standard measurement is based on human anatomy. CU for Close-up, EC for Extreme close-up, WS for Wide shot, MS for Mid-shot. A close-up takes less time to interpret. A wide-shot takes more time to interpret.
	Storyboard content A	Annotations for action, dialogue, shots, and timing indications meeting project specifications.
	Storyboard content B	Annotations for directives and timing indications.
	Direction lines	Direction lines to indicate a character's movement.
	Cartoon captions	Dialogue of characters was recognized as another form of annotation.

Note. (Metz, 1974, p. 126; Kibbey, 2005, p. 139; Bordwell & Thompson, 2004).

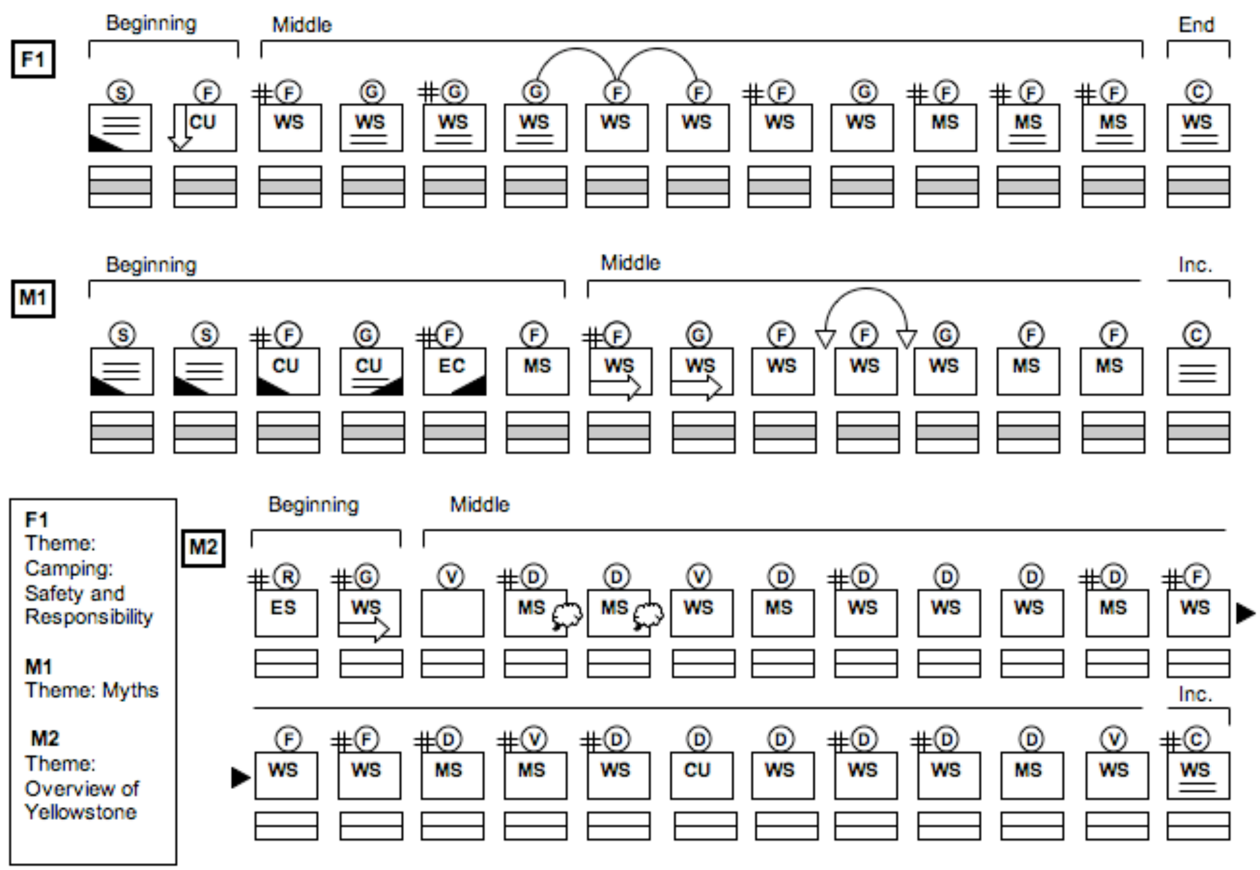


Figure 3. Visual document of storyboards based on each of the participant’s interpretation of related concepts and project specifications

Results. The storyboard was intended to extend the vernacular that had begun with the initial written proposal and script. It also represented the first visual translation of narrative representations and only hand-sketched part of the narrative project. In the foregoing section, the list of categories (see Table 18 and Appendix H) and visual document (see Figure 3) were used to underscore to what extent the participants used the storyboard format and also to respond the fourth research question regarding the features and forms of narrative at this stage of content creation. In an effort to provide further support for these findings, first person accounts are included in this report.

The extensive range of connotative and denotative features and forms, in the teachers' storyboards, suggests the open-endedness of this format for both planning and developing narrative representations to enhance instruction. It also suggests the format supports different content areas.

Participant F1. F1's storyboard "Know the Basics: Backcountry Camping in Yellowstone National Park" demonstrates the three structural features of narrative derived from Aristotle's Poetics. The sequential order of the work is realized in the subject matter and linear style that includes light and dark effects in an effort to achieve unity among the different scenes.

F1's storyboard annotations include the multimedia learning principle of personalization in an attempt to connect with the audience. The extensive use of a second person directive, rendered as a figurative representation of F1, is also used to connect with the audience and, at the same time, exemplify the key points of the lesson. From the outset, F1's character is shown addressing the audience in both a close-up and mid-shot view followed by a profile and then an over the shoulder shot.

On a self grade sheet, at the end of project, F1 wrote, “I used the lessons about shot variety and film theory reviewed in class. I also paid close attention to create a beginning, middle, and end that made sense for the message and story I planned to tell."

The storyboard was designed in an *informational show and tell format*. Compared to the other participants’ work, it also demonstrated a range of representational treatments.

As the other work in this report will show, F1 was committed to understanding how different kinds of representations could be used to facilitate learning. She had designed a mnemonic device, for example, to suggest what to do in an emergency situation and intended to use it as a memory aid for students.

F1 considered both the storyboard and instructors active agents in her own learning and development. This view supports Vygotsky’s (1978) conception of the zone of proximal development. “It really set me up to be ready to begin with the creation phase of the project. I think I would have been wandering around in the dark without this component and the feedback I received,” F1 said. When asked to comment on the drawing requirements, F1 remarked, “I don't get to draw very much. I always liked to draw.”

Participant M1. M1’s storyboard titled “Myths: Buffalo and Eagle Wing” represented a departure from the other participants’ work that had concentrated solely on the topic of Yellowstone. Even less common, but no less noteworthy, is the way in which M1 used visual analogies to convey information based on his students’ intellectual level of understanding. A figurative representation of an opera singer, for example, was offered to suggest the oral traditions of story telling.

Although the use of Participant M1's second person directive might be compared to Participant F1's work, he had intended for his character to assume the position of a teller of myths from behind the scenes. Accordingly, this character (i.e., existent) is only shown once, in a close-up view, wearing sunglasses to project humor and interest for his student audience.

The scenes of the storyboard were designed in a *polyptyph narrative format* in order to suggest the spatial and temporal order of the subject matter. Specifically, a polyptyph is a multi-panel scene, and narrative format, that is associated with the Renaissance period of art history. M1 used this format as a compositional device in order to create unity among the different characters and objects and also to compensate for his primitive drawing style.

It is suggested, the polyptyph narrative format served as an active agent by providing a structure for M1 to develop his ideas. "I can do the narrative written part, but coming up with the pictures and considering my drawing experience is stick figures, I can't really get an idea of what I want it to look like," he said. As a result, some scenes were offered in the form of diptychs and triptychs and were connected using transition effects such as fade-ins and fade-outs.

On a self-grade sheet, at the end of project, M1 wrote, "I put over 10 hours into this project. I learned about scene shots, the rule of thirds, visual grammar and montage to name a few." During an interview, however, M1 admitted he had been constrained by the hand-sketching requirements of the storyboard project. The unfinished ending suggests this mindset.

In contrast to F1, M1 had been undecided about the benefits of storyboarding as learning tool for his own development. “It does help you think through a little bit of what you want to do and you can, like you said, fix mistakes. But I don't know if it’s for me . . . I've been thinking this is kind of like prewriting. I just want to do it . . . I don't want to have to do all this early work,” M1 said.

Participant M2. Even before the project began, M2 had constructed his storyboard titled “Overview of Yellowstone.” He had illustrated 24 scenes onto sheets of white bond paper and then trimmed and pasted each one onto manila colored sheets to function as a display. Once M2 realized a template was required, he said, “That’s alright, it doesn’t take me long,” and then rendered 24 more in the exact same cartoon, contour style.

Blending reality with fantasy, M2’s storyboard scenes concentrated on the park’s architecture, landscapes, tourists and wildlife. The scenes offered his students humorous interpretations of human energy and the excitement involved in witnessing exploding mud pots, erupting geysers, tourists engaged in the act of sightseeing, and animals expressing emotions.

Among the participants, M2 was the only one who did not submit a script. When asked about it, he claimed it was an oversight. “I don’t think I realized I had to write one,” he said. When his storyboard submission showed a few word balloons and notational directives as opposed to the required written annotations, M2 claimed the omission was not intentional. “I might have of seen it there [referring to the project specifications]. I think I was in a rush because I was trying to transfer the storyboard I had done before over to the new one,” he said.

The apparently unfinished work, however, demonstrates M2's skill and prior experience with storyboards. For this reason, he used it as a tool to construct his own reality, rendering every idea into a visual form.

Arranged in a *picture book format*, the work is a visual narrative. Each scene is illustrated to tell its own story and is arranged to correspond with the successive order of the other scenes. The visual details include implicit line directives such as psychic lines. Further, some scenes include an underlying message. A double narrative, for example, was noted in one storyboard scene in which a large wolf was rendered to tower over a small red riding hood figure (see Table 17).

Because each scene had been hand-sketched in permanent black marker, rather than pencil, it is suggested M2 had confidence in his own drawing ability. His former professional training was also evident in the way in which he was able to quickly visualize and render information to appeal to his student audience.

In terms of context, M2 claimed, "The storyboard was fun. The proposal was fine too. I think I have a pretty good idea of what I want to do and the storyboard helped quite a bit."

Concurrent Protocol Analysis For a Montage Task

The concurrent, think aloud protocol analysis presented in this section investigates the different narrative design factors and conditions that influenced each of the participants' content and process thinking during their involvement in a montage task. It demonstrates the results through selected examples and offers a network graph to illustrate the kinds of design reasoning that went into each of the participants' designs. Specifically, this section offers an overview of the elicitation procedures, preprocessing

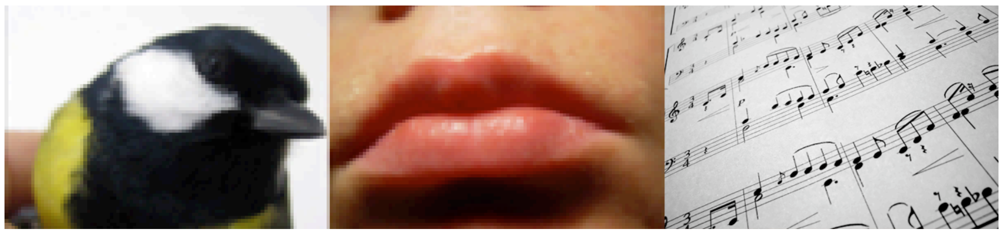
stages, and results of the analytic work, respectively.

In this study, frame is defined as the extent to which the participants attended to the problematic aspects of the design situation. In other words how they attempted to "set its boundaries, select particular things and relations for attention, and impose on the situation a coherence that guides subsequent moves" (Schön, 1988, p. 182). According to Schön (1988) framing can be an ongoing process because designing, in general, creates a sense of awareness of the different design factors and conditions that can affect a particular design situation.

Elicitation procedures. The concurrent protocol sessions were conducted on an individual basis in a private seminar room, adjacent to the traditional classroom (see Figure 1). At the start of each session, the student investigator read the details of the TA protocol; reviewed the tenets of the study and spent a few minutes going over the technical features of the software. The participants were given instructions to verbalize their design thoughts, concurrently, for 15 minutes as they constructed a series of montage equations from well-composed static images. Occasional prompts were given to the participants to continue talking if they paused for more than 10 seconds during the task.

In general, a montage sequence sums up a topic, theme or message and thus, condenses time by displaying short, quick semiotic images (Bordwell & Thompson, 2004) and or sounds (Quigley, 2004). The images are connected (i.e., linked) through the implementation of transitions such as dissolves and fades in an authoring program. As a type of editing, montage "... emphasizes dynamic, often discontinuous, relationships between shots and the juxtaposition of images to create ideas not present in either shot by itself" (Bordwell &

Thompson, 2004, p. 504). An example of a montage equation is offered in Figure 4. Additional information about the montage project can be found in the subsequent montage document analysis section of this chapter.



Bird + Mouth = Sing

Figure 4. A Montage Equation

The technology included a Mac Book Pro computer and the iPhoto and iMovie software applications, developed by Apple Computer. Each of the participants used their own visual representations that were saved to a separate hard drive before the task. This included original representations, generated by the participants, in addition to representations retrieved from image-sharing networks. Image-sharing networks were also used, during the task, to access and retrieve representations.

It should be noted, the protocol session had included a choice of computer platforms and software applications. In addition, the narrative design activity had been introduced two weeks prior to the task in order to give the participants enough time to collect the necessary resources. The introduction to the task included a demonstration of image-sharing networks. This was followed by a demonstration of the software applications 1 week prior to the task.

The procedure included the use of two video cameras and one mobile media player, with an attachable microphone, in order to ensure the data had been recorded for

each session. One camera was positioned to capture the participant's screen actions and the other camera was positioned to capture the participant's articulations, expressions and gestures.

Preprocessing stages. The preprocessing stage of the think aloud protocol session included three parts: (a) transcription, (b) segmentation, and (c) encoding. The transcription stage consisted of downloading the pre-recorded video, from each of the protocol sessions, into a computer and then typesetting the verbalized content into a word processing program. Next, a code sheet was developed based on data observations from each of the videotaped sessions in an effort to underscore the participants' verbal articulations, facial expressions and physical gestures (see Appendix I). Subsequently, the various codes were applied to each of the transcripts in order to further inform the data for this analysis.

The segmentation stage consisted of organizing the transcripts into numbered units based on any indications of a change in a participant's actions, intentions or the "content of their thoughts" (Suwa, Purcell, & Gero, 1998, p. 459). The research on protocol analysis techniques that are oriented toward design studies informed this approach. According to Suwa et al. (1998) a segment can consist of words, phrases or full paragraphs provided that a propositional change has been noted.

Once the foregoing stages of transcription and segmentation had been completed, the numbered units were further decomposed through another technique called encoding. This included refining the categories, from the initial proposal, to identify any unforeseen relationships. It also included revisiting the literatures on constructivist theory, design processes, narrative representations, narrative structures, and multimedia learning

principles. The refinements of data included a review of each videotaped session and transcript.

Cognitive categories. Five cognitive categories were identified including: (a) content area thinking, (b) design thinking, (c) narrative thinking, (d) representational thinking, and (e) technology thinking. These five cognitive categories and the corresponding subcategories, discussed in the subsequent section of this chapter, represent the content and process components used by the participants to frame and reason their way through the narrative design task using constructivist tools and resources.

Content area thinking refers the instructional design based on content area decisions and the theoretical approach to multimedia learning and teaching.

Design thinking refers to design decisions based on goals, strategies and actions (Dorst & Dijkhuis, 1995; Suwa & Tversky, 1997; Schön, 1984).

Narrative thinking refers to the arrangement and selection of signifying units based on diachronic sequencing, visual grammar, and storytelling structures (Abbott, 2004; Bruner, 2002; Chatman, 1978; Kibbey, 2005; Metz, 1974).

Representational thinking refers to the selection and implementation of visual and verbal resources based on aesthetic design elements, design principles, and other subject matter considerations discussed in the storyboard section of this chapter.

Technical thinking refers to physical interactions with the technology (Dick & Carey, 2005), multimedia tools and resources.

Table 20 offers an example of a segmented transcript with encoded categories and subcategories based on a concurrent protocol session with Participant F1.

Table 20

An Example of a Segmented Transcript with Encoded Categories and Subcategories

Transcript segmentation	Categories and subcategories
2. So, I've got my **storyboard** and I'm going to **review it** and basically **check out my plan to figure out where I want to start** with my first **montage**.	*(DT) Reference, (DT) Review, (DT) Project (NT) Montage*
3. So, **I've got one in mind** where I will / I need to find the picture. So, **I want to** / / find the one with the map. That's where I want to start.	*(DT) Idea, (DT) Project*
4. Ok, so, I want to first /. M**y idea is** to kind of start with the beginning **because** this is about Yellowstone and I'm talking about camping at Yellowstone.	*(DT) Idea, (RT) Judgment*
5. I found this really **nice image** of one of the **signs of Yellowstone** National Park. So / and **its at an angle** ~~ where it looks like you're looking into the park. So, I thought that was pretty cool.	*(DT) Judgment (RT) Form, (NT) Shot scale*
6. So then, next, I want to / / / **move it** / lets see / / ~~ Ok, there we go, so I've got my **sign** at the **very beginning** [SB] [turns page].	*(DT) Edit, (RT) Form, (RT) Spatial orientation*
7. Starting at my beginning of the **storyboard**. At the **beginning**, I guess, and I'm going to go **right in, into talking** about **things that people can do recreation-wise** in Yellowstone, tailored to or focused on camping itself.	*(DT) Reference, (RT) Spatial orientation, (DT) Project, (CT) Accessibility*
8. So, I've got some **pictures** of people and different **group dynamics** of **people camping** or **getting things set up** for campsites.	*(RT) Form, (NT) Semiotic meaning, (RT) Form, (RT) Function*

(table continues)

Table 20 *(continued)*.

Transcript segmentation	Categories and subcategories
9. So, I've got **these guys** that are setting up their tent. These three guys. S**o, I think that would be a good one.** And, I'm going to **put these in** and then **organize** them **in the order** that I want them there [ ).	*(RT) Form,* *(DT) Judgment,* *(TT) Import,* *(DT) Edit, (DT) Edit*

Note. Category codes: Content area thinking (CT), design thinking (DT), narrative thinking (NT), representational thinking (RT), and technology thinking (TT). [SB]: Storyboard.

Subcategories. Further data refinements for the concurrent protocol analysis included decomposing each of the five cognitive categories into subcategories and then formulating a definition for each one. The subcategories were developed from data observations of the prerecorded videotapes, transcripts, and references to the literature.

The identification of subcategories involved an iterative process of searching for content and process components across the individual cases. The term *content* refers to the "information, resources and knowledge" used by a participant to solve a design problem in a given design situation (Suwa & Tvertsky, 1997, p. 398). In this way, content also refers to form. Conversely, the term *process* refers to design propositions such as the participants' design ideas and the strategies they used to actively structure and frame the design problem (Dorst & Dijkhuis, 1995; Goldschmidt & Tatsa, 2005; Schön, 1988).

The individual subcategories were also included as a unit of analysis in this research because understanding narrative as a form of representation for multimedia learning and instructional design practice is not constrained to one treatment, formula or purpose. In addition, an individual perspective takes this research one step closer to

describing, with greater accuracy, the role of narrative in multimedia learning due to the meaning it might have for others (see Appendix J).

Table 21 includes the results of the encoded protocol definitions for categories and subcategories for this concurrent think aloud protocol analysis. A narrative multimedia design taxonomy of all protocol activities and associated subcategories are also offered in the appendix of this paper (see Appendix O).

Table 21

Encoded Definitions for the Concurrent Protocol Analysis (Pre-Post)

Category	Subcategories	Definitions
CT	Accessibility	To provide access to the subject matter by addressing the learning needs and interests of a particular student audience.
	Folk term	To include a name, phrase or term that has meaning or value for a particular domain.
	Knowledge acquisition	To dispense information for the learner to add to memory (Mayer, 2005).
	Knowledge construction	To cognitively guide the learner to actively solve a problem (Mayer, 2005).
DT	Edit	To generally arrange, fix, organize, revise or apply an effect to one or more visual and or verbal representation(s).
	Idea	To design, plan for or develop a concept based on what needs to be done.
	Judgment	To assess and then make a decision.
	Project	To communicate a future plan of action.
	Recall	To retrace steps in order to solve a problem.
	Reference	To use a supplementary resource to acquire information (e.g., script and storyboard).
	Review	To check, examine or make an appraisal based on past actions.

(table continues)

Table 21 *(continued)*.

Category	Subcategories	Definitions
DT	Trial and error	To try different approaches in an effort to solve a problem (e.g., discovery learning).
NT	Montage	To refer to or implement a form of editing emphasizing "the relationships between shots and juxtaposition of images to create ideas not present in either shot by itself" (Bordwell & Thompson, 2004, p. 504). Montage also refers to the surface relationships across shots (Kibbey, 2005).
	Narration	To tell a story or part of a story (Abbott, 2004).
	Shot scale (text)	To use the visual composition of a shot to convey narrative information within a scene (e.g., close-up).
	Semiotic meaning	A character or object containing a denotative or connotative "meaning" (Chatman, 1978).
	Space relationship	The "objects, relations and dimensions," shown in a story world (Chatman, 1978, p. 96).
	Time relationship	The action that takes place within a particular time frame of a story.
RT	Feature	An attribute or the style attributed to a visual or verbal form such as color, shape, size, sound, and effects.
	Form	A visual or verbal representation.
	Spatial orientation	The position of an object within a scene or movie.
	Function	"The purpose of the artifact" (Gero & McNeill, 1998, p. 23) such as how it operates to fulfill a need or role (De Vries, 2006).
TT	Application method	To use an application to carry out a particular function for a given task.
	Import	To bring audio, images, text or video into a software application.
	Find	To locate or gather audio, images, text or video.
	Search	To use a search engine to acquire information or access files.
	Technical issue	A real or anticipated technical problem.
	Tool method	To use a tool to perform an action or implement a function (e.g., display images, capture audio).

Note. CT= Content area Thinking, DT=Design Thinking, NT=Narrative Thinking, RT= Representational Thinking, and TT= Technology Thinking.

Results. Table 22 indicates a percentage for each type of cognitive category (i.e., activity) and the number of times a particular type of subcategory (i.e., step) was used by each of the participants during the concurrent protocol session. Dashed lines indicate subcategories that were not reported by the participants. Of the task-related thoughts and design actions that were generated from protocol transcripts, each one represents the cognitive strategies the study participants brought to this phase of the content creation process.

Table 22

Concurrent, Think Aloud Protocol

Categories	Subcategories	F1	F1 %	M1	M1 %	M2	M2 %
CT			11		0		0
	Accessibility	4		-		-	
	Folk term	4		-		-	
	Knowledge acquisition	3		-		-	
	Knowledge construction	1		-		-	
DT			28.4		57.0		51.1
	Edit	4		18		16	
	Idea	6		2		-	
	Judgment	8		15		11	
	Project	7		10		6	
	Recall	2		2		1	
	Reference	2		11		-	
	Review	1		7		9	
	Trial and error	1		4		5	
NT			12.8		5.0		1.1
	Montage	5		3		1	
	Narration	1		1		-	
	Semiotic meaning	3		2		-	
	Space relationship	3		-		-	
	Shot scale	1		-		-	
	Time relationship	1		-		-	
RT			28.4		18.2		14.9
	Feature	-		1		-	
	Form	24		20		14	
	Function	2		1		-	
	Spatial orientation	5		-		-	
			19.3		19.8		32.9
TT	Application method	2		1		2	
	Import	1		4		1	
	Find	3		1		1	
	Search	2		3		-	
	Technical issue	5		6		12	
	Tool method	8		9		15	
Total percent			100		100		100
Total number	Subcategory steps	109		121		94	
Total percent	Category score		100		80.0		80.0

In the section that follows, attention is given to the broader categories and subcategories each of the participants used to organize their knowledge of the montage task. Each one is identified, summarized and arranged by frequency when applicable.

Participant F1. In this protocol session, Participant F1 covered all five of the cognitive activities and incorporated every step into the montage task with the exception of RT, features. In the category of RT, she explored the subject matter of visual forms and the aesthetic qualities of the media. She read, selected and arranged visual representations based on themes related to the park experience. Alternately, in the category of DT, she demonstrated how she made judgments according to the placement of visual representations and narrations. She explained, "I think this should go closer down here, to the end, because then, I'm going to talk about setting up camp . . . "

Participant F1 mainly used the storyboard as a reference base to inform her design decisions. At the beginning of the protocol session, for example, she announced, "I've got my storyboard and I'm going to review it and basically check out my plan to figure out where I want to start with my first montage."

In the category of TT, she spent time acquiring digital images from an image-sharing network and used various tool methods in an effort to download and search for files. When she experienced technical difficulties, such as encountering the small size of digital images, she engaged in guesswork for a short period of time.

In the category of NT, Participant F1 thought about the design of the montage equations. She described the content as "action themes" and "action slides" based on topics such as "rock climbing," fly-fishing" and "setting up camp." Beyond this, she talked about the space relationships of representations. She used terms such as "entry

points," "ties" and "points of prospect," in an effort to describe the way in which she intended for students, "to enter into the content." Her recognition of student needs also extended to the category of CT.

In a few instances, Participant F1 considered accessibility and knowledge acquisition concepts. She explained, "I'm trying to create and idea for a person who is viewing this that this is a place you go and you are going to do something while you are there . . . things people can do recreation-wise tailored to or focused on camping itself."

Participant M1. Participant M1's concurrent report shows he covered four out of five cognitive activities and incorporated 66% of the steps into the montage task. From the beginning of the protocol session, he put his effort into the category of DT, which included addressing both the aesthetic and practical demands of the task. Like Participant F1, Participant M1 used digital resources such as photographs acquired from image-sharing networks. There were differences, however, in the methods he used. For example, Participant M1 combined digital music with photographs and he also developed the narrative structure for the montage equations.

In searching for digital solutions, Participant M1 made judgments regarding the time durations of visual representations and sound quality of verbal representations. On several occasions, he reviewed the visual impact of his graphic editing efforts. Reflecting on his actions, he said, "So, let's see how that picture turned out. That's a pretty big file. Yeah, that's a good picture. So, now, I'm just going to see what it looks like."

More than Participant F1, Participant M1 used a variety of analog and digital devices, as a reference base, to support his understanding of montage. For example, he used the storyboard, written script, and help menu in the software application. In the

category of TT, he demonstrated how he used the help menu to record narrations: "White noise? I don't want any white noise. I'm going to use the "noise reduction" [reading help menu]. So. I'm going to drag the slider to the right to prevent any extra noise."

In the category of RT Participant M1 read the surface features of representations. He attended to aesthetic qualities of the media such as the image resolution and sound quality. Rather than developing subject matter themes like the two other participants, he spent time attending to the visual coherence, stylization, and general harmony among the representations. He explained, "All right, so, I'm just listening and looking at the photos and listening to see if it works combined together."

In the category of NT, Participant M1 reported on his approach to the design of the montage equations. He provided examples of how he used digital photographs of animals and landscapes to represent both story characters and settings. He also reflected on the notion of montage as a visual metaphor. He explained, "It represents the wilderness and life that's around here."

Participant M2. It should be noted at the beginning of the protocol session, Participant M2 experienced difficulty with both the iMovie and iPhoto software applications due to his inexperience with both programs. As a result, he dedicated more than half of his time attempting to resolve technical issues. This may explain why CT was not addressed and NT differed significantly from the two other participants. His interests were mainly centered on discovery learning and he used this approach in order to control and explore the media and work his way through technical issues.

In general, the concurrent report of Participant M2 shows he covered four out of five cognitive activities and incorporated approximately half of the steps into the montage

task. His primarily method of working was focused on DT and he framed the design problem with an emphasis on the structure of representations.

The category of DT was explored in relation to both digital editing and judgments. Like Participant M1, Participant M2 spent time exploring the features of the software such as the timeline and transitions effects. His interests, however, are more technical than aesthetic. This fact leads him to compare the general arrangement, tensions, and flow among representations as a whole for the montage equations. Reflecting on his actions, he said, "All right, so I'll play it through. Here comes the fade-out. It still seems a little abrupt, but it might be okay . . . fade-out. Here we go. That might even still be too long. I think you get the idea without the 10-seconds."

Beyond TT, Participant M2 reported on the category of RT in relation to visual forms. He selected and counted representations. He also used vague descriptions such as "there's four," when referring to the subject matter. As a consequence of this, it was difficult to understand Participant M2's intentions or whether NT and CT had occurred.

Comparisons. Despite variations, in percentages and number of steps across the individual cases, data from the concurrent protocol show higher-level numbers in the participants' use of DT, RT, and TT during the montage task. Specifically, the most widely used categories and subcategories included (a) RT, forms, (b) DT, judgments, and (c) TT, tool methods. Taken as a whole, the findings suggest attention was given to these categories because they represented a larger part of the instructional design curriculum in addition to being an integral part of the narrative conceptual design process. To a certain extent, the participants' prior knowledge of representations, general awareness and understanding were also supported through these interactions.

Although the findings show lower levels of content area thinking and narrative thinking, across the individual cases, it is important to note the problematic nature of a design situation is a nonlinear experience (Lambert et al., 2002; Schön, 1988) even though the method itself is sequential (Ericsson & Simon, 1993). This means, similar to other constructivist activities, no predetermined pathway exists in which to enter into a design situation. It also suggests these activities may have been more difficult to capture and demonstrate given this concurrent STM approach.

The findings also show both F1 and M1 implemented more NT and RT subcategories than M2. It is interesting to note, both of these participants used the storyboard as a reference base at different points in time in order to guide their NT. Thus, this analysis suggests the storyboard was an important resource for them to understand how to approach the montage task and attend to the corresponding narrative content.

From these findings it is clear, each of the participants' were able to frame the content of the montage task, on different levels, following instruction. Consistent with a constructivist learning, the participants' interests, knowledge, use of resources, in addition to the constraints of the design situation affected the extent of their efforts.

Of particular importance, each of the participants experienced technical issues during the task. Specifically, file size, image size, resolution size and the sound quality of digital representations posed difficulties to varying degrees. The participants' lack of prior knowledge in this area became evident during the task. Consequently, this also has important practical implications for understanding the kinds of skills teachers need in order to design narrative instructional presentations successfully.

Verbal protocols. In addition to the cognitive activities, several patterns related to the study participants' verbal protocols during the concurrent design sessions and were added here for comparisons. For example, in their responses to the formal properties of representations and the sensory properties of various media, each of the participants used *referential statements* such as names, idioms, and inferences in an attempt to identify, introduce and or characterize what they were seeing and reading. Subsequently, in their responses to different phases of the design process such as the pre-production phase of ideas and production phase of skills and techniques, each of the participants used *procedural explanations* to provide an indication of what they were doing. Moreover, when faced with design constraints such as computer graphics issues they engaged in *guesswork* also known as *probing*. These and other findings suggest each of the participants actively attempted to construct a design situation that could offer them the ability to organize their knowledge and, in turn, shape the form of the montage equations. The dimensions of their task-related thoughts are exemplified are follows:

Referential statements

Participant F1: I've got some pictures of people and different group dynamics of people camping.

Participant M1: There's a grizzly bear and I'm putting a picture of a grizzly bear inside my montage and see if that picture turns out a lot better than the wolf picture.

Participant M2: So now, I've got all three [images].

Procedural Explanations

Participant F1: Now, I've also got another one in mind later, in my presentation

where I want to talk about what to bring . . . and how to figure out . . . what you need.

Participant M1: Breaking down time that I want the music. Let's try 34-seconds for the music, and . . . now. Let's go back to the screen shot. Let's see, we have 34-seconds so let's try 36 seconds.

Participant M2: Let's put some fade-out in between them [images]. And, let's see what fade-outs look like. So, I'll put two fade-outs there and we'll increase the time. Take it down to, I don't know, 5-seconds and maybe I'll increase the time as the images go on.

Guesswork and or Probing

Participant F1: The problem is, well, let's see. Can I change this to like zero point something? Well, I guess, I'll try. Ok, I think what it was, I clicked on the thumbnail to save them into this file rather then saving the entire picture itself from some of the photo-sharing sites. So, that's probably, okay.

Participant M1: Somehow, I've got good pictures and poor pictures . . . and it downsized the pictures so I might have to go back and make those 6-seconds long.

Participant M2: It's not going to the last image. I wonder why that is? Maybe they all have to be the same type of transition? Let's see what happens now. See, here it goes.

Network Graph of Concurrent Protocol Transcript Links and Segments

The protocol elicitation techniques discussed in this chapter reflect Schön's (1984) conception of the design process as a form of inquiry and artistry involving an active and "reflective conversation with the materials of the situation" (p. 5). According to constructivist theory reflection provides the opportunity to think about one's own actions through the experience of constructing knowledge and meaning (Lambert et al., 2002). This sense of awareness has important consequences for understanding how to interpret new information (Lambert et al., 2002) and, in this research, how to design for instruction.

The representational form of this next analysis is intended to illustrate the reflective, narrative design process as a basis for further understanding the extent of the participants' narrative design knowledge and reasoning following instruction. To achieve this aim, data collected from the concurrent protocol transcripts is presented in a visual form called a linkography or network graph (Goldschmidt & Tatsa, 2005). The method was informed by the work of architects Goldschmidt and Tatsa (2005) and Suwa and Tvertsky (1997) with modifications made to account for narrative multimedia design (see Figure 4). In this research, this representational form is referred to as a network graph. Its design consists of numbered units that are intended to represent the segments from protocol transcripts. In-between each unit, links have been arranged to represent the participants' design reasoning (Goldschmidt & Tatsa, 2005; Goldschmidt & Weil, 1998; Suwa & Tvertsky, 1997). According to Goldschmidt and Weil (1998), links between segments are applied according to the similarity of the "subject matter(s)" that is defined as "the designed entity, its properties and functions" (p. 90).

The segmented units of this network graph have been arranged sequentially and the links function in one of two ways: (a) a segment can link to a preceding segment, or (b) a segment can link to another segment that is positioned at earlier point in time. For example, links move backwards and a segment can link to another segment that has been positioned more than one segment beyond the current one (Goldschmidt & Weil, 1998; Suwa & Tvertsky, 1997). Some segments also constitute independent thoughts. Consequently, an independent segment does not maintain any link(s) with other segments (Goldschmidt & Weil, 1998; Suwa & Tvertsky, 1997). The following descriptions and definitions demonstrate the way in which links and segments function in the network graph.

> *Chunk links* are used to indicate a sequence of continuous segments containing design thought links. Goldschmidt and Weil (1998) proposed the denser the pattern of chunk links, in a network graph, the higher the level of cognitive processing used to solve a design problem. A pattern of chunk links indicates a participant's design reasoning and the links indicate the content of their actions called *moves* (Goldschmidt & Weil, 1998).
>
> *Continuous segment* is used to indicate a continuation of the same subject matter from a previous segment. A small white square, affixed with a number, represents its form.
>
> *New thought segment* is used to indicate the start of new subject matter. A small, black square, affixed with a number represents, its form. A new thought segment is used to represent a new thought, action or content of the participants' thought (AIC). A new thought segment either represents the first segment in a chunk or an

independent segment that is not related to any of the other segments in the network graph.

Dependency link is used to indicate the connection among or between segments. Together the segments form a conceptual relationship that is based on the same subject matter (Goldschmidt & Tatsa, 2005; Suwa & Tvertsky, 1997).

Design thought link is used to indicate the connection among or between continuous segments that is related to the same subject matter.

Narrative dependency link is used to highlight the location and connection among or between segments containing narrative content. It is used to assess the use of narrative content in relation to the other segments in a narrative design task.

Return link is used to indicate a return to subject matter from an earlier point in time. Return links demonstrates the ability to decompose a design problem and continue to work on other areas of a task until connections can be made with preceding links.

Segments 1, 11 and 12 of Participant F1's network graph indicate a return link. Similarly segments 1-11 and 21 of M1's network graph indicate a return link.

Table 23 together with Figure 5 demonstrates the correspondence between transcript segments and represents the model of segments and links that are used in this analysis. Specifically, Table 23 displays the segmented transcript of a concurrent protocol session with Participant F1. Segment 2 of Table 23 corresponds to the new segment 2 of the Figure 5 network graph. Similarly, segments 3-9 of the table correspond to the continuous segments 3-9 of the network graph. The subject matter of each segment is focused on storyboards.

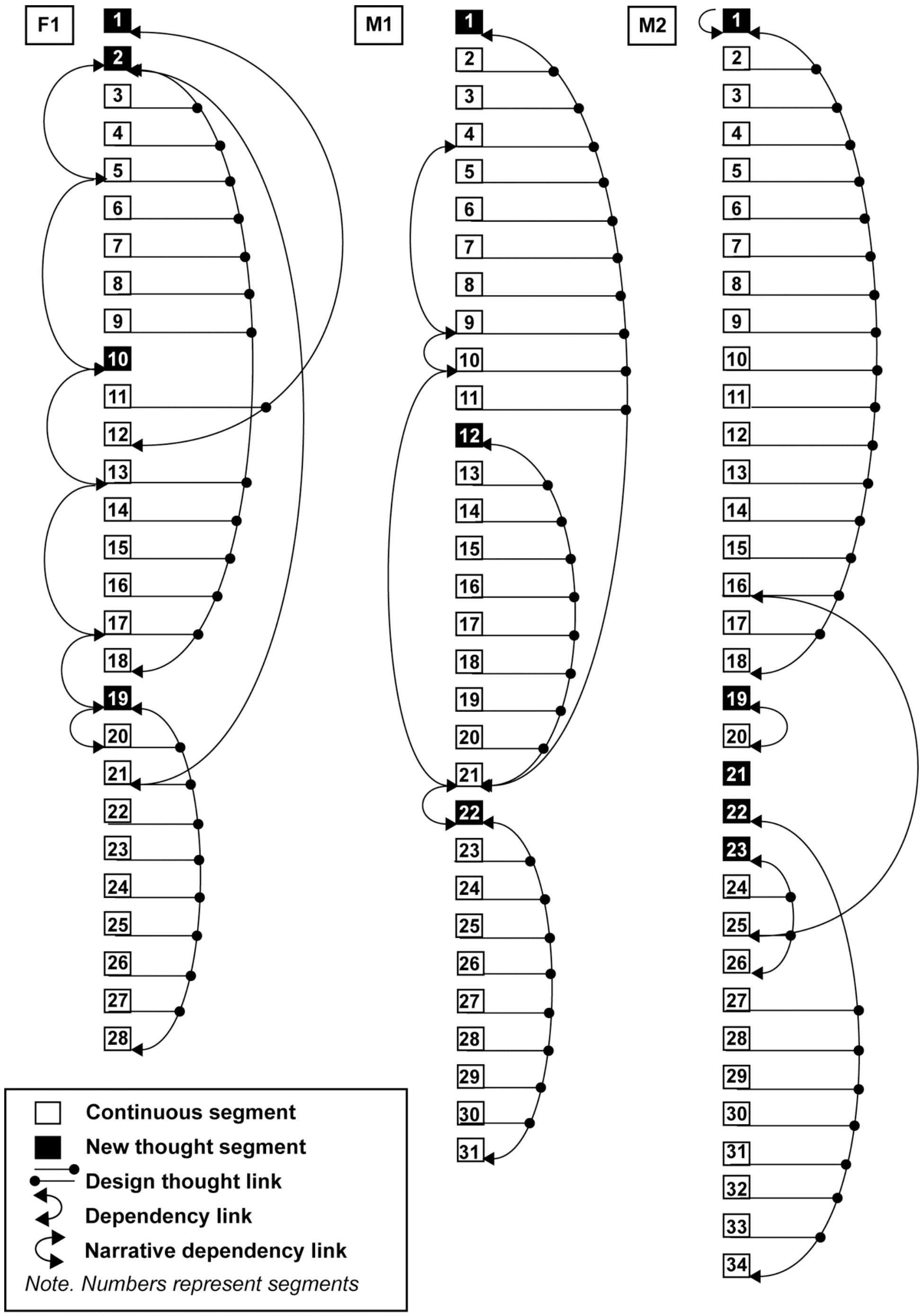


Figure 5. Individual Network Graphs indicating the sequential order of links and segments from a 15-minute concurrent protocol session. Black box numbered segments indicates the start of a new verbalization (i.e., new thought segment), whereas white box numbered units indicate continuous verbalizations (i.e., continuous segments). The various links indicate similarities among or between verbalized thought segments (Goldschmidt & Weil, 1998; Goldschmidt & Tatsa, 2005; Suwa & Tvertsky, 1997; Schön, 1988).

Results. Table 23 presents the percentage of continuous segments (CS) and new thought segments (NTS) assessed across the individual cases for the montage task. The findings show M1 had the highest percentage of continuous segments 90.3% and lowest percentage of new thought segments 9.7% compared to the other two participants. This suggests M1's level of concentration was greater for the duration of the montage task. One reason for this difference can be observed in M1's network graph in which the pattern of CS and NTS are causally connected (see Figure 5). As M1's protocol transcript indicates, each of his NTS started with a design thinking subcategory. For example: [NTS 1, DT, Reference; NTS 12, DT, Review, and NTS 22; DT, Project]. In addition, each subcategory was structured in a logical and sequential way. Hence, it is suggested M1's ability to remain focused on specific aspects of the subject matter, and the kinds of design thinking in which he engaged, may have contributed to his ability to progress throughout the task without deviations. The structural features of his work did not consist of any new independent thought segments (NITS).

The findings for F1 and M2 show similarities in terms of the percentage of CS and NTS when working on the montage task. In contrast to M2, their production of a new independent thought segment (NITS) resulted in the omission of a corresponding continuous segment(s) for one NTS. As their network graph indicates, F1 produced an independent thought segment in unit 10 and M2 produced one in unit 21. In both instances, a technical issue had interfered with their line of reasoning either during or just after the segment. Accordingly, their design intentions were not heeded (see Appendix K). Of equal importance, once F1 and M2 resumed their work, neither one of them reinstated their preceding design intention. Instead, they both attended to new subject

matter content. This suggests NTS is both temporary and susceptible to the conditions of the design situation. Further, NITS is not necessary retained in short-term memory.

Unlike M1, F1 started each NTS by concentrating on different subcategories: [F1: NTS 1, 2, 19; TT, Import, DT, Reference, NT, Montage]. Indeed, from the onset, F1 actively explored the possibilities of the design situation. It is suggested, this approach, may have actually contributed to F1's production of a NITS. It is also interesting to note, similar to M1, M2 also started each NTS with a design thinking category: [M2: NTS 1, 19, 22, 23; DT, Project, DT, Project, DT, Edit, DT, Edit]. In contrast to M1, however, M2's starting segments concentrated on editing for two out of four subcategories. It should also be noted editing is oriented towards the active knowledge construction, whereas reference and review, that entailed the starting segment in M1's work, were oriented towards knowledge acquisition. Consequently, this difference may have contributed to M2's production of one NITS because higher-level cognitive processing was required to perform the task.

Table 23

Indicators of Continuing and New Thought Segments

Segment type	F1 (%)	M1 (%)	M2 (%)
Continuous segments	85.7	90.3	85.3
New thought segments	14.3	9.7	14.7
Total	100	100	100

Table 24 presents the number of both small and large chunk links in addition to return links assessed across the individual cases. The findings show M2 produced three small chunk links and M1 produced three large chunk links during the montage task. As data from the corresponding protocol transcripts indicate, both participants were actively involved in editing procedures.

Taken as a whole, the findings correspond to Goldschmidt and Weil's (1998) theory about the density of chunk links serving as indicators of low or high-level cognitive processing. The larger chunk links are more detailed in comparison to the smaller chunk links based on the work performed during the montage task.

Editing visual and verbal representations, including music and narrations, were employed in the first large chunk link, whereas the importing and placement of visual representations were employed in the smaller chunk link. In addition, the second large chunk link attended to the montage in terms of overlaying characters with sound and interacting with sound settings, whereas the second small chunk link solely attended to editing the time durations for visual representations.

It is suggested M1 was intrinsically motivated to actively interact with the representations and tools in addition to initial concepts of creating an intellectual montage, whereas M2's motivation was to largely aimed at interacting with the tools and representations to acquire technical information.

Table 24 also presents the results for return links based on data collected from the network graphs. The findings show each of the participants used return links when working on the montage task in order to resolve any of their unfinished segments. In particular, F1 had the greatest number of return links (3) compared to the other two

participants. In particular, obtaining missing representations from social networks, amending digital image size problems and building on the montage theme were some of the content-oriented approaches F1 used to work productively on the return links for 1, 11 and 12; 2 and 21; and 9 and 13.

The return links also suggest Participant F1 was able to actively reason and apply former ideas when a new situation arose that related to the representational content. For example, in segment 2, F1 talked about starting the montage sequence with an image of a map. Then, in segment 21, when she worked on an online image-sharing network, she recalled her earlier intention to use a map for the montage sequence and began a search in that regard.

Table 24

Indicators of Chunk Links and Return Links

Segment type	F1	M1	M2
Small chunk links: 2-9	2	-	3
Large chunk links: 10 or more	1	3	1
Return links	3	1	2
Total number	6	4	6

Table 25 presents the percentage of narrative dependency links and task segments assessed across the individual cases for the montage task. Narrative dependency links were shown in 25 % of F1's total montage task segments. This finding shows F1 was able to implement new knowledge about narrative into the montage task following instruction.

As mentioned earlier, F1 framed the design situation by attending to the surface features of the montage to promote audience interests. This putting together of images "like bricks" (Kibbey, 2005) was evident in five out of seven dependency links. Eliciting accounts of F1's work show she was reading the surface features of representations for segments 13 and 17, 19 and 20. She also attended to the aesthetic features for an establishing wide shot in segment 5 and reinforced storyboard ideas in segment 2. Lastly, propositions for the narration was discussed in segment 10.

Table 25

Indicators of Narrative Dependency Links in Relation to Total Montage Segments

Segment type	F1	M1	M2
Narrative dependency links	25.0	16.1	2.9
Task segments	75.0	83.9	97.1
Total	100	100	100

Comparisons of Concurrent Protocol Analysis and Retrospective Protocol Analysis

This section presents the results of the retrospective protocol analysis (i.e., discussion meetings) as a counterpart to the concurrent protocol analysis that was presented previously. The successive elicitation methods were structured to compare the accuracy of verbal thoughts between the two protocol sessions. The aim of this comparative analysis was to allow for a more complete report and general verification of the findings (Ericsson & Simon, 1993).

Elicitation procedures. The retrospective reporting sessions were conducted on an individual basis in order to collect verbal reports of thoughts following the montage

task. The three participants were shown videotapes of their narrative design work from the concurrent design session. They were also asked to recall their design thoughts and actions in relation to the montage task.

The videotapes were used to provide the participants with memory cues and to compare the verbal design thoughts that were reported from both protocol sessions (Ericsson & Simon, 1993). Each of the reporting sessions was videotaped following the same procedures as those used for the concurrent design sessions. The average duration of each reporting session was 30 minutes.

Preprocessing stages. The preprocessing stages of the comparative analysis of concurrent and retrospective verbal protocols involved three steps. First, the video data from the retrospective reporting session was transcribed and segmented following the same procedures as those used for the concurrent protocol analysis.

Second, the encoding scheme from the concurrent protocol transcripts was mapped with the retrospective protocol transcripts in order to identify related categories and subcategories. The mapping procedure was repeated three times over a 14-day period, by one encoder, in order to ensure the categories were accurate. The method was informed by the work of Gero and Tang (2001). Subsequently, the retrospective protocol transcripts were encoded with the former encoding scheme. In addition, the *e-learning* subcategory was identified and added to the CT category of retrospective protocols.

Third, the concurrent protocol transcripts and retrospective protocol transcripts were formatted into an arrangement necessary to make side-by-side comparisons. This involved matching the segments between the two sets of protocol transcripts in order to

identify and evaluate the similarity of meanings and intentions in addition to differences in thoughts and gaps in across each of the transcripts (see Appendix K).

Results. Table 26 shows the percentage of cognitive activities (i.e., categories) for the three participants and for making comparisons between the concurrent verbal protocols and retrospective verbal protocols. The number of concurrent and retrospective transcript segments and number of gaps in the retrospective transcript segments is also indicated. Dashed lines indicate gaps or subcategories that were not used by the participants. A representative selection of transcript segments, from this comparative analysis, is offered in Table 27.

Table 26

Comparisons of Cognitive Categories for the Concurrent and Retrospective Protocols

Categories	F1 *(CP %)*	F1 *(RP %)*	M1 *(CP %)*	M1 *(RP %)*	M2 *(CP %)*	M2 *(RP %)*
CT	11.2	6.3	0	2.9	0	0
DT	29.0	32.6	57.0	37.1	51.1	29.3
NT	10.3	20.0	5.0	10.0	1.1	18.7
RT	29.9	21.1	18.2	20.0	14.9	33.3
TT	19.6	20.1	19.8	30	32.9	18.7
Percent	100	100	100	100	100	100
Total segments	28	23	30	24	34	24
DT gaps	-	-	-	5	-	2
RT gaps	-	-	-	-	-	1
TT gaps	-	5	-	1	-	7
Total gaps	-	5	-	6	-	10

Note. CT=Content area thinking, DT= Design thinking, NT=Narrative thinking, RT=Representational thinking, TT=Technical thinking, CP= Concurrent protocol, RP=Retrospective protocol.

In an attempt to compare the three participants' interactions between the two protocol sessions, and what they were able to recall, the broader cognitive categories are discussed in this section. The percentages of retrospective reports for each type of activity and the number of times a particular type of subcategory (i.e., step) was used by each of the participants is offered in the appendix of this paper (see Appendix L).

In much the same way as the highest percentages of concurrent reports were found in DT, RT and TT, the highest percentages of retrospective reports were found in the same three activities. This suggests each of the three participants was able to recognize and respond to these activities more often when reporting on their narrative design thoughts and actions from the montage task. However, even as they focused on these activities there were gaps in all three of the participants' retrospective reports.

Most of the TT gaps in the reporting of the concurrent protocol sessions were related to tool methods, whereas all of the DT gaps were related to digital editing. Considering all three of the participants' were inexperienced with the technology tools, it is possible the complexity of these interactions interfered with the way in which they encoded the information in STM and, as a consequence of this, it affected their ability to retrieve the information during the retrospective session. One the other hand, the difference between DT in Participant M1 and Participant M2's reports may also indicate they relied on DT more often during the concurrent protocol session than they did during the retrospective session. In other words they focused their efforts on other aspects of the montage task during retrospective session.

In terms of the similarities between the two protocol sessions, the retrospective report of Participant F1 appeared to be logically connected to her concurrent report. She

was able to recall a high percentage of her task-related thoughts and generally stated her ideas for the montage equations. In comparison, the retrospective reports of Participant M1 and Participant M2 often consisted of new information that was related to the tacit dimensions of their task-related concurrent activities. Thinking about the rule of thirds, syntagmas and metaphors are some of the activities they reported on. As a consequence of this, there were more variations in the reporting of their task-related activities between the two protocol sessions.

In terms of differences, NT was significantly greater for the retrospective sessions than the concurrent sessions. This means, to a certain extent, the mediating aspects of NT did not fully translate into the three participants' task-related thoughts during concurrent sessions. As a short-term memory (STM) method, paired with a think-aloud protocol, the concurrent sessions were found to be effective in eliciting a direct apprehension of the participants' narrative design activity, but not the subtle effects of their thoughts and perceptions. The retrospective sessions had in this way been important for exposing a wider range of NT activities including how the participants intended for their montage equations to operate. In particular, each of the participants' reported on certain aspects of NT such as forms of signification that were not observed in concurrent protocol reports. An intellectual montage, for example, was articulated in the corresponding protocol segments from the transcripts of Participant M2, as shown in Table 27. Further, Participant M2's NT was equal to his TT.

Similar to the concurrent sessions, CT was reported less often during the retrospectives sessions. In this respect, it continued to be treated as a subordinate activity. There were also differences in the reporting of CT. Participant F1, for example used CT

less often, whereas Participant M1 reported on CT for the first time. It should be noted, both of the participants reported on student accessibility and multimedia learning concepts.

Taken as a whole, the comparisons of protocol transcripts provide evidence, the participants were able to recognize many of their task-related thoughts and offer new information related to the montage task during the retrospective protocol sessions (see Appendix K). In this respect, the retrospective session had provided another means for understanding the participants' narrative design thoughts and actions. Although the concurrent method had been effective in capturing the sequence of design thoughts, it was limited in capturing the subtle dimensions of the participants' narrative design thinking. As noted by Ericsson and Simon (1993) this comparative analysis allowed for a more complete report of thoughts and also provided insight into the interactions between the two protocol sessions.

Corresponding NT segments from protocol transcripts. As shown in Table 27 the transcript segments from the two protocol sessions shows certain broad parallels between the arrangements of representations in each of the participants' reports. However, new information, such as the tacit dimensions of NT in Participant M2's report, did not become apparent until the reporting session.

Table 27

Selected Examples of Transcript Segments from the Two Protocol Sessions

	Concurrent protocol session	Retrospective protocol session
F1	Now, I've also got another one in mind later, in my presentation where I want to talk about what to bring basically and how to figure out how what you need and whatever it is that you need to bring.	I knew that I wanted to put those images in or find images to convey that message . . . that people in your group, plus location and the things you want do dictates what you are going to bring.
M1	All right, so, I'm just listening. Looking at the photos and listening to see if it works, combined together, and it's interesting seeing the pictures go in and out . . . but I don't know if I want it to go like that. I'm going to have to change that.	And, I was going to change that in and out. So, I didn't know if that would work or not . . . And I was also trying to think about all of the issues that we learned about in class . . . Like the thirds issue. And then the eye-levels. You know of the animals. You wanted them the same because, you don't want the eyes to look at the picture here and then the next shots over here . . .
M2	I'm down there. Let me see if I've got it this time. I'm going to call it four . . . four is an image of that one. All right, maybe it's around here someplace. Ah, there's five and six. So, we didn't, ah, there it is. Ok, so I'll see if I can just delete those two. All right. There are my images.	That was my first set. So, I kind of wanted to have three images that tied into each other. So, I had a wolf and World War Two trenches, which is kind of a metaphor for just war and conflict, and the wolf kind of ties in with that.

Componential Analysis for the Montage Equations

In this section, the results of the componential analysis are presented using cross-case comparisons based on data collection practices associated with qualitative case study research. The componential analysis was used to identify, analyze and interpret the *attributes* of the three participants' montage documents and also to develop a paradigm based on the information. In the text that follows, the montage task for his study is summarized and the steps involved in the development of the componential analysis are provided. Subsequently, the results are reported.

The task. The montage task was designed to extend what had begun earlier during the concurrent protocol sessions. The objective was for the three participants to approach the design work with an understanding of the intellectual and textual meanings that could be achieved through an arrangement of representations. They were told to experiment and to develop one or more of the three montage equations for the final narrative instructional presentation.

Project specifications included the following steps:

1. Create a sequence of three montage equations in the iMovie program from well-composed static images (your own or from other sources).
2. Include 10-seconds of black at the beginning and end of the montage movie.
3. Crop and arrange simple and complex shots in the timeline.
4. Apply dissolves and fades to connect the images.
5. Include readable titles for the intro, montage equations and credits.
6. Attend to the visual grammar and compositional elements in the arrangement of shots.

The process. Spradley's (1980) cyclical model for conducting an ethnographic study was used to collect and analyze data for the componential analysis. The method included four steps that are summarized as follows:

First, a domain analysis was conducted using descriptive and focused observations of documents in order to search for patterns across the individual cases and to develop a domain list as suggested by Spradely (1980). The triangulation of data included (a) the three participants' montage equations, (b) interview transcripts, (c) self-grade sheets, (d) protocol reports, and (e) literature related to the history of film and cinematic semiotics. The coding scheme, described in chapter three, was used to identify analytic terms from the review of documents. Semantic relationships such as cause-effects and parts of montage equations were identified using structural questions. A domain list was developed and mapped with the visual frames of the three participants' montage equations, and literature, in order to check for the accuracy of these interpretations.

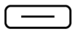
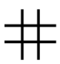
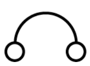
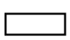
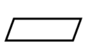
Second, a montage equation descriptive text document was developed using focused observations of the three participants' montage equations as a means of identifying additional included terms in the cultural domain (see Appendix L). Interpretations such as meanings, transitions and substitutions were organized into taxonomy of parts and verified with data collected from follow-up interviews with each of the participants to ensure the accuracy of the taxonomy. Next, a card sorting activity was used (Spradley, 1980) in order to identify similarities and contrasts in the domain using contrast questions. Then further refinements were made to the taxonomy.

Third, a narrower focus was undertaken to search for attributes for the componential analysis. The process entailed further refinements to the taxonomy in addition to selective observations of documents. As a result, eight attributes related to the domain of montage equations were identified. According to Spradley (1980) attributes constitute “units of meaning” that can be seen together in a paradigm and represent the “dimensions of contrast” in a cultural domain (p. 131). Each dimension of contrast is made up of two or more parts (Spradley, 1980). In film theory, for example, a fundamental part of cinematic framing is called a shot. In this study, wide shots, close-ups, and mid-shots represent attributes. When grouped together they represent the dimensions of contrasts for the cultural domain of montage equations.

Fourth, the attributes of montage were entered into a cross-case paradigm (see Table 29) and descriptions of the cultural domain were developed. In addition, the attributes of the cultural domain of montage equations were defined. To assist the reader in understanding what was done, a list of definitions was further developed (see Table 28).

Table 28

Coding Scheme for Montage Equations

Codes	Topic	Indicated for
	Bracket sytagma	Connects sytagmas through transitions such as dissolves, fades, swipes and pans (Metz, 1974).
	Discontinued sytagma	The end of a sytagmatic sequence.
	Indice/index	A natural sign that points to something.
	Iconic legisigns	" . . . (diagrams or cartoons—abstracted from real appearances, but still perceived as resembling some real thing)" (Pierce 1960, as cited in Manning, 1998, p. 66).
	Iconic sinsigns	" . . . (realistic images resembling actual things, like a photograph or a realist painting) . . ." (Pierce 1960, as cited in Manning, 1998, p. 66).
	Logo	A graphic used to represent a person, place or thing.
	Intellectual montage and hybrid intellectual montage	Contrasting shots. The "...relationships between shots and the juxtaposition of images to create ideas not present in either shot by itself" (Bordwell & Thompson, 2004). H. Intellectual refers to a hybrid montage.
	Kuleshov effect	The arrangement of two shots to convey a third meaning that is not present in either shot by itself.
	Rule of thirds	Well-composed shots that require less screen time to cognitively process the information.
	Montage of attractions	Images that are put together "like bricks" (Kibbey, 2005). The surface information of images are interpreted.
	Paradigm	Paradigms operate on the vertical axis in a multimedia presentation to convey either denotative or connotative meanings. Icons, symbols and indices operate on the paradigmatic level (Metz, 1974).
	Sytagm	Sytagms operate on a horizontal axis in a multimedia presentation. The categories are used for editing to convey meaning through either space or time relationships or the linking of shots. Montage operates on the sytagmatic level (Metz, 1974).
	Title card	Introductory title, credit or exemplary text that is used to link the different parts of a synchronic presentation.
	Text Label	Text that is positioned on an area of a representation to describe a montage concept.

(table continues)

Table 28 *(continued).*

Codes	Topic	Indicated for
C G P T V	Representations	Verbal and visual images indicated by the first letter such as C for credits, G for graphics, P for photographs, T for text, and V for video.
CU, EC, WS, MS	Shot scale	The composition of a shot within a frame. The standard measurement is based on human anatomy. CU for Close-up, EC for Extreme close-up, WS for Wide shot, MS for Mid-shot. A close-up takes less time to interpret. A wide-shot takes more time to interpret.

Note. (Metz 1974, p. 126; Kibbey, 2005; Bordwell & Thompson, 2004; Manning, 1998; Monaco, 2000, p. 177).

The fifth stage of data analysis involved developing a visual code sheet. Similar to the storyboard analysis, the overall intent was to represent the project specifications for both the design and development of the visual document in order to make visual cross-case comparisons possible (see Figure 6). In addition to depicting the annotations and compositional elements, the visual grammars consistent with what Metz (1974) called "the semiotics of the cinema—montage, camera movements, scale of the shots, relationships between image and speech, sequences, and other large syntagmatic units . . ." (p. 94) were subsequently rendered as iconic representations.

The objective of analyzing the completed montage documents was to shift the focus away from the design process back to the development of the narrative design products that began with the storyboard document analysis. Although, the protocols from the two protocol sessions were considered an important resource for the development of the componential analysis, it only represented only one part of the larger context of the research.

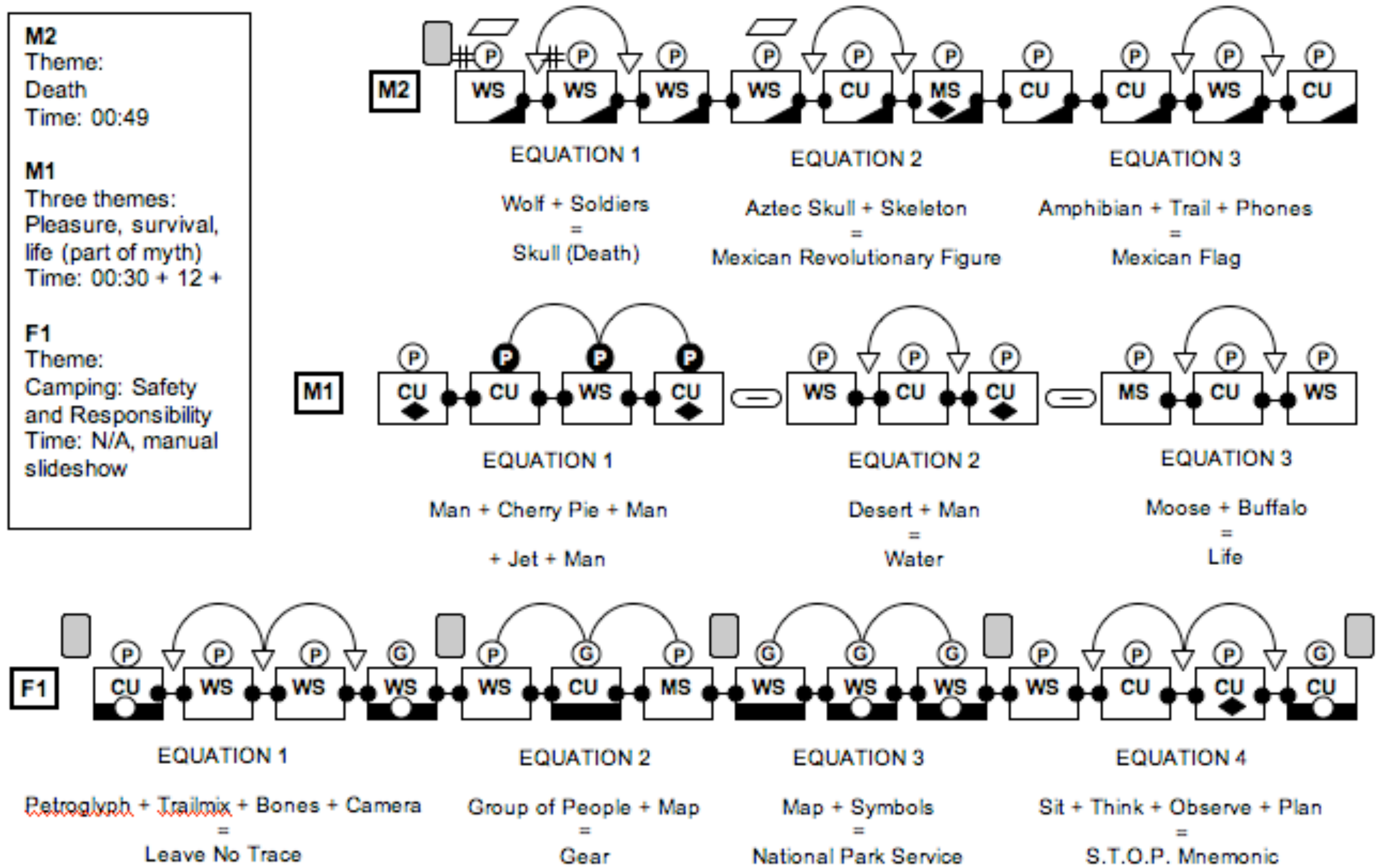


Figure 6. Visual Document from the Montage Analysis

Results. Table 29 provides a paradigm of attributes from the taxonomic and componential analysis of montage equations with an emphasis on one of the montage equations each of the participants developed at this stage of the content creation process. In the following report, both the formal elements and semiotic qualities of the montage equations are described based the system of relationships (i.e., axes) the three participants recognized. In an effort to provide further insight into these findings, first person accounts are also offered.

Table 29

Componential Analysis: Categories of a Montage Presentation

Domain	Dimensions of Contrast		
	F1	M1	M2
Montage Equation 1A			
Axes	two	two	two
Special FX	no	no	yes
Kuleshov effect:	no	yes	no
Montage type	h. intellectual	intellectual	intellectual
Logical linking	contrast	contrast	contrast
Type of shot	close-up	mid-shot	wide-shot
Type of icon	iconic sinsign	iconic sinsign	iconic sinsign
Image quality:	good	good	good
Composition:	asymmetrical	asymmetrical	asymmetrical
Rule of thirds:	yes	yes	yes
Theme	leave no trace	life	death
Montage Equation 1B			
Axes	two	two	two
Special FX	no	no	no
Kuleshov effect:	no	no	no
Montage type	h. intellectual	intellectual	intellectual
Logical linking	contrast	contrast	contrast
Type of shot	wide-shot	close-up	wide-shot
Type of icon	iconic legisign	iconic sinsign	iconic sinsign
Image quality:	some pixilation	good	good
Composition:	symmetrical	asymmetrical	asymmetrical
Rule of thirds:	no	yes	yes
Theme	leave no trace	life	death
Montage Equation 1C			
Axes	two	two	two
Special FX	no	no	no
Kuleshov effect:	no	no	no
Montage type	h. intellectual	intellectual	intellectual
Logical linking	contrast	contrast	contrast
Type of shot	wide-shot	wide-shot	wide-shot
Type of icon	iconic legisign	iconic sinsign	iconic sinsign
Image quality:	Pixilated	good	good
Composition:	symmetrical	asymmetrical	asymmetrical
Rule of thirds:	none	yes	yes
Theme	leave no trace	life	death

Participant F1. Participant F1's montage "Park Safety and Park Responsibility," demonstrates an understanding of the two axes that are related to the history of film and semiotics of cinema (Metz, 1974). Her approach was based on communicating visual and textual information in both connotative and denotative ways.

The montage equation, referred to as *Petroglyphs + Bones + Trail Mix +Camera = Leave No Trace,* was designed to raise learners' awareness about the cultural and natural resources of Yellowstone National Park as part of a preservation effort. Her visual document shows she used several legisigns as a means to communicate the notion of sacred objects [petroglyphs], life and death [bones], food for scavengers [trail mix] in addition to how to document one's visit without disturbing the park's natural resources [camera]. One sinsign, in the form of a logo, was also used to communicate what she called the "leave no trace principle."

One of the unique features of this series of montage equations was Participant F1's use of title cards. The title card methodology is rooted in the history of silent films and was used as a means to support audience understanding when the viewing experience could not be supported by visuals alone (Van Leeuween, 2005). In an effort to facilitate this mode of communication, and support learners' understanding, Participant F1 positioned textual descriptions, intermittently, throughout the montage presentation. As a result, the title cards serve as indexical objects, functioning as signposts to guide the learner through the visual information.

The Leave No Trace montage also represents a hybrid intellectual montage. This means the design is devoid of both metric and rhythmic elements as a consequence of the slide show format Participant F1 used.

One of the patterns that emerged in this study was Participant F1's tendency to think about representations in a synchronic way as opposed to diachronic way. As a consequence of this, the design of the montage equations was problematic because she had not considered the effect on learners. The fact that she provided manual controls for learners to move through the content suggests she had not come to fully appreciate the effects or purpose of an intellectual montage. In other ways too, the use of two wide-shots and pixilation meant additional constraints, as learners will require more time to read and decode the information. Why did Participant F1 do this?

Part of the problem was Participant F1 was not sure if she understood the concept of montage and this may have affected the attention she gave to other areas of the task. On a few occasions, she tried to make sense of the situation. For example, she asked, "Its part plus part equals whole. Right?" "Oh, its like, I'm preparing for a back country camping trip . . . so I have a picture of a map and the number of people make a difference in the amount of equipment you are going to bring. Is that a montage? Or no? Not necessarily? In spite of her uncertainty, Participant F1 remained committed to understanding how to design with representations. In fact, on the narrative web log, at the end of the project, she wrote:

> My effort on this project is directly related to the steep learning curve I underwent to complete it. Before completing this project, I knew next to nothing about the complexities involved with montage. Because of this I worked very hard to apply all that I have learned about narrative, film theory, and visual grammar as well as other components of design presented and discussed in class (contiguity, etc.).

Participant M1. Like Participant F1, Participant M1's montage titled "Life" shows the use of both axes. The montage equations in this series, however, were designed in two different ways. The first montage, for example, is rooted in the work of Lev Vladimirovich Kuleshov, a Russian filmmaker and theorist who translated some of the concepts that were initially conceived by the American filmmaker D.W. Griffith during the silent film era. The result is a juxtaposition of montage effects. By contrast, the second and third sets of montage equations are rooted in the work of Sergei Eisenstein, another Russian filmmaker, who was a student of Kuleshov and went on to develop what is described here as an intellectual montage. In this regard, Participant M1 used sinsigns to demonstrate how the meaning of any one shot is contextual and how the juxtaposition of related shots can be used to convey a concept (Bordwell & Thompson, 2004).

Moose + Buffalo = Life represents one of the montage equations Participant M1 developed as an intellectual montage. The first scene shows an image of a moose submerged in a riverbed. The moose is intended to symbolize life and the region's ecosystem. The next scene shows an image of the buffalo made up of mass, muscle, texture and color. As creatures of the earth, both animals rely on natural resources such as the riverbed that is shown in its entirety in the last scene of this montage.

Similar to the way in which Participant M1 challenged the storyboard project, he questioned the necessity of learning about montage. "Montage, I just, I don't, know if this is great background knowledge and how worthwhile it is to think about what you are doing especially if you want to go into tech leadership," he explained. Although his work showed a high level of sophistication, like Participant F1, Participant M1 also struggled with the concept of montage:

I'm not sure I exactly understand the concept of a montage yet. So maybe its used more often then I realize it. Or, maybe, I'm not just understanding the concept of what a montage is and so you have a shot from here and you have a shot from here and you have a totally unrelated shot and it still fits with the two previously related shots. You get A + B = AB?

Participant M2. In this series of montage equations, Participant M1 used "Death" as a resounding theme to logically link the montage equations and also to allow viewers to transition visually and emotionally from one sinsign to the next. The series of visual relationships are based on both animal and human behaviors. Like Participant M1, the work shows the influence of Eisenstein.

The montage, *Wolf + Soldiers = Skull (Death)* was designed as an intellectual montage. The opening scene depicts an image of a wolf frozen in space and time. A sense of movement is conveyed through the subject legs that are positioned forward in the frame. In the next scene, ten soldiers are seen standing guard in a dirt trench. They are wearing gas masks and protective helmets. Tension is created throughout this composition by the successive use of overlapping bodies. Each soldier is positioned to advance forward at a moments notice. Both scenes show predatory animals and suggest death. The last scene shows a photograph of a human skull that is composed of white sand. The skull is positioned diagonally within the frame. To the left, is a wide shadow, filling an empty area of this form. Here and there, patches of shadow are interwoven with sunlight. The effect is an aesthetically pleasing contrast in what is otherwise considered a very morbid scene.

With the potential for creativity, Participant M2 was motivated to complete this project. He juxtaposed shots and used transition effects without hesitation. In the same way Participant F1 used title cards to reinforce concepts, Participant M2 used an array of associational forms to repeat the message of death. Interestingly, none of the montage equations were intended to be included in the final narrative. Instead, Participant M2 treated the work as an intellectual exercise. He explained it this way:

> I wanted to have a couple of slides transition from one theme into another. And, I wanted to transition three times because there was supposed to be nine slides. So, there are sets of three, which I think you wanted anyway. I wanted them to kind of tie into each other so the last slide, or the last set, would feed into what happened in the next.

Just as professional writers are capable of expressing concepts in a few words, Participant M2 is capable of expressing visual concepts with the same sort of natural ability.

Retrospective Protocol Analysis for the Narrative Task

The following section presents a general overview of the elicitation procedures, preprocessing stages and the results of the analytic work from the retrospective reporting sessions. In an effort to determine the differences in design reasoning, across the individual cases, the results of network graphs are also discussed.

Elicitation procedures. The retrospective protocol analysis for the narrative task included a design session *without* verbal protocols and a reporting session *with* verbal protocols. One design session was conducted within the context of the natural classroom

with the other teachers present and engaged in the same activity. By contrast, the reporting sessions were conducted in a private seminar room on an individual basis.

The narrative task was designed to reflect the initial phase of production for the narrative instructional presentation. The specifications were introduced during a previous class session and the related instructional materials were distributed to all of the teachers on a DVD. The teachers were also told to collect and save digital representations to a separate drive for the narrative task.

At the start of the design session, the participants were given instructions to work on the initial phase of the narrative instructional presentation without verbal protocols. The technology included a Mac Book Pro computer and the iPhoto and iMovie software applications, developed by Apple Computer. In addition to these resources, Participant F1 used the PowerPoint application, developed by Microsoft Windows, to edit images and Participant M2 used the PowerPoint application for the entire design session. They also used image-sharing networks to access and retrieve additional representations. As mentioned earlier, all of the teachers had been given a choice of computer platforms and applications before the task began. The duration of the design session was 30 minutes.

During the retrospective reporting session, each of the participants reviewed the videotape of their narrative design work from the design session and reported the results of their thoughts. Without the support of verbal protocols, the reporting sessions represented a conscious effort, on the part of each participant, to reflect upon their prior content decisions, perceptions and reasoning strategies (Ericsson & Simon, 1993; Suwa & Tversky, 1997). The duration of each reporting session was 30 minutes.

Preprocessing stages. Data collection methods and techniques followed the same procedures as those used for the concurrent protocol analysis. This included transcription and segmentation. As part of this process, one encoder mapped the encoding scheme from the concurrent protocol transcripts with the retrospective protocol transcripts (Ericsson & Simon, 1993). The encoding scheme was mapped five times over a 14-day period. With the exception of three new subcategories that were identified and added to retrospective protocols (see Table 30) the encoding scheme was found to be congruent between the two types of protocols. For inter-rater reliability, two coders evaluated the protocol segments, resulting in an 83% agreement.

Table 30

Additional Encoded Protocol Definitions for Retrospective Protocols (Pre-Post)

Category	Subcategories	Definitions
DT	Construct	To build or exploit representation(s).
NT	Agent/Existent	A character (Laurel, 1993) or object in the story setting that "performs a plot-significant action" (Chatman, 1978, p. 32). Agents respond to events and perform certain roles to make things happen in a story.
	Event	Indications of an act, action or happening (Abbott, 2004; Chatman, 1978) that is used to demonstrate a cause and effect.

Results. Table 31 indicates a percentage for each type of category (i.e., activity) and the number of times a particular type of subcategory (i.e., step) was used by each of the participants during the retrospective protocol session. Dashed lines indicate subcategories that were not used by the participants. In the subsequent section, the broader use of categories and subcategories are described in relation to selected examples. The aim was to understand to what extent the three participants were able to recognize their design performance following the concurrent design session. Several findings related to each of the participants' prior knowledge of representations, technical skills and new understanding of visual narratives.

Table 31

Retrospective Protocols for the Three Participants for the Narrative Task

Categories	Subcategories	F1	F1 %	M1	M1 %	M2	M2 %
CT			7.4		11		8.1
	Accessibility	3		5		3	
	e-learning principle	2		-		-	
	Folk term	3		1		-	
	Knowledge acquisition	-		3		2	
	Knowledge construction	1		2		1	
	Prior knowledge	-		1		-	
DT			22.3		34		31.1
	Construct	3		1		3	
	Edit	9		9		8	
	Idea	3		8		2	
	Judgment	8		9		8	
	Project	-		1		1	
	Recall	1		-		-	
	Reference	3		6		-	
	Review	-		-		1	
	Trial and error	-		3		-	
NT			9.1		12.8		1.4
	Event	1		1		-	
	Agent/Existent	-		3		-	
	Narration	-		3		1	
	Montage	4		1		-	
	Space relationship	-		1		-	
	Semiotic meaning	5		5		-	
	Shot scale	1		-		-	
RT			29.0		26.6		35.1
	Feature	3		3		-	
	Form (Representation)	21		15		13	
	Function	5		10		11	
	Spatial orientation	6		1		2	
TT			32.2		15.6		24.3
	Application method	4		2		5	
	Import	5		5		3	
	Find	7		1		-	
	Search	5		-		1	
	Technical issue	10		5		6	
	Tool method	8		4		3	
Total percent			100		100		100
Total number	Subcategory steps	118		109		74	
Total percent	Categories implemented		100		100		100

Participant F1. Participant F1's retrospective report shows she recalled all five of the cognitive categories and recognized 75% percent of the steps involved in the narrative task. She spent most of the protocol session reporting on the results of her RT (29%) and TT (32.2%) interactions.

In the category of RT, Participant F1 recalled how she read and selected visual representations based on the subject matter, composition, surface features, image size, and the way in which the aesthetic qualities might be perceived. She also considered the conceptual meanings and spatial relationships among representations: "I remember thinking, it's a good picture because it fits in here but, it's also kind of messy, which is not part of the leave no trace message I was trying to convey."

In the category of TT, Participant F1 recalled the procedures and strategies she used in an attempt to operate the digital tools and also to control the qualities of digital media. On a few occasions, she explained how she substituted one tool method or file format for another, particularly when she experienced technical difficulties: "And now, I'm looking for the last . . . compass image, but I saved it as a gif file instead of a jpeg so it wasn't registering. So I went back to try and find another compass" [image]."

In the category of DT, Participant F1 described how she created a graphic mnemonic using the PPT application to crop, "size," and "line up words" with images. She also recalled how she studied the design and layout of professional work in an attempt to apply similar features in the design of her own work: "I took a page from your book. I liked how in a lot of your presentations, you had the images on the side and the words on the right or left of the images, corresponding images."

In the NT category, Participant F1 recalled how she read, adapted and developed visual concepts based on the semiotic meanings across multiple representations. She used digital photographs of “people sitting,” “the brain” an “eyeball” and a “compass with a map” [sit, think, observe and plan] to communicate the concept of park safety. She also used digital photographs of camping “gear” to communicate the “concept of what to bring” on a camping trip.

In the category of CT, Participant F1 explained how the design of the graphic mnemonic was intended to serve as a learning aid and how the instructional design was intended to promote knowledge acquisition, knowledge construction, and accessibility concepts.

Participant M1. The retrospective report of Participant M1 shows he recalled all five of the cognitive activities and recognized 84% of the steps involved in the narrative task. For most of the protocol session he reported on the results of his DT (34%) and RT (26.6%) interactions.

In the category of RT, Participant M1 recalled how he read and selected representations based on the aesthetic qualities of the media and subject matter information. Additionally, he arranged multiple representations based on the stylistic features and associational form. Similar to the concurrent protocol session, he talked about maintaining the relative harmony and visual consistency among visual forms: “Right here I’m adding pictures of the characters that I had in the narrative part. So I’m adding the buffalo . . . I tried to keep the same kind of picture with the buffalo and the grandfather.”

In the category of DT, Participant M1 showed some of the graphic editing techniques and methods he used to design the presentation. In a few instances, he pointed out how he reviewed both the storyboard and script before importing any of the digital media files into the iPhoto and iMovie programs. He also explained how he considered the synchronization of digital media files: “I would usually guess a time for the narration. So I would make a picture go for that long and then I would put the narration in there.”

In terms of designing the entry points for the various agent/existents, Participant M1 explained, “One thing I did do when I was thinking through this, . . . was to try to theme music. Like when a certain character would come along, it would be a different music. So I had the buffalo theme and the boy theme and the grandfather theme music.”

In the category of NT, Participant M1 recalled almost every narrative step. He explained how he further developed humor by including the celebrity agents from the storyboard and theme music for the introduction and end of the presentation. Commenting on the latter idea, he said he wanted “to help the narrative out.” In addition to serving as entry cues for the various agent/existents, the music was intended to serve as a semiotic mechanism to arouse student emotions and interests. To a certain extent then, the music cues, humor and stylization effects all played a part in the category of CT. Like Participant F1, the instructional design was intended to promote accessibility, knowledge acquisition and knowledge construction concepts. The presentation was also designed as a “self-guided teaching tool.”

Participant M2. The retrospective report of Participant M2 shows he recalled all five of the cognitive categories and recognized 44% percent of the steps involved in the

narrative task. For most of the protocol session, he reported on the results of his DT (31.1%) and RT (35.1%) interactions.

In the category of RT Participant M2 recalled how he read, selected and organized visual representations around subject matter themes related to the animals and environment of Yellowstone National Park. The forms and figures are realistic, colorful, logically connected and well-balanced compositions. Likewise, there are no messages, hidden meanings, or abstractions of any kind.

In the category of DT, Participant M2 recalled how he interacted with digital photographs and inserted "transitions slides," "blank slides," and sound files into the PPT application. On a few occasions, he also explained how he designed text arrangements such as captions, credit lines and title slides in order "to get it all spaced in right."

In the category of TT, he responded to the visual impact of the presentation. He pointed out how he was primarily concerned with developing the technical aspects of the work such as tension between images, overall unity and also wanted "to see how it [the total form] was flowing." "Just seeing how the slides are going. . . . Just if something awkward that doesn't seem . . . like if I had an animal picture mixed up with the pictures of the environment that would be something to catch."

In the category of CT, Participant M2 emphasized his teaching style and needs as an art teacher. He explained, he was more concerned with teaching the art of learning to see visual information. The presentation, he said, was designed as a reference base " . . . to show to a class that does a Yellowstone drawing assignment. So, they have an idea of the sort of things they could draw in a picture."

Although Participant M2 addressed all five of the cognitive categories during the protocol session, the category of NT represented the lowest level among the participants. Other then mentioning why he recorded the narration without writing a script, to avoid sounding "mundane," and "monotone," and also referring to the Yellowstone animals as "characters" there was little indication Participant M2 had considered any of the narrative elements during the narrative task.

Comparisons. Despite the variations, in percentages and number of steps across the individual cases, data from the retrospective protocols continued to show the highest percentages in the categories of DT, RT and TT for the narrative design task. The three participants used these activities as a starting point in order in order to make associations and connections with CT and NT. As part of this process, they engaged in digital editing and reported on the informational, perceptual and stylistic qualities of their design work.

There were differences in NT that appeared to reflect the instructional method. In particular, both Participant M1 and Participant F1 designed the presentation as a learning tool, whereas Participant M2 designed the presentation as an introduction to a multimodal lesson. Because the latter approach included social forms of cognition that went beyond the immediacy of the narrative design task, certain aspects of NT were not recognized. This may explain why there was a difference in Participant M2's NT compared to the two other participants.

The influence of prior knowledge was observed in relation to all of the participants' interactions with the technology tools and control of the qualities of the media. For instance, Participant F1 read and arranged representations according to the visual properties; Participant M1 composed, synchronized and arranged music, and Participant

M1 concentrated on the total form of the artwork. Moreover, the fact that both Participant F1 and Participant M2 decided to use the PowerPoint application, instead of the video editing tools during the task also indicates they used their prior knowledge. Lack of time to learn a new skill and access to the software were some of the reasons Participant F1 and Participant M2 gave for using these methods. It is suggested the course curriculum and classroom activities may have also influenced their decision to resort to familiar forms of technology.

It should also be noted, throughout this analysis, working with digital representations continued to be problematic. As previously mentioned, there was still little understanding of how to appropriately download images in the correct resolutions, image sizes, or file formats.

Retrospective Network Graphs of the Three Participants for the Narrative Task

In this next section, the retrospective network graphs of the three participants are used to compare their narrative design activity based on their report of the design session. The three teachers showed differences in their ability to recognize their design work and they used different strategies in order to compensate for it.

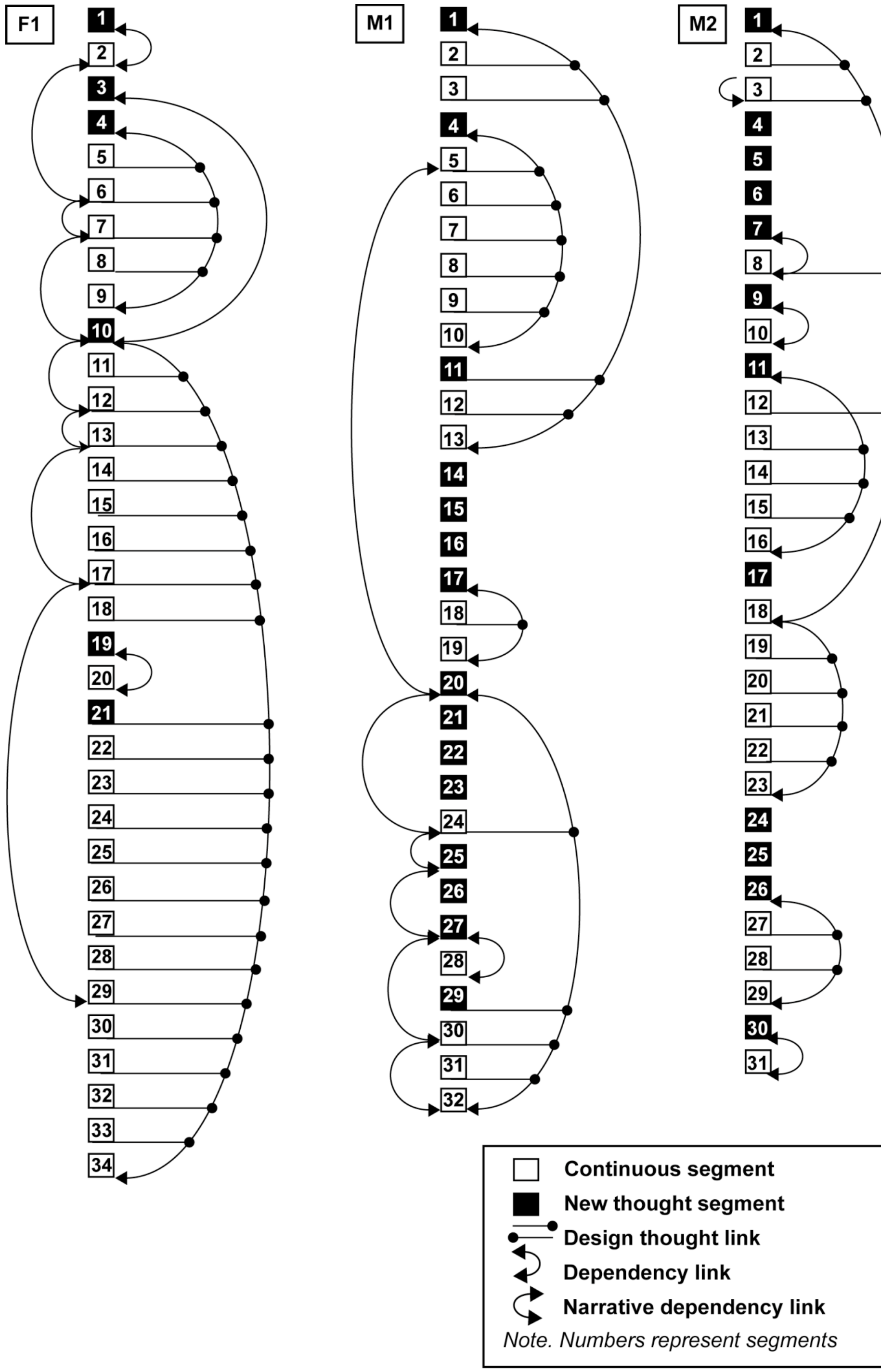


Figure 7. Network Graphs of Retrospective Protocol Transcript Links and Segments: Each numbered unit indicates a verbal statement pertaining to the three participants' reconstruction of the narrative task steps. Connecting lines and curved lines indicate relationships among the verbal statements that are based on the same subject matter. By contrast, the density of lines indicates meaningful thoughts (Goldschmidt & Tatsa 2005).

Results. Table 32 presents the percentage of continuous segments (CS) and new thought segments (NTS) assessed across the individual cases for the reporting session. The findings show, Participant F1 had the highest percentage of continuous segments 82.4% and lowest percentage of new thought segments 17.6% compared to the two other participants. This suggests Participant F1's ability to reconstruct the different levels of her own design practice was greater for the duration of the reporting session. One reason for this difference can be explained by Participant F1's network graph in which the pattern of CS and NTS are causally connected according to mutually dependent verbal statements. Each verbal statement represents a design move (Goldschmidt & Tatsa, 2005) that was related the narrative design session.

Another reason for this difference corresponds to a second analysis of the retrospective protocol transcripts that was used to determine the extent of each NTS and the outcome of each NITS that was produced by the participants. In this respect, each NTS and NITS was examined in relation to its corresponding transcript segment in addition to the participant's actions or intentions that fostered its creation (see Appendix N). This included how each NTS and NITS was initiated, explicated and the consequences of its use. For example, Participant F1 produced one NTS and one NITS in relation to the TT category and corresponding TT subcategories during the reporting session. In addition, she produced four more NTS in relation to some of other categories and subcategories. Examples include units 3, 4, and 10 that were initiated by an application or media effect, whereas the units 19 and 21 were both initiated by DT editing. Unit 1 started the session. Hence, it was not initiated by another activity. The narrative design activity was interpreted as follows:

1. NTS 1, TT, Tool method (gathering media);
2. NITS 3, TT, Technical issue (probing the media);
3. NTS 4, CT, Accessibility (student reception);
4. NTS 10, RT, Form (moving a montage image);
5. NTS 19, DT, Edit (aligning text and images);
6. NTS 21, DT, Edit (sizing and cropping an image).

The patterns of activity and themes, in the protocol transcripts, showed Participant F1 in addition to the two other participants produced four types of NTS when they reported on the narrative design task: (a) construction, (b) exploration, (c) interpretation, and (d) organization. Each NTS was produced as a natural part of the design process. In the foregoing examples (a) DT, edit is a construction, (b) TT, tool method is an exploration, (c) CT, accessibility is an interpretation, and (d) RT, form is an organization. TT, tool method, in segment 1, was also a form of organization as some categories were found to be multifunctional depending upon how they were used. Conversely, each NITS were produced when the interdependence between a participant's design moves were not apparent or when a participant did not recognize their prior narrative design activity from the videotapes (Ericsson & Simon, 1993). Interdependence refers to the pattern of relationships that figure into a design situation based on design ideas, reasoning strategies and the related consequences of the work (Goldschmidt & Tatsa, 2005; Schön, 1988).

The fact that Participant F1 produced one NITS suggests she recognized and could articulate the inner workings of narrative design for most of the reporting session. Conversely, the findings for Participant M1 and Participant M2 showed a lower percentage of CS and a higher percentage of NITS when reporting on the narrative design

task. In contrast to Participant F1, their production NITS resulted in a lower percentage of NTS. As their network graphs indicate, Participant M1 produced eight NITS in units 14, 15, 16, 21, 22, 23 25 and 26. Similarly, Participant M2 produced six NITS in units 4, 5, 6, 17, 24 and 25. In order to provide further insight into both of the participants' NITS, the following selected examples are offered.

For Participant M1, one NITS started with a TT subcategory focused on a technology interaction, whereas two NITS started with a DT category focused on design idea. In unit 13, Participant M1 reported on the time duration of the story and subsequently initiated memory structures that went beyond the immediate focus of the narrative design task (see Appendix N). In units 14, 15 and 16, Participant M1 described his future intentions for the presentation in addition to his beliefs about the project. The extent of three consecutive NITS suggests Participant M1 had engaged in metacognitive thinking. The narrative design activity was interpreted as follows:

NITS, 14, DT, idea (future intention for a wiki);

NITS, 15, TT, tool method (future intention for the classroom);

NITS, 16, DT, idea (belief about the project for teaching)

For Participant M2, one NITS started with a TT category focused on a former decision and two NITS started with a TT category focused on a technology function. Although Participant M2's design activities were related to design work, the interdependence of his design moves was not evident. In unit 16 Participant M2 described an application method and, similar to Participant M1 initiated memory structures that went beyond the focus of the task. In unit 23, Participant M2 started to address a

representational form, but when the design sequence did not offer any memory cues, the content was not heeded and he attended to a technology application

The narrative design activity was interpreted as follows:

NITS, 17, TT, Technical issue, (speculation about a microphone);

NITS, 24, TT, Application method (Google search);

NITS, 25, TT, Application method (QuickTime and saving)

According to Ericsson and Simon (1993), the practical implications of verbal reports include the tendency of a participant to speculate or make inferences about prior thought processes, rather than reinstating the nature of the design activity according to the way it really happened. This occurs when information stored in long-term memory (LTM) cannot be retrieved or when the information may not have been heeded to begin with. As was the case with both Participant M1 and Participant M2, they both changed verbal thoughts when the prerecorded video did not offer them the retrieval cues they needed to recognize their own design activity. Despite these limitations, their verbal protocols provided insight into their plans for the future utility of the narrative presentation.

Table 32

Indicators of Continuing and New Thought Segments

Segment type	F1 (%)	M1 (%)	M2 (%)
Continuous segments	82.4	53.1	58.1
New thought segments	17.6	46.9	41.9
Total	100	100	100

Table 33 presents the number of both small and large chunk links in addition to return links assessed across the individual cases. The findings show Participant F1 was the only participant to produce one large chunk link and Participant M2 was the only participant to produce seven small chunk links during the reporting session. These findings show Participant F1 had achieved the highest level of reflection at NTS 21 as evidenced by the density of CS for units 22-34.

Reflecting on the active construction of the graphic mnemonic constituted Participant F1's large chunk link, whereas attending to the placement and function of slides in addition to the circumstances regarding the absence of both script and video components constituted Participant M2's smaller chunk links.

As mentioned earlier, the density of chunk links serves as indicators of both high and low-level cognitive processing (Goldschmidt & Tatsa, 2005). Participant F1's large chunk link typifies the rational interdependence of her verbal statements. Her reflections suggest she was trying to explicate the details of her design activity based on what she has been working towards up until this point in time, whereas Participant M2's reflections suggest he was involved in an earlier phase of working his way through the narrative design process.

Table 33 also presents the results for return links based on data collected from the network graphs. The findings show all three of the participants used return links during the reporting session in an effort understand their prior actions or processes and the point at which they were able to return and resolve them.

Despite the differences between them, both Participant M1 and M2 employed the same number of return links (3) for the duration of the reporting session. In this respect,

determining the time duration of slides; importing images and, more importantly, extending the meaning of representations constituted some of the distinguishing factors involved in Participant M1's return links for units 3 and 11; 20 and 24, and 24 and 29. Conversely, importing and editing transition slides and attending to an arrangement of thematic representations constituted some of the distinguishing factors involved in Participant M2's return links for units 1 and 18; 3 and 8; 8 and 12.

The extent of Participant M1's return links suggests the planned time durations were intended to promote a conversation among the student audience based on the number of the agent/existents they could recognize in the presentation.

Table 33

Indicators of Chunk Links and Return Links for the Narrative Task

Segment type	F1	M1	M2
Small chunk links: 2-9	5	6	7
Large chunk links: 10 or more	1	-	-
Return links	2	3	3
Total number	8	9	10

Table 34 presents the percentage of narrative dependency links and narrative design task segments assessed across the individual cases for the narrative design task. Narrative dependency links were shown in 23.5% of Participant F1's narrative design segments and 21.9% of Participant M1's narrative design segments. These findings provide evidence that the two participants were able to apply their new knowledge of

narrative to develop a presentation following instruction. They differed, however, in their translation of the narrative form. Participant F1, for example, attended to the message, whereas Participant M1 attended on the story. In the subsequent analysis, attention is given to the design work of Participant M1 because it is more closely related to the instructional aims of this research.

Of the seven narrative dependency links, on Participant M1's network graph, the narrative protocols pertaining to agents, narrations and semiotic meanings were each represented twice. In addition, the narrative protocols pertaining to event, montage and space relationships were each represented once. The corresponding protocol transcript shows when Participant M1 attended to the relations between two external representations he initiated memory structures that were related to the semiotic meanings in his prior design work. By contrast, when he attended to either the content, form or structure of external representations, including narrative ones, he initiated memory structures that were related to the other narrative protocols in his prior design work. This suggests Participant M1 was able to recognize the inner workings of his narrative design, and articulate the narrative forms and narrative structure by attending to the features and functions of external representations including syntagmatic and paradigmatic relationships.

For the development of the agent/existents Participant M1 attended to both the emotional and stylistic qualities of representations and the spatial relationships among the representations. This is evident in units 5, 20, 24, 27 and 30. The formulation of storytelling structures and meaning of the lesson is also evident in units 25, 30 and 32, respectively.

Table 34

Indicators of Narrative Dependency Links in Relation to Total Narrative Segments

Segment type	F1	M1	M2
Narrative dependency links	23.5	21.9	3.2
Task segments	76.5	78.1	96.8
Total	100	100	100

Componential Analysis for the Narrative Instructional Presentations

In this section, the results of the componential analysis are presented using cross-case comparisons based on data collection practices associated with qualitative case study research. The componential analysis was used to identify, analyze, and interpret the *attributes* (Spradley, 1980) of the three participants' narrative instructional presentations in addition to those created by both intermediate and expert designers. The aim of this analysis then was to draw on the cultural knowledge of various domain members (i.e., members of this culture), as suggested by Spradley, (1980) in an attempt to understand the attributes each domain member assigned to the form of a narrative instructional presentation.

It should be noted, of the other designers whose work was observed in this study, VG is the host and producer of a privately owned video production studio (Syverson, 2006). NG is a photographer who works for a large non-profit scientific and educational institution (McLain, 2005/2008). By contrast EG1 and EG2 are educators, scientists and co-founders of a non-profit organization that produces videos for educators (Audel & Nelson, 2006).

In the text that follows, the project specifications for the final narrative project are presented and the stages involved in the development of the componential analysis are summarized. Subsequently, the results of are reported.

The project. The objective of the narrative instructional presentation was for the three participants to approach the design work with a fundamental understanding of cinematic framing conventions (i.e., shot scale), e-learning principles and montage principles in addition to the narrative structures that could be used to enhance an arrangement of verbal and visual representations. They were told to use the script, storyboard, and montage equations as a reference base throughout the project. They were also told to design a 10-minute presentation and to think about the presentation method.

Project specifications included the following steps:

1. Create a narrative instructional presentation based on a topic related to Yellowstone National Park and your content area.
2. Reference all preliminary work for the instructional presentation including the written proposal, script, storyboard and montage equations.
3. Attend to the visual grammar and compositional elements in the arrangement of shots.
4. Demonstrate at least one example of intellectual montage that makes sense for your topic.
5. Demonstrate at least one example of rhythmic montage that makes sense for your topic.
6. Crop and arrange both simple and complex audio files and digital images.
7. Apply dissolves and fades to connect the digital images.

8. Include titles for the intro and any other necessary text and closing credits.
9. Include music and narrations that make sense for your topic.
10. Tell an instructional story that includes a beginning, middle and end.

The stages. Spradley's (1980) cyclical model for conducting an ethnographic study was used to collect and analyze data for the componential analysis. The study included a domain analysis and taxonomic analysis as part of this ongoing system of inquiry and interpretation (Merriam, 1998). Ethnographic observations included all six of the narrative instructional presentations that were created by each of the domain members. Each of the narrative instructional presentations was transcribed and analyzed using variations of the text description format that were used to report the content of the storyboard analysis (see Appendix P and Appendix Q).

Table 35 offers an example of the text descriptive format that was used in this study based on two scenes from a narrative instructional presentation constructed by Participant M1. In this display, both the script and text descriptions of scenes were transcribed and formatted into one text descriptive document that was used to assist in identifying parts of the domain. In addition, the text descriptive format was used to gather data and organize the information into a paradigm for reporting and comparing attributes across all six of the narrative instructional presentations. In this example, capital letters, bracketed text and bracketed symbols are used to indicate the attributes that were identified in the script and two scenes of this document.

Table 35

An Example of a Text Descriptive Document Based on Ethnographic Observations

Time	Script	Scene descriptions
02:01 Scene 20	Cue: Buffalo picture, NMUS Dialogue: The buffalo walked to a mountain one day and said, “Would you liked to be changed into something?” DKG	[Photograph and music] 19. WS, ZO, centered image, ¾ profile of a brown and grey colored buffalo facing a green field that is covered in mist along the right side of the frame. Beyond the horizon line, along the top rule of thirds, there is a mountain covered in snow with patches of sunlight and shadows. White clouds extend past the edge of the frame.
02:11 Scene 21	Dialogue: "Yes," [++] replied the mountain. "I would like to be changed into something nobody would want to climb over."	[Photograph] 20. WS, WEV. The bottom, third of the frame is filled with yellow and green colored foliage. The middle-third of the frame shows a rocky, stair-stepped, grey mountain. Sparse evergreens cover some of its protruding angles.

Note. NMUS = No music, [++] = Inflection, DKG = Ducking music, WS = Wide-shot, ZO = Zoom out, WEV= Worm’s eye view.

In addition to the text descriptive documents, data gathering and analysis for this study included (a) semi-structured interviews, (b) informal discussion meetings, (c) field notes, (d) self-grade sheets, (e) protocol reports, (f) videotapes, (g) public radio shows, and (h) literature reflecting epistemological, historical, practical, and theoretical interests relating to narrative, multimedia learning and teaching. As part of the data gathering process, the coding scheme, described in Chapter 3 (e.g., act, goals, objects and space etc.) was used to identify emerging cultural patterns from the domain.

Initially, ethnographic observations were conducted and descriptive and structural questions were asked to assist in identifying the formal elements of a narrative instructional presentation. Then, more focused observations were conducted and structural questions were asked to assist in identifying the results of combining the formal elements such as cinematic framing conventions, spatial and temporal structuring, the subject matter, and instructional features into the design of a narrative instructional presentation. As part of this cycle of questioning, the data was mapped against the three participants' interview transcripts in addition to the three designer's web sites. Analytic terms and concepts were also mapped with the literature to check for the accuracy of the information.

For the taxonomic analysis, additional structural questions were asked and the domain list, developed in the previous steps, was organized into a taxonomy: *The Form of a Narrative Instructional Presentation*. The information was then verified with data collected from protocol reports, field notes, self-grade sheets and the literature on film form, narrative structures and multimedia learning principles. In addition, another instructional designer was consulted in an effort to ensure the accuracy of the taxonomy before conducting selective observations for the componential analysis.

The conception of form as both a system and format for structuring all of the formal elements of a multimedia movie for instruction were informed by theories and practices related to film and television (Arnheim, 1957; Altheide, 1996; Metz, 1974; Bordwell & Thompson, 2004). In their book, *Film Art*, film theorists Bordwell and Thompson (2004), for example, suggested " . . . even elements of what is normally considered content—subject matter, or abstract ideas—take on a function within any

work" (p. 66). They argue, form is a total system " . . . there is no inside and outside" every element interacts within the larger context of a film's form and the viewer reacts to it (p. 50). Thus, the aim of the componential analysis was to identify the attributes of the formal elements that were used in each of the narrative instructional presentations and to provide some examples of how they functioned as part of the total system for each of the domain members.

Table 36 shows the coding scheme used to indicate some of the attributes on areas of the text descriptive documents and the paradigm (see Table 37). The paradigm also indicates some of the attributes in the form of words, numeric values and binary values as can be seen by the words yes and no (Spradley, 1980). In a componential analysis the attributes are also called "dimensions of contrast" across the domain in addition to "units of meaning" (Spradley, 1980, p. 131).

Results. Eight formal elements of the domain and related subsets were identified as the form of a narrative instructional presentation. The paradigm shows the domain information and the intersection of attributes for each of the domain members (see Table 37). In this discussion, each of the formal elements is summarized in an attempt to establish an understanding of how they were commonly used across the domain members. In addition one attribute for a few of the formal elements is described using excerpts and selected examples from the narrative instructional presentation. Quotes from the three participants' class discussions and interviews are also included.

Table 36

Componential Analysis: Narrative Project and Script Codes

Multimedia	Music Effects	Script Annotations	Transition Effects	Visual Grammar
A: Audio	DKG: Ducking music (lower music volume)	[++] Inflection	FI: Fade in	AERV: Aerial view
Ani: Animation	NDKG: No ducking	INF: Inflection of character	FO: Fade out	CRP: Cropped image
D: Diagrams	NMUS: No music	NS, CFS: Not shown, changed from original storyboard	FTS: Images float. No unity of images within the space	CU Close-up
G: Graphics	CMU: Change of music	NS: Not shown	PAN: Movement across a scene	EM: Eye Match
Ic: Icon	MUSB: Music begins	SC: Script change	MOP: Movement of a picture	EX CU Extreme close-Up
I: Image		TECHP: Technical problem	RPE: Ripple effect	EX WS Extreme wide shot
L: Logo		O, Original work	REPEAT: Repeat of an image	OTS: Over the shoulder
M: Maps		IB: Image Bank	SW: Side swipe	PSY: Psychic lines
Mu: Music		ISN: Image sharing network	Un FX: Unnecessary effects	MTG I: Intellectual Montage
Ptg: Painting			ZN: Zoom In	MTG OP: Montage of parts
P: Photographs			ZO: Zoom out	MS Mid-shot
S: Singing				WS Wide-shot
SI: Static images				WEV: Worms Eye View
T: Text				
V: Video				

Table 37

Componential Analysis: Attributes of a Narrative Multimedia Instructional Presentation

Domains	Dimensions of Contrast					
Producers	Novice Narratives			Intermediate and Expert Narratives		
	F1	M1	M2	VG	EG	NG
Subject Matter						
Discipline	Recreation	Language Arts	Art	Technology	Ecology	Health
Topic	Camping	Niitsítapi	Landscape	Aspect Ratio	Biome	Culture
Theme	Safety and responsibility	Supernatural beings/events	Visual thinking	Sound and pictures	Streams and rivers	Secrets of longevity
Instructional Design						
Accessibility	Yes	Yes	Yes	Yes	Yes	Yes
Demonstration	Yes, P, T	Yes, P	Inc., P	Yes/Ani	Yes/Ani	Yes, P
Folk terms	Yes	Yes	Yes	Yes	Yes	Yes
Information	Yes	Yes	Yes	Yes	Yes	Yes
Problem solving	Yes	Yes	Yes	Yes	Yes	Yes
Reflection	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	Analogies	No	Yes	Yes	Yes
Representations	L, Ic, M, P, T	M, P, T	P, Ptg, T	Ani, G, P, T	Ani, M, T	P, T
e-Learning						
Coherence principle	Un FX	Yes	Yes	Yes	Un FX	Yes
Contiguity principle	Yes	Yes	Yes	Yes	Yes	Yes
Modality	Yes	Yes	Yes	Yes	Yes	Yes
Multimedia principle	Yes	Yes	Yes	Yes	Yes	Yes
Personalization	Yes	Yes	Yes	Yes	Yes	Yes
Redundancy	A & T	A & T	No	A & T	Mu	Mu

(table continues)

Table 37 *(continued)*

Domains	Dimensions of Contrast					
Producers	Novice Narratives			Intermediate and Expert Narratives		
	F1	M1	M2	VG	EG	NG
Narrative						
Action/Events	Yes	Yes	No	Yes	Yes	Yes
Agents/Characters	No	Yes	No	Yes	Yes	Yes
Agent interactions	No	Yes	No	Yes	Yes	Yes
Bait/Suspense	No	Yes	No	Yes, Episodic	Yes	Yes
Logos, ethos, pathos	L	L, E, P	L	L, E, P	L, E, P	L, E, P
Montage	MTG OP	MTG I	None	MTG I /MTG OP	MTG I/MTG OP	MTG OP
Narrator is seen	No	Yes	No	Yes	Yes	Yes
Narrator is heard	Yes	Yes	Yes	Yes	Yes	Yes
Reflection	Yes	Yes	No	Yes	Yes	Yes
Semiotics	Yes	Yes	No	Yes		No
Time relationships	Yes	Yes	No	Yes	Yes	Yes
Space relationships	Yes	Yes	Yes	Yes	Yes	Yes
Shot scale						
CU	8	8	0	6	10	8
EST	1	0	1	0	0	0
EX CU	0	1	0	0	0	0
MS	8	15	3	11	10	24
WS	106	12	23	9	23	29
Total Shots	128	47	30	30 (Video)	48 (Video)	63
Shots per minute	11.74	6.86	4.28	8.33	12.74	12.27
Surface features						
Text only	3	6	3	3	2	0
Aerial views	1	1	1	0	4	2

(table continues)

Table 37 *(continued)*

Domains	Dimensions of Contrast					
Producers	Novice Narratives			Intermediate and Expert Narratives		
	F1	M1	M2	VG	EG	NG
Surface features cont.						
Black screen	2	5	0	1	3	2
Rule of thirds	33	8	9	1	19	25
Repeating scenes	13	9	0	6	0	(5-Ch-txt)
Transitions	DI, FO, SW, ZI	FO, MOP, ZI	FI, FO		FI, FO	FI, FO, PAN
Codes						
Eye match lines	3	9	0	2	6	2
Psychic lines	30	7	6	8	17	15
Indexical objects	Yes	Yes	No	Yes	Yes	Yes
Media						
Ambient sounds	0	0	0	0	5	0
Sound effects (FX)	0	1	0	1	4	0
Music scores	1	4	0	1	5	1
Multimedia	A, G, M, Mu, P, T	A, Mu, T, P	A, P, Ptg, T	A, Ani, Mu, G, P, T, V	A, Ani, M, Mu, P, S, T, V	A, Mu, T, P
Technology						
File size	2 GB	233.7 MB	22.3 MB	6.7 MB	17.5 MB	N/A
Time	10:59	06:51	07:00	03:36	03:46	05:08
Distribution	DVD & Web	Podcast	DVD	Podcast	Podcast	Streaming
Format	Slideshow	Slideshow	Slideshow	Video	Video	Slideshow
Resources	ISN, O	ISN	ISN, O	IB, O	O	O
Composition issues	FTS	One pause	REPEAT	None	None	None
Technical issues	Audio, file size, readability, pixelation	Audio, black frames, DKG, aspect ratio	Audio, WS, cut dialogue	None	Camera shake, speaker is out of the frame.	None

Subject matter. The term subject matter is used to describe the content that is one of the formal elements of a narrative instructional presentation. The subject matter addresses the discipline, topic, and themes that were used as a result of institutional requirements including project specifications and instructional goals.

Themes. The notion of subject matter themes was informed by the work of Altheide (1987). In his article on news culture, he observed themes not only give meaning to news reports, they are also used as a means for journalists to organize news stories. The significance of Altheide's observation for this study lies in the fact that all of domain members used themes and showed contrasts in the way in which they organized their narrative instructional presentations.

Participant F1. Participant F1developed two visual themes: one related to safety and one related to responsibility in order to facilitate student understanding of "what to do in an emergency situation" and also "to ensure students are responsible campers," she said. In the opening sequence of her presentation, Participant F1 combines the sounds of percussion instruments with a rhythmic montage of photographic landscapes in order to create a sense of the natural beauty and hidden dangers of Yellowstone National Park. There are a series of wide-shots of bison walking past thermal pools, overflowing hot springs, volcanic activity, mountainous regions and vegetation. The dramatic sequence effectively sets up students' expectations for the scenes that will follow in which similar kinds of visual and verbal information are organized to suggest similar kinds of situations.

"I had this idea and I was trying to figure out how I was going to convey those messages using images," she said in an interview. "I didn't want to talk the whole time."

For this reason, the narration mode was deliberately minimized. In this way, she consciously applied a second person directive that was also indicative of her storyboard thinking.

To lead into the theme of safety, Participant F1 states: "Five essential survival tips: "Attitude, Shelter, Water, Fire, and Food." Concurrently, there is a cut to a wide-shot of cars tramped in mud and then a cut to a wide-shot of bison trapped in a brush fire. The theme of responsibility is even more visual. Graphic organizers and iconic representations appear in a series of quick cuts. There is a logo for *Leave No Trace,* an aerial view of a people tending to a campfire and maps of the park.

Participant M1. Unlike the other domain members, Participant M1varied his approach, using both explicit and implicit themes as a means to communicate the signifier that is an inherent part of myths. "I guess, I like making some things more interesting," he said in an interview**.**

In the opening sequence of *Myths: Buffalo and Eagle Wing,* Participant M1, who is also the narrator of this presentation, explains the explicit themes that are related to supernatural events and oral traditions. He then shows a display of photographs that conform to the storyboard ideas he had proposed earlier. The musical content includes the accented beats of instrumentals such as a xylophone, flute and maracas. In the second sequence, both the narration mode and music change to signal the start of the implicit themes that are related to broken promises. As noted earlier in this study, Participant M1 understood the potential of using music to carry themes.

One thing I did do when I was thinking through this was trying to theme music. Like when a certain character would come along, it would be a different music. So, I had the buffalo theme and the boy theme and the grandfather theme music.

The subsequent appearance of story characters includes fades, zooms and an array of sounds such as a wind effects and both string and wind instrument music as a way to reinforce the message. At the same time, Participant M1 speaks for each of the story characters.

Participant M2. By contrast to Participant M1, Participant M2's approach to the presentation included two explicit visual themes related to the natural wonders and animals of Yellowstone National Park. "I just wanted to make sure I divided those themes up into two separate parts of the presentation and that's just something I did for visual grammar, I guess," he said**.** For natural wonders, he showed on an establishing wide shot of the valley and then another image of a geyser erupting from a volcanic rock and then showed a sequence of related images. Later, he showed the words: "The Animals of Yellowstone" superimposed over an image of grey wolf and then showed another sequence of related images. Participant M2 was concerned about associations between the images and two themes. "They didn't flow easily into each other," he said.

EG1 and EG2. Another difference in the use of themes was observed in the work of EG1 and EG2. Interestingly, their approach was fairly typical of the two other designers. They used two themes based on the subject matter of streams and rivers as a means to make connections with mini themes based on the "geology of the river," "food web relationships" and "algae and plants." In addition to using strumming banjos and

harmonica music, to suggest the start of the mini themes, they showed video segments of their interactions in and around these habitats (Audel & Nelson, 2006).

VG. On a sensory level, VG used two themes based on sounds and pictures as a means to make connections with mini themes such as the changing nature of film formats and screen formats (Syverson, 2006).

NG. Used one theme based on lifestyles as a way to make connections with three mini themes related to the three different cultures. Once this was established, NG showed contrasts among the cultures (McLain, 2005/2008).

Instructional design. In this study, the term instructional design is used to describe another one of the formal elements of a narrative instructional presentation. To put it more precisely, the instructional design is another example of the content of a narrative instructional presentation. As mentioned previously, content is the "subject matter or abstract ideas" that function as "part of the overall pattern that is perceived" (Bordwell & Thompson, 2005, p. 50). In this case, the abstract ideas include learning theories, instructional strategies and the objectives each of the domain members had in mind for learners. The instructional design includes (a) accessibility, (b) a demonstration, (c) folk terms, (d) information, (e) problem solving, (f) reflective thinking, (g) prior knowledge, and (h) representations for learning and teaching.

Demonstrations. Two types of demonstrations were observed in this study. One focused on teaching a concept and one focused on showing a process. Modeling and skills were not observed in any of the presentations. The general structure of the work was designed in a linear format and all of the domain members included a controller as a means for learners to stop and return to different parts of the demonstration at anytime.

Knowledge creation, knowledge building and knowledge distribution activities are some of the ways in which the domain members used multimedia technology as a tool to promote the demonstration.

Participant F1. The content of Participant F1's demonstration focused on what she called "smart camping" for the novice camper. "It's about how to plan, pack, and prepare for worst," she said. "It is meant for someone who wouldn't know how to plan a trip on their own . . . or has never gone camping before," she continued. In the first phase of her demonstration, Participant F1 shows photographs of people camping and camping gear. She asks, "Who makes up your camping party?" At the same time, she shows the same words repeated in a clipping mask. Then she asks, "What kind of group will you be camping with?" She allows time for students to respond. By the end of the first phase of the demonstration, Participant F1 has asked and answered many of her own questions and has also identified the best places to camp in the park.

In the second phase, Participant F1 shows a rhythmic montage of landscapes and maps. Concurrently, she states: "Yellowstone National Park is over 3,468 square miles, with over 1,000 miles of hiking trails and many outdoor attractions."

Participant F1 explained in an interview: "These things are not part of their knowledge set yet. Very baseline. You know? What do they need to know? That's how I approached this project."

Participant M1. The content of Participant M1's demonstration focused on the theme of myths "involving supernatural beings and events." The demonstration was designed for students to make connections with the conception of a myth, "so, they could write their own," he said. Participant M1 also believed it was important for the entire

demonstration to be organized around a story. For this reason, he made the decision to have all of the content "relate back" to the writing assignment so he could reinforce concepts of what students needed to do. With such high expectations, he was also concerned about the clarity of his own script. "I think there are still a couple of parts of the storyline that don't make sense," he said. "The script was the hardest part of the whole project."

In first phase of his demonstration, Participant M1 states, "Myth is a traditional story, especially one concerning the early history of a people." He shows both contemporary and traditional examples of myths that conform to the storyboard ideas he had proposed earlier. He then leads into the oral traditions of the Blackfoot Indian Tribe (i.e., Niitsítapi Tribe) that is related to the story. From there, he shows the setting including an image of a tepee in a field, a map depicting the Western half of the US, a grey wolf, a black bear, tribal gatherings and the main characters. He states, "So let me tell you about a boy. A grandfather. And a buffalo . . . " In the second phase of the demonstration, he uses music to cue the students. He shows a picture of himself, as the narrator, before announcing: "The story of the Buffalo and Eagle Wing explains why there are rocks and how they came to be. Look at the geyser. How did it get there?" Concurrently, he shows an image of a geyser erupting. "The Native Americans had a way to explain this through a myth. See if you can create your own myth about how Old Faithful works," he said.

Participant M2. The content of Participant M2's demonstration focused on the animals and wildlife of Yellowstone National Park. "The idea was to show it to a class

that does a Yellowstone drawing assignment," he explained in a retrospective meeting. "So, they have an idea of the sort of things they can *draw in a picture*."

"Enter, the whole park's environment," states Participant M2 in his demonstration as he shows bubbling mud pots, volcanic activity and thermal parks. "These are some of the more unique things about Yellowstone," he adds.

"It's pretty impressive and the kids have probably never seen anything like that before," he said later. That's why I spent more of my time talking about that."

Participant M2's dialogue for the demonstration was unrehearsed and improvised. "I just wrote down a couple of points I wanted to hit on," he said. In the demonstration, he states, "Many strange sights can be seen in these pools like these rock formations and the bubbling water there. Like this water is probably hot enough to burn your skin . . . It comes right out from that volcanic activity underneath Yellowstone."

In the second phase of his demonstration, Participant M2 showed what he called "the characters," or "wildlife of Yellowstone . . . all the park's animals really." He showed images of elk, wolves, bison, pronghorn and deer—similar to the animals he had depicted in the storyboard task.

There is no music, sound effects, or transitions in this demonstration. Instead Participant M2 uses humor and also talks about visual details: "You don't want to get too near those grizzly bears . . . they can kind of be dangerous creatures. It's not a good idea to walk up to a grizzly bear and poke it on the nose," he warns. "This is a male moose and it has these big giant horns you can see on top of its head and it uses those to kind of start fights with other male moose."

EG1 and EG2. EG1 and EG2 enhanced their demonstration of the geology of the river by including live video. They also used an animation to demonstrate the concept of algae and used a voice over in addition to lively music (Audel & Nelson, 2006). They explained the demonstration this way:

> It all starts with microorganisms, algae and plants that grow in the water [music starts playing] and on the rocks. Algae and plants photosynthesize, converting, light to energy they then are eaten by small aquatic bugs that then are eaten by fish [music strums in the background] (Audel & Nelson, 2006).

VG. VG also used an animation and a voice over for a demonstration based on the concept of the aspect ratio, as it is related to the history of film. He described it this way:

> Now, for our purposes we don't really even care about 24 and 18, what we care about is the mathematical relationship between the two, which comes out to about 1.3, which is the same way of saying 4 units wide by three units high, or 4:3 - and this is what we call the aspect ratio, and you gotta remember this term because we're going to be talking about it forever (Syverson, 2006).

CHAPTER 5

DISCUSSION

Organization

This chapter consists of three sections. The first section provides a summary of the research. The second section discusses the findings of this study in relation to the research questions and other research. The third section discusses the implications of the research for both the fields of multimedia learning and technology education with limitations, and conclusions described in turn. The following research questions guided the direction of this study:

1. What role does narrative play in multimedia learning?
2. How does an understanding of narrative forms of representation and constructivist technologies affect the way in which teachers design instructional presentations?
3. How do teachers describe their approach to the design of narrative instructional presentations for their content area and what evidence exist to support the processes they describe?
4. How are the features and forms of narrative expressed in the teachers' designs?

Summary of the Research

This study investigated the role of narrative in multimedia learning and teaching and observed how teachers applied their understanding of narrative, and new constructivist technologies, to design multimedia presentations for instruction. The majority of the instructional presentations described in this study are visual narratives

adapted from the domains of fine art, comics, film, and television (Abbott, 2002). They were expressed in both analog and digital media, and were created by teachers in a university classroom. Drawing on a constructivist view of cognition and on multiple methods, the research studied them together as the actions, thoughts, and expressions that were integral to three teachers' abilities as designers in this context.

Three teachers were selected through purposeful sampling for this study. Before the study began, a student questionnaire designed to address the research criterion was distributed to nine graduate students enrolled in a university instructional design of educational software course. The data were organized around a criterion scale sheet and a continuum was used to array each of the students' responses (Schensul et al., 1999). Each one was selected because they had a current educational background in instructional technology.

Descriptive case study procedures were used because a holistic approach was needed in order to uncover insights, interpretations and important features (Merriam, 1998) of narrative's role in multimedia learning that could otherwise be impossible to separate in this context. Questions were structured to provide insight into the classroom setting, the three teachers' design activities, and the work they produced. Data collection and analysis included both verbal and visual knowledge elicitation techniques (Emmison & Smith, 2002; Ericsson & Simon, 1993; Pedgley, 1997), and ethnographic methods (Althiede, 1996; Fields, 1988; Spradley, 1980).

In this research, the triangulation of data included: (a) interview transcripts, (b) self-grade sheets, (c) student questionnaires, (d) protocol transcripts, (e) field notes, (f) project sheets, (g) videotapes, (h) audio tapes, (i) Web log posts, (j) video clips from

social networks, online directories and online repositories, and (j) literature reflecting epistemological, historical, practical, and theoretical interests relating to visual narratives, multimedia learning and teaching. Verification included discussions with each of the teachers, the principal investigator, and a professional designer-educator. Inter-rater reliability and one-encoder reliability tests of protocol data were also analyzed (Creswell, 2007; Ericsson & Simon, 1993; Gero & Tang, 2001).

In addition to the foregoing qualitative procedures, this study was conducted in three phases using a chronological approach to the latter stages of content creation. Descriptive vignettes, reflecting the circumstances and dialogs from both the protocol transcripts and the interview transcripts were written in an effort to further support the credibility of the findings (Yin, 2003; Creswell, 2007).

The Storyboard Phase

For the storyboard phase, the combined techniques of ethnographic document analysis (Althiede, 1996; Fields, 1988) and professional art criticism (Barrett, 1991) were used to collect data on how each of the teachers used the storyboard format. Observations focused on the formal arrangement of storyboard scenes and descriptive questions were asked. A descriptive text document was initially created based on information gathered from the storyboard scenes and emergent patterns, meanings and themes were identified and labeled (Althiede, 1996; Fields, 1988). The resulting data were then categorized into domain lists and four design features and four design forms were identified. From these data, a visual document was created in order to assist in making cross-case comparisons.

The Montage Equation Phase

The montage equation phase was used to collect both numeric and descriptive data on how each of the teachers used digital images to suggest elements of meaning in an edited sequence. Qualitative procedures included: (a) concurrent think-aloud protocols, (b) retrospective protocols, (c) concurrent network graphs, and (d) domain, taxonomic and componential analyses.

All of the protocol sessions were conducted on an individual basis in a private seminar room and were videotaped. For the concurrent protocol sessions, each of the teachers were asked to actively report on their task-related thoughts and design actions. By contrast, for the retrospective protocol sessions, each of the teachers was asked to review the videotapes from the previous protocol session and to recall their task-related thoughts and design actions. Data collection and analysis for both protocol sessions included: (a) transcription, (b) segmentation, and (c) encoding (Ericsson & Simon, 1993).

Initially, categories, subcategories and frequencies, representing the three teachers' cognitive activities were identified. Then, the encoding scheme from each of the concurrent protocol transcripts was mapped with the retrospective protocol transcripts and corresponding categories, subcategories, and gaps were noted. Lastly, network graphs were developed based on data gathered from the concurrent protocol transcript segments. The sequential order of the network graphs were used to collectively illustrate and analyze each of the teachers' active design reasoning and successive design moves.

For the componential analysis of montage equations, the attributes of the three teachers' documents were identified and analyzed using Spradley's (1980) cyclical model. Three types of observations were conducted using descriptive, focused and

contrast questions. Text description documents and a visual code sheet of symbolic codes were also developed for making cross-case comparisons. Emergent patterns were then noted, based on project specifications, and extracted for analysis. From these data, several domain lists, a taxonomy, and a *paradigm of montage equation parts* were created.

The Narrative Instructional Presentation Phase

The narrative instructional presentation phase was used to collect both numeric and descriptive data on how each of teachers used the format (Althiede, 1996). This included how they made connections between the aesthetic and semiotic dimensions of narrative, as well as the subject matter and instructional method for their respective content areas. Qualitative procedures included: (a) concurrent protocols, (b) retrospective protocols, (c) retrospective network graphs, and (d) a domain, taxonomic and componential analysis.

The concurrent and retrospective protocols for the narrative task included a design session *without* verbal protocols and a reporting session *with* verbal protocols. The concurrent sessions were conducted in the traditional classroom. By contrast, the retrospective sessions were conducted in a private seminar room. Data collection and analysis methods followed the same procedures as the foregoing protocol sessions. Five cognitive categories and thirty-two respective subcategories were chosen from all of the protocols and then arranged into a *taxonomy of the narrative multimedia design process* (see Appendix O). Retrospective narrative network graphs were also created.

For the last stage of content creation, a componential analysis was conducted and eight attributes from the three teachers' narrative instructional presentations were identified and compared with other designers' work. The procedures were the same as the

componential analysis of montage equations. What resulted from this stage were several domain lists, a taxonomy, and a *paradigm of the form of a narrative instructional presentation*.

Discussion of Research Findings and Other Research

This section identifies and discusses (a) the role of narrative in multimedia learning, (b) the approaches to understanding NFR and new constructivist technologies, (c) the design of a narrative instructional presentation, and (d) the features and forms of narrative.

The Role of Narrative in Multimedia Learning

The stages of content creation, which began with the three teachers' written proposals and ended with their narrative multimedia instructional presentations, became the basis for this analysis of the role of narrative forms of representation (NFR) in multimedia learning. Through these stages, the teachers learned not simply how to read representations, but how to arrange them according to their formal elements, symbolic relationships, and the ways in which their students might perceive them. The forms of cognition that influenced each (Ainsworth, 2006; Eisner, 1997; Gardener, 1990; Schön, 1987) had been demonstrated in the protocols of professional practice tasks and retrospective reporting (Ericsson & Simon, 1993). The data showed, for example, how each of the teachers used both naming conventions and narrative formats in an "orienting role," and both problem framing and digital editing in a "mediating role" (Prawat, 2002, p. 19), in an attempt to construct interpretations of their design situations.

Against this backdrop are constructivist frameworks for what Dewey and Vygotsky came to recognize as "the role of language in concept development" (Prawat,

2002, p. 19) and what Goodman (1968) further recognized as symbolic systems and the various symbolic competencies they might engender (Gardener, 1990). Before this study, the teachers said they had not given much thought to the uses and meanings that might arise from an arrangement of multiple forms of representation in a multimedia instructional presentation.

Active agents. Monitoring and support were deliberately perpetuated in this study through the use of active agents such as digital tools, narrative formats, symbol systems, and social interactions in the classroom (Daniels, 1996; Decortis, 2005; Bruner, 1996). The use of active agents were for the most part oriented towards the active construction of visual narratives and played both an orienting role and a mediating role in different contexts and situations.

For example, the analog storyboard scenes (i.e., narrative formats) played an orienting role in both the planning and development of an edited sequence. The range of possibilities the storyboard scenes provided included a reference base for the conceptualization of ideas, the implementation of digital techniques, and the arrangement of symbolic codes associated with the conventions of visual narratives. Likewise, the content of the storyboards such as, Participant F1's *graphic mnemonic* and Participant M1's *stylistic existents* played a mediating role during digital editing and the reflections that followed.

Some of the monitoring and support in this study was somewhat consistent with the findings of Stern et al. (2003) whose research on the active construction of graphs fostered "cross-content transfer" (p. 193) and understanding of how to map content information into representations. Rather than providing visual aids and transfer hints

(Stern et al., 2003) in this study, however, the teachers generated their own preliminary work and similarly used them as reasoning and transfer tools.

Themes of talk. This study further explicated how each of the teachers used cognitive strategies such as naming conventions and problem framing (Schön, 1987) in an effort to monitor and support their cognitive activities (i.e., design activities) during their involvement in the professional practice tasks of montage equations. Their cognitive strategies were revealed in their responses to: (a) the formal properties of montage equations, (b) the sensory properties of both analog and digital media, and (c) the design constraints imposed by project specifications and technical issues.

For example, all of the teachers used referential statements, procedural explanations, and probing questions that essentially translated into a pattern of seeing, reading, doing, and guesswork. These cognitive strategies also fit well with what Schön (1987) had called the "themes of talk" (p. 31) that designers engage in as they attempt to achieve artistry in their work. This includes (a) repertoires of talk, and (b) "back talk" (Schön, 1987, p. 31). In both the orienting and mediating roles in this study, themes of talk entailed *reflecting-in-action* during design problem solving and *reflecting on the montage sequence* after the task was performed (Schön, 1987).

The teachers in the current study also demonstrated more sophisticated forms of reflective thinking and reflective discourse (McDonnell et. al., 2004; Schön, 1987; Kozma, 2000). In contrast to articulating the formal elements of individual surface information, they had begun to explore more complex forms of representation associated with the structure of visual narratives (Grabe & Zhou, 2003; Quigley, 2004; Metz, 1974). The principle concept underlying this practice is based on the media's representation of

the montage sequence, which is defined in literature as the temporal linking of representations (Chatman, 1978; Metz, 1974; Van Leeuwen, 2005). Several of the features of the montage sequence were expressed in the form of *summary* that is a cinematic way of deciphering “selected aspects of an event” (Chatman, 1978, p. 69). Data from Participant M1’s segmented protocol transcript and respective narrative network graph, for example, demonstrated his ability to articulate selected aspects of narrative by attending to both the sensory and stylistic functions of existents, as reflected in his use of music themes and metaphoric expressions.

These findings are somewhat consistent with the findings of McDonnell et al. (2004) whose research on video storytelling also indicated industrial design students tended to concentrate on the surface descriptions of their work initially and achieved much higher levels of critical reflection through video editing and retrospective reporting. Rather than collaborative approaches to design practice and narrative, however, this study was concerned with individual interpretations that were relevant to the three teachers’ respective content areas, student populations, and the context from which they presented instruction.

The Approaches to Understanding NFR and New Constructivist Technologies

This study described how an understanding of NFR and new constructivist technologies affected the way in which three teachers designed instructional presentations. Several findings were drawn from protocol reports, montage equation documents, respective interviews, and constructivist theory in an attempt to provide a more comprehensive view of this approach to design practice and the methods for obtaining such ends. Each aspect is presented with selected examples.

The protocols reports. The concurrent and retrospective protocols of montage equations identified five cognitive activities evident in each of the teachers' design performance—specifically, representational approaches to understanding the design process and its connection to the context of their own instruction. The five cognitive categories were identified as (a) content area thinking, (b) design thinking, (c) narrative thinking, (d) representational thinking, and (e) technology thinking. Subcategories for each of the categories were also recognized. Together, the protocols represented a taxonomy of the narrative multimedia design process and show how each of the teachers actively reasoned and attempted to organize their knowledge of NFR using constructivist technologies and multiple media resources. Such an approach was fundamental to meaning making and provided a basis for understanding the countless ways a presentation might be communicated and interpreted (Dewey, 1938; Bruner, 1990; Chandler, 2007; Eisner, 1997; Goodman, 1978; Metz, 1974; Schön, 1987).

When mapping the concurrent protocol reports with the retrospective protocol reports, the concurrent reports were found to be effective in eliciting a direct apprehension of narrative design activity, for both Participant M1 and Participant M2, but not the subtle effects of their thoughts and perceptions. As a result, surface description information mainly was reported. By contrast, when mapping the retrospective protocol reports, significant differences were found in narrative thinking. Findings indicated both visual grammars and semiotic codes, such as syntagmatic and paradigmatic relationships were recognized and reported by all of the teachers.

Studies of design cognition have identified similar findings (Schön, 1988; Suwa & Tvertsky, 1997; Pedgley, 2007). Schön (1988) noted in a protocol study of practicing

architects that a designer's knowledge encompasses both explicit and tacit forms of design reasoning and other design processes. According to Schön (1988), the latter more tacit forms of design cognition function as "holding environments" (p. 182) from which designers make connections, search for patterns, and find solutions based on their prior knowledge and experience of similar design situations and media. Suwa and Tvertsky (1997), from a protocol study of novice and expert designers, further suggested that think-aloud protocols have the potential to affect a designer's perceptions of their work given the information processing perspective reported in the protocol research of Ericsson and Simon (1993). By pursuing retrospective reporting, with video cues, they claimed, they were able to retrieve the functional thoughts underlying expert designers' sketches.

These forms of cognition and perception might also help to explain some of the individual differences that were observed in this study. As noted in Chapter 4, the three teachers' prior knowledge and experiences with representations were codified in what has been described as symbol systems (Chandler, 2007; Eisner, 1997; Gardener, 1990; Goodman, 1968). From this perspective, Participant F1's orientation towards reading the surface information of representations and subsequently arranging MERs according to the spatial information might be seen as comparable to the information source view proposed by Mayer (2005) and the encoding view proposed by Sundermeier et al. (2005), with respect to prior knowledge and narrative text, respectively. Both views were introduced in Chapter 2.

It might help to recall that Sundermeier et al. (2005) found that spatial information is encoded and can be accessed and retrieved in narrative text depending on

its casual relevance in addition to how accessible and functional the information is to the reader. This suggests Participant F1's ability to recognize spatial relationships during the retrospective reporting session may have been due her ability to make connections between her prior knowledge of reading and the spatial information in the montage sequence. Metz (1974) proposed, "the word is a syntagma that is precast by code" (p. 100) and the sentence is comparable to a cinematic shot. Given this perspective, Participant F1 may have been reading representations in a similar way. As a consequence of this, events and codes were recognized as patterns in the montage sequence and may have also triggered memory responses that allowed her to recall her cognitive activities; sometimes in ways that ran in parallel to her concurrent report.

Correspondingly, the network graphs of concurrent think-aloud transcript segments of montage equations showed how Participant M1's continuous thought segments (e.g., same subject matter) and new thought segments (e.g., start of new subject matter) were the most productive among the individual cases. In this way, each new thought segment began with a design proposition such as reference and review as opposed to digital editing, in the case of Participant M2. Digital editing, in this study, appeared to require higher degrees of cognitive processing due to the use of new tool methods and techniques. Technical issues were also found to interfere with productive design moves for both Participant F1 and Participant M2.

According to Samaras et al. (2006) " . . . active cognitive processing is important for learners to make sense of information . . . If learners are not actively processing information . . . the conformity between media affordances and task demands, may not make much of a difference" (p. 22). This suggests, digital editing as it related to the use

of new constructivist technologies may have occasionally interfered with the teachers' active cognitive processing.

In the analysis of retrospective narrative protocol sessions with video cues, differences were also found in the teachers' choice of technology tools and working methods. For example, Participant F1 reported how she used the PPT application to crop and size images. By contrast, Participant M1 explained how he considered the synchronization of digital media files in the iMovie application, and Participant M2 recalled how he used digital photographs and inserted blank slides and sound files into the PPT application.

The montage equation documents. The results of the paradigm of montage equation parts (i.e., documents) showed how all of the teachers recognized the formal elements and semiotic qualities of montage equations. Just as in the storyboards stage, they each found distinctive ways to link images such as title cards and other silent film inspired juxtapositions. Both Participant F1 and Participant M1created montage equations and techniques based on what they considered to be most important and appropriate for their final presentations. Neither one, however, recognized what Schön (1987) had called the situations of their own design practice. As a consequence of this, they probed and offered examples of what they thought montage might be during interviews. Moreover, Participant F1's decision to use the PPT application as opposed to new constructivist technologies resulted in what might be called a hybrid intellectual montage because she had not considered the dynamic features of the design. This latter and necessary function had been observed in the two other teachers' work.

Cognitive dissonance. The inability to recognize “deep structural relations” among representations has been explained in the research literature as novice behaviors (Ainsworth, 2006, p. 191). Without the necessary domain knowledge and corresponding level of skill, novice learners tend to experience difficulties both in their approaches to arranging representations (Ainsworth, 2006; De Vries, 2004; Kozma, 2003; Lewalter, 2003) and in their recognition of their competent performance (Schön, 1987).

For the teachers in this study, the narrative stages of content creation had been purposefully designed to (a) foster knowledge transfer (Ainsworth, 2006; Kirschner et al., 2005; Stern et al., 2003), (b) allow for associations, and (c) support them in the complex task of design problem solving. However, most of the work required new computer graphics competencies and technology skills and this had both practical and theoretical consequences for the teachers. For example, the teachers had to cope with the *cognitive dissonance* they were experiencing by first deciding whether the conception of a narrative instructional presentation even fit with their teaching philosophies (Baviskar et al., 2009). Then, they had to improve upon their work by adapting new design practices into their previous working methods. Most of all, they had to make changes to their knowledge constructs (Baviskar, et al., 2009; Hirumi, 2002; Sivan, 1986). Cognitive dissonance is described in constructivist literature as an important criterion for learners to be able to expand upon their knowledge constructs (Baviskar, et al., 2009).

In conversations with the three teachers there was sense of achievement, enjoyment, and satisfaction about understanding the dimensions of NFR. Further, there were motivations such as career goals and perceived opportunities for creative expression. All of the teachers said the narrative stages of content creation had helped

them to become better designers. They also believed they had acquired the representational competencies that are important for teachers to know.

Reverting was defined in this study as resorting to the use of prior knowledge in an effort to complete a task. On various occasions, the teachers attempted to reduce the cognitive dissonance they were experiencing by resorting to the use of older constructivist technologies such as PPT. Design factors and socio-cultural conditions such as accessibility, course requirements, time constraints, and low-level computer graphics competencies occasionally affected the way in which the teachers used new constructivist technologies.

Indications of low-level computer graphics competencies included downloading files as thumbnails rather than by file types and then experiencing problems due to the handling of small image sizes. This latter effect caused both Participant M1 and Participant M2 to spend time trying to correct what they perceived to be image resolution issues. In addition to technical issues with images, file sizes, and file types, the management of sound files was problematic. Observations revealed abrupt changes in music and static noises to varying degrees.

Participant F1 claimed her decision to revert back was due to lack of time and unfamiliarity with the digital editing software. In addition, she admitted she had little understanding of how to download images. She used a camera microphone to record her voice rather than using audio-editing software and a computer microphone. She also used the PPT application to edit her representations because, she claimed, she did not know how to use image-editing software.

Another reason Participant F1 gave for reverting back to older technologies had to do with college lab times. Later, during a discussion meeting, she acknowledged, she did have access to the software in her position as a graduate assistant, but it did not occur to her at the time.

Participant M2 considered the video editing software to be inferior and of poor quality. This misconception was a consequence of the way in which he had downloaded images as thumbnails. Constraints such as having little time to practice using the software tools, and access, were also cited as reasons for reverting.

Participant M1 was the only one of the teachers who appeared to understand how to incorporate new constructivist technologies into his work. This may have been due to the fact that he owned the software and could experiment with it and, therefore, did not have as many technical issues to contend with.

The Design of a Narrative Instructional Presentation

This study explored how each of the teachers described their approach to the design of a narrative instructional presentation for their content area and the evidence that existed to support the processes they described. The results of the narrative protocol reports and componential analysis of narrative instructional presentations, with respective interviews, highlighted these activities from both formative and summative perspectives.

The qualities of form. The narrative retrospective protocol data showed how all of the teachers designed the narrative instructional presentation to complement their content area and the formal context in which the work was to be presented. For example, both Participant F1 and Participant M1 designed the narrative instructional presentations to be used as a self-guided teaching tool, whereas Participant M2 designed the narrative

instructional presentation to be used as an introduction to a multimodal lesson. The formal contexts included a Web site, wiki, and a live performance in the classroom, respectively.

As far as the total form was concerned (Bordwell & Thompson, 2004), the teachers focused on the construction of a narrative instructional presentation rather than on approaches to evaluating it in a real life context. Time constraints and curriculum needs were cited as some of the reasons for not showing the work to students during the study. By contrast, some the narrative multimedia design studies, presented in Chapter 2, focused on the educational value and coherence of the total form of a multimedia presentation for an audience. Approaches to evaluations in these studies included: (a) usability testing (Kim, 2005), (b) student outcomes (Laurillard, 1998; Voithofer, 2003), (c) individual experiences (Blythe et al., 2006), and (d) interactive engagement (Mallon & Webb, 2000) in both digital environments and situated real life contexts.

Related to the three teachers' focus on the construction of a narrative instructional presentation is what Ainsworth (2006) had called a "novel representation" (p. 185). Like montage, a novel representation is interpreted before the information can be further combined with information from other representations. The situation quickly becomes complex when there is more than one novel representation to contend with. In this case, the novel information resulted in a novel format. That is, a narrative instructional presentation.

In the current study, the teachers described how they attempted to integrate both the project specifications and subject matter information into the structure of the presentations so that it might operate effectively within the formal context. Because they

did not possess the level of expertise necessary to balance all of the external conditions of the design situation, the student audience became problematic. De Vries (2006), from a protocol study of learners' interactions with MERs on the CAD system suggested, learners' "construct a deeper understanding" through the process of "progressively imagining the future artefact in more detail as they represent it and vice versa" (p. 217). The fact that the teachers had considered the function of the total form suggests they were consciously striving to construct a deeper understanding of the design situation in order to determine how the presentation might function in a real-world teaching context.

Themes and demonstrations. The paradigm of narrative instructional presentation served as further evidence of the three teachers' efforts to make connections between the narrative format and the formal context of the work. Eight attributes, representing the form of a presentation, such as themes and demonstrations were identified in all of the instructional presentations. Findings indicated Participant F1 developed two visual themes. One related to park safety and one related to park responsibility. Music, narrations, graphic organizers and iconic representations were demonstrated. By contrast, Participant M1 developed one explicit theme and one implicit theme based on the conception of myths and meanings. Characterizations, narrations, existents, music themes and maps were arranged in an effort to arouse student emotions and interests. Conversely, Participant M2 used two explicit visual themes. One related to the natural wonders of Yellowstone National Park and one related to the park's animals. The narration mode was improvised and two sequences depicting the subject matter were arranged with supporting text.

Demonstrations were designed to include extended activities such as planning a trip, writing a myth and using digital photographs as a reference base for a drawing assignment. The preeminent enactment (Chatman, 1978) of the teachers that began with the use of directives in the storyboards was also evident in all of work. For example, the dialogues in the presentations were spoken in a conversation style consistent with the e-learning principle of personalization (Mayer, 2005: Mayer et al., 2004; Mayer et al., 2003) together with some of the dramatic principles consistent with Aristotelian triads (Grabe & Zhou, 2003).

As noted in Chapter 4, the social persuasiveness of Participant M1's narration included making visible appearances inside of the presentation. By representing his own existent (i.e., character) in both visual and auditory forms, he was able to achieve personalization and "Help the narrative out," he said in an interview. Within the presentation, Participant M1's existent functions as an active agent by offering what Moreno and Mayer (2005) had called "guided explanations," as he highlights important details in some of the scenes of the story. As part of this preeminent enactment, he exposed some of the thoughts of individual existents and makes emotional appeals to students based on some of the conflicts the main character is experiencing. In describing data gathered from a census of the 60 Minutes news program, Grabe and Zhou (2003) identified these characteristics and used them as proof of logos, ethos, and pathos in news reporters' narratives.

The Features and Forms of Narrative

This study described how the features and forms of narrative were expressed in each of the teachers' designs. As was the case with the other aspects of NFR in this study,

the features and forms might be seen as a series of connected relationships, starting with what Arnheim (1957) had called “the hierarchy of media in a work of art” (p. 233). For example, throughout the design process, the conceptual foundation of storyboards provided a basis for making revisions to the features and forms of NFR in both the montage equations and narrative documents and also showed how the three teachers shared a common interest in exploring both the conceptual and perceptual affordances of the media.

Whereas the total form of the work had been concerned with the three dimensionality of connected relationships in terms of how the presentation form, formal context, and student audience function together; the features and forms described here had been concerned with connected relationships in terms of how “objects, symbols, and meanings” commingle within the presentation form itself (Altheide, 1996, p. 2).

Like the total form, these relationships include both explicit and tacit dimensions and were expressed in the teachers’ designs through (a) practical approaches to understanding the “techniques of representation” as indicated by approaches to content creation and forms of meaning making (see Table 38) (Metz, 1974), (b) stylistic and historical influences stemming from a system of codes and visual grammars as indicated by narrative treatments (see Table 38) (Arnheim, 1957; Metz, 1974, Chandler, 2007), and (c) theoretical accounts of the teachers’ design experiences and perceptions based on design practices and making connections with their respective content areas as indicated by cultural perspectives (see Table 39) (Eisner, 1997; Schön, 1987; Goodman, 1978).

In conversations with the three teachers there was a heightened sense of awareness of how students’ might experience a narrative instructional presentation and

also of their new cultural knowledge as novice designers. On a sensory level, they said were determined to move beyond the docile relationship that often exists between teacher-presenter and student-viewer by constructing learning experiences that could elicit both emotional and intellectual responses from their students.

Table 38

Cross-case Synthesis: Associated Theoretical Outcomes

Case	Effects on Instructional Designs		
	Goals	Approaches to Content Creation	Narrative Treatments
F 1	Web display	Five stages of content creation	Storyboard format: Show and tell
	DVD	Decoding aesthetic and surface information	Graphic mnemonic: Spatial syntagm
		Cognitive activities: CT, DT, NT, RT, TT	Poetic structures
		Design moves: NITS, NTS, Return links	Montage: Syntagma and paradigms
		Multimedia principles: Contiguity and personalization	Hybrid intellectual, relational, rhythmic
		Prior knowledge of reading	Narrative presentation movie:
		Reference base: Storyboard	Second person directive
		Representations:	Sequential syntagma
		Distinctive, figurative, graphic, symbolic, music	Aristotelian triad: Logos and ethos
		Codes and visual grammar	Linguistic structures
M1	Wiki	Five stages of content creation	Storyboard format: Polyptyph narrative
		Decoding aesthetic and stylistic elements	Humor and celebrity existents
		Cognitive activities: CT, DT, NT, RT, TT	Second person directive
		Design moves: NITS, NTS, Return links	Poetic structures
		Multimedia principles: Contiguity and personalization	Montage: Syntagma and paradigms
		Embedding representations	Intellectual, summary and parts
		Prior knowledge of music	Sensory and stylistic existents
		Reference bases: Script, storyboard, help	Narrative presentation movie:
		Representations:	Sequential syntagm
		Distinctive, figurative, symbolic, music	Structuralist storytelling
		Music mixing and sound editing	(“Help the narrative out”)
		Codes and visual grammar	Aristotelian triad: Logos, ethos, pathos

(table continues)

Table 38 *(continued)*.

Case	Effects on Instructional Designs		
	Goals	Approaches to Content Creation	Narrative Treatments
M2	Multimodal performance	Four stages of content creation Decoding the aesthetic qualities of images Cognitive activities: CT, DT, NT, RT, TT Design moves: NITS, NTS, Return links Multimedia principles: Personalization Prior knowledge of art Discovery learning: Unstructured Extend ideas Perceptual effects—Transitional flow Representations: Distinctive, figurative, and symbolic Codes and visual grammar	Storyboard format: Picture book Double narrative Humor and caricatures Montage: Syntagma and paradigms Metaphors: Death; Mexican culture Intellectual and parts Narrative presentation slideshow movie: Sequential syntagm Aristotelian triad: Logos and ethos Linguistic structures

Table 39

Cross-case Synthesis: Associated Theoretical Outcomes

Case	Effects on Social Interactions		
	Tool Use	Cultural Perspectives	Forms of Meaning Making
F1	iMovie/iPhoto MovieMaker PPT Image networks Blog Camera microphone	"I think, I approached this from the perspective, this is something I don't know; this is something I need to know; this is something I want to know" "I realized, there's more there than I as a creator was even aware of as I was doing it" "Huge learning curve" Practical importance-hands-on "Another toolbox for teachers" "Sense of accomplishment" "That's what kids do now" (i.e. video) "I watch movies in a new way now" Teachers need to know this	Storyboard annotations and drawing Script writing Decoding: "Thinking 'contiguity' here" Deconstructing images Iconography Gathering media Ill-structured problem solving Digital editing Probing the media (issue) Visual themes: Safety and responsibility Demonstrations: Planning a trip
M1	iMovie/iPhoto Image Networks Social Networks Microphone	"I wanted to make sure that it would be something that I could use in my classroom to teach my students" "I learned the design of any narrative takes time" "Help the narrative out" (i.e., music cues) Student needs "I can't look at films the same way as I did before" Technology teachers as narrative designers "Reusable product"	Storyboard annotations and drawing Script writing Metaphors Compositing images Gathering media Ill-structured problem solving Digital editing Probing the media (issue) Metacognitive thinking Implicit theme: myths and meanings Demonstrations: Writing a myth

Table 39 (continued).

Case	Effects on Social Interactions		
	Tool Use	Cultural Perspectives	Forms of Meaning Making
M2	PPT iMovie/iPhoto Image Networks Microphone	“Develop a critical eye” (i.e., learn to see) “I was still in kind of in a PowerPoint mode” “Expose all teachers to multimedia technologies and narrative techniques” “Student engagement is important” “If it engages the student, it’s time well spent” “Avoid sounding monotone” (i.e., unrehearsed narrations)	Storyboard balloons and directives Drawing Visual thinking Implicit features: Visual analogies Metaphors Gathering media Ill-structured problem solving Digital editing Probing the media (issue) Metacogitive thinking Visual themes: Natural wonders-animals Demonstrations: Using digital photographs as a reference base for a drawing assignment.

Implications of Research

Contemporary interests in the field of multimedia learning have acknowledged the importance of studies focused on design issues (Ainsworth, 2006; Ainsworth, 1999; De Vries, 2006; Lajoie & Nakamura, 2005; Schnotz, 2005) beyond those concerned with observational data and expert verses novice performance data. Among these design issues is the need to study a broader range of digital media and interactive technologies from different perspectives (Ainsworth, 2006; Ainsworth, 1999; De Vries, 2006; Lajoie & Nakamura, 2005; Schnotz, 2005). Design problem solving with various media and design activities involving the construction of representations are examples of what some multimedia researchers have been attempting to understand (Ainsworth, 2006; De Vries, 2006; Lajoie & Nakamura, 2005).

The current study coincided with contemporary interests in multimedia learning and narrative multimedia design. Through this analysis the relationship between constructivist technologies and media affordances, historical and technological sources of narrative, and teachers positioned as designers allowed for an in-depth view of design-based learning from an interdisciplinary perspective.

The findings of this study also have implications for both the fields of multimedia learning research and teacher education in terms of learning how to design multimedia instructional presentations effectively. Professional development in learning how to design with computer graphics and new constructivist technologies is also suggested.

Limitations of Study

As with all studies, there were limitations in the current study that affected the research findings. These include (a) generalizability, and (b) researcher's bias.

First, the descriptive qualitative procedures that were used in this study were designed for a small sample of teachers enrolled as graduate students in an instructional design of educational software course at a university. The possibility therefore exists that the research findings might yield different outcomes for more diverse populations and the circumstances of their productions. Further, the three teachers' individual approaches to design practice and the particularities of their narrative instructional presentations might not be transferable to other academic disciplines or instructional design situations. Lastly, the categorizations of cognitive activities from protocol reports and the attributes of NFR from paradigms might allow for generalizations to be made in relation to both multiple case studies and experimental studies if similar design criterion are used, as suggested in the research of Merriam (1998) and Stake (2006).

Second, because the researcher conducted all of the data collection and analysis for this study, there is the possibility of researcher bias with respect to the results reported. In addition to being the primary instrument (i.e., researcher as instrument), the researcher was a visiting professor of computer graphics and a doctoral student in curriculum and instruction with an emphasis in technology at the time of this study. Further, the researcher designed the narrative curriculum and presented the related instruction to all of the teachers in the classroom. In an attempt to reduce researcher's bias, thick descriptions, teacher vignettes, and direct quotations were used (Merriam, 1998, Schön, 1987; Spradley, 1980). Further, data such as the protocols were analyzed more than once in an effort to provide accurate descriptions of both the three teachers' tacit knowledge and worldviews (Merriam, 1998).

Conclusions

This study introduced both formative and summative learning situations in which three teachers constructed narrative instructional presentations for the first time. It differed from the other studies in the literature review of this paper focused on formative situations from an audience perspective (Blythe, et. al, 2006; Kim, 2004); professional perspective (Grabe & Zube, 2003), peer perspective (Lee et al, 2007; McDonnell et al., 2004), expert guidance perspective (Voithofer, 2003), and design-based learning perspective involving the design of one product (De Vries, 2006; McDonnell et al., 2004).

The development of the narrative curriculum for design problem solving in this study also reflects the narrative design work of McDonnell et al. (2004) and design-based work of De Vries (2006). However, this study also provided an in-depth look at the different phases of content creation based on design concepts, perceptions, theories, and practical approaches from the standpoint of teachers learning to design narrative instructional presentations for students to learn from.

One of the objectives of the research was to determine how NFR might be used to present instruction in different learning situations and contexts and also across different academic disciplines. Given the array of possibilities that have surfaced during this investigation, it is not possible to offer a complete framework. However, the implications of the research suggest the formal elements, semiotic dimensions, and aesthetics of narrative, in combination with some of the principles of multimedia learning may offer learning situations and experiences that can foster student engagement.

The theoretical framework of constructivism provided a basis for analyzing the three teachers' learning experiences. The approach, however, is open for further analysis and experimentation. The attributes and performance descriptions in this narrative multimedia framework was offered from the position that it might be captured and applied to some of the emerging mobile technologies that can promote dynamic visual and verbal representations aimed at personal learning experiences for both students and teachers. Although this form of learning to design with new constructivist technologies did not occur as anticipated, there were many other dimensions of these design situations that were both observed and documented and extend beyond what has been reported here.

APPENDIX A

STUDENT QUESTIONNAIRE

Appendix A

Student Questionnaire

Name:____

Email: ____
Course: Instructional Design of Educational Software
Principal Investigator: Randall Boone
Student Investigator: M. Elyse Diamond

What is your level of confidence to perform the following technology-related tasks?
Check all that apply ☑

❑ Operate the Mac operating system	❑ Use a search engine
❑ Save files	❑ Download a file from the Internet
❑ Create folders	❑ Upload files to WebCT
❑ Use a text application	❑ Scan files
❑ Copy and paste text	❑ Edit audio
❑ Transfer files to a disk	❑ Edit images
❑ Burn a CD	❑ Edit video
❑ Send an email	❑ Build a website
❑ Send an email attachment	❑ File Transfer Protocol (FTP)
❑ Surf the Internet	

Constructivism
Define constructivist learning.

Instructional Technology Courses
List all of the instructional technology courses have you have completed.

Instructional Lessons
Describe how you use technology in your classroom instruction.

Academic Discipline
What subjects do you teach? What grade level?

School
List your school affiliation and education level (e.g., elementary, secondary, post-secondary).

APPENDIX B

CRITERION SCALE SHEET

Appendix B

Criterion Scale Sheet

Name: Continuum: /30

What is your level of confidence to perform the following technology-related tasks?

Total Points:	No response	Meets some of the criteria	Meets most of the criteria	Meets all the criteria
	0 Points	1-6 Points	7-8 Points	9 Points

Instructional Technology Courses. List all instructional technology courses completed.

Total Points:	No response	One-Two courses	Three-Four courses	Five-Ten courses
	0 Points	1 Points	2 Points	3 Points

Instructional Lessons. Describe how you use technology in your classroom instruction.

Total Points:	No response	Described one way technology is	Described two ways technology	Described three or more ways
	0 Points	1 Points	2 Points	3 Points

Academic Discipline. What subjects do you teach?

Total Points:	Same subject area as three or more participants	Same subject area as two participants	Same subject area as one participant	Different subject area
	0 Points	1 Points	2 Points	3 Points

What grade level do you teach?

Total Points:	Same grade level as three or more participants	Same grade level as two participants	Same grade level as one participant	Different grade level
	0 Points	1 Points	2 Points	3 Points

School. List your school affiliation.

Total Points:	Same school as three or more participants	Same school as two participants	Same school as one participant	Different school
	0 Points	1 Points	2 Points	3 Points

List your education level (e.g., elementary, secondary, post-secondary).

Total Points:	Same education level as three or more participants	Same education level as two participants	Same education level as one participant	Different education level
	0 Points	1 Points	2 Points	3 Points

Continuum

	Lowest	Average	Above average	Highest
	0-20 Points	21-26 Points	27-29 Points	30 points

APPENDIX C

INFORMED CONSENT

Appendix C

INFORMED CONSENT

Department of Curriculum and Instruction

TITLE OF STUDY: The Role of Narrative in Multimedia Learning
INVESTIGATOR(S): Randall Boone, Professor in the Curriculum and Instruction department.
Myrna Elyse Diamond, doctoral student in the Curriculum and Instruction department.

Purpose of the Study
You are invited to participate in a research study. The purpose of this study will be to describe the way in which teachers apply their understanding of narrative and new technologies to construct multimedia presentations for learning and instruction.

Participants
You are being asked to participate in the study because you are enrolled in the course, CIT 743 - Instructional Design of Educational Software, and Dr. Boone wants to get student reactions to the use of narrative as a specialized representational format for the design of instructional presentations constructed with constructivist technologies (new Internet oriented tools).
.
Procedures
If you volunteer to participate in this study, you will be asked to do the following:
(a) Engage in a talk-aloud protocol analysis in which you will work through a narrative design task and verbalize your thoughts for fifteen minutes. The analysis will be video recorded and discussed with you in a subsequent discussion meeting.
(b) Engage in a retrospective protocol analysis in which you will work through a narrative design task without verbalization for thirty-minutes. This task is the same, as the in-class activity required of all students. The difference is your participation will be video recorded and discussed with you in a subsequent discussion meeting.
(c) Agree to one interview and two discussion meetings with a UNLV researcher to be scheduled over the six-week timeframe of this study. The interview will be a background interview. The two discussion meetings will be based on the talk-aloud and retrospective protocol analyses mentioned above. The duration of the interview and two discussion meetings will be approximately thirty-minutes.
(d) Agree to data collection of your class projects for analysis.
Data from this study will be used only for the purposes outlined in the research questions of this study and will not be used or effect any work evaluation.

Benefits of Participation
There may be direct benefits to you as a participant in this study. We hope to learn the implications of teachers' use of narrative forms of representation and constructivist technologies in the design of instructional presentations and the effects of these findings on multimedia learning. Students who participate in the study will have the opportunity to express their thoughts regarding the use of narrative as an instructional presentation format and the potential benefits of creating their own instructional presentations, developed with constructivist technologies.

Risks of Participation
There are risks involved in all research studies. This study may include only minimal risks. You may be nervous about having a UNLV researcher observe you in class, about sharing information in the protocol analyses, about having your narrative products analyzed and or about participating in the interviews. However, all efforts will be made to provide a comfortable environment and put you at ease during these times.

Cost /Compensation
There will not be financial cost to you to participate in this study. The study will take two hours of your time. You will not be compensated for your time.

Contact Information
If you have any questions or concerns about the study, you may contact Dr. Boone at (702) 895-3375. For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact **the UNLV Office for the Protection of Research Subjects at 702-895-2794.**

Voluntary Participation
Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality
All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for three years after completion of the study. After the storage time the information gathered will be destroyed.

Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

____ __________________
Signature of Participant Date

____
Participant Name (Please Print)

Participant Note: Please do not sign this document if the Approval Stamp is missing or is expired.

APPENDIX D

CURRICULUM SCHEDULE: INSTRUCTIONAL DESIGN

OF EDUCATIONAL SOFTWARE

Appendix D

Instructional Design of Educational Software, M, 04:00 PM-6:45 PM, BDC 113

Curriculum Schedule – Fall 2008 (Some topics were not covered)

Wk	Rep. & Tools	Task
1	Images or Video	Introduction to narrative and forms of representation: • Narrative forms, media, perception • Narrative examples: content, form, events and function Discuss software tools, equipment and supplies
	Text	Introduction to the project: Teach a narrative concept using multimedia • Specifications (process requirements) • Audiences' narrative needs and teacher-designers' interpretations
	Images or Video	• End product (goal)
	Images or Video	Introduction to visual grammar (iconic elements of narrative): • Describe the function of shot scale: What is it? How does it work? • Review a slide show on the standard measures of shot scale • Practice identifying cinematic framing (e.g., shot scale)
	Images or Video	Composition: Lines and gaze
	Action	In-class, collaborative identification of cinematic framing Homework:
	Text	• Write a proposal for the final project and post it by week 3
	Text	• Assigned reading(s)
2	Images or Video	Introduction to events and personalization: • Terms: Agents/Characters/Existents • Aristotle's Triads: Ethos, logos, pathos
	Images or Video	Narrative Form • Cross-cutting • Point of View (POV) • Over the Shoulder (OTS) • Spatial, temporal and causal orders
	Diagrams	• Plot models (e.g., Aristotlean and Freytag's triangle) Composition: Information value (placement)
	Images	Introduction to storyboarding concepts
	Images or Video	• Demonstration of storyboarding concepts
	Video	• Aspect ratios
	WWW & Text	Fair Use; Copyright free audio and images
	Text	Introduction to scripts for narrations and transitions (FX)
	Action	In-class, collaborative identification of form and personalizations

(table continues)

Appendix D *(continued)*

Curriculum Schedule – Fall 2008 (Some topics were not covered)

Wk	Rep. & Tools	Task
	Text	• Assigned reading(s)
	Multimedia	• Research text and collect artifacts for the storyboard visualizations
	Text	• Develop a script for the storyboard narration
3		Composition:
	Images	• Linking conventions and media affordances
		• Color concepts for comprehension
4	Video	• History of montage
	Images or Video	Introduction to montage techniques (iconic elements of narrative)
	Video	• Kuleshov effect and Eisenstein's intellectual montage
5	Mics & SF	Introduction to sound, audio & image capturing, editing and saving
	SW	Introduction to intros, outros and FX (e.g., sound effects)
	Action	In-class, create a collaborative intros
		Homework:
		• Collect and bring images for intellectual montage editing, next class
6	Images	Homework:
		• Develop storyboards on supplied templates
	Text	• Assigned reading(s)
7	Images or Video	Review the function of montage: What is it? How does it work?
		Formative critiques on storyboards
8	Action	In-class, create mini visual narrative: Intellectual montage
	Images/Video	Introduction to video capture, general editing, FX and saving
		Homework:
	SW & Text	• Record the audio track from script with intro, outro and FX
	Text	• Assigned reading(s)
		• Collect and bring images for instructional present task
9	Audio	Audio cont.:Intro to Foley artists (iconic elements of narrative)
		Embedding causal cues
	SW & Video	Introduction to video capture, general editing, FX and saving
	Action	Hands-on practice editing video
		Homework:
10	SW & Video	• Capture images and or video
	Action	Publishing: FTP and Web posting
11	Critique	Narrative presentations
		Summative critique

APPENDIX E

BACKGROUND INTERVIEW QUESTIONS AND EXAMPLES

Appendix E

Background Interview Questions and Examples

Question	*Example*
Background	What is your educational background? What is your content area? What kinds of experience do you have with technology?
Descriptive	Describe your goals for developing instructional presentations. Describe the types of instructional materials you have constructed and how they were used.
Devil's Advocate	Suppose you are the teacher of this course. What would you do differently?
Hypothetical	Some instructional designers would say developing a script is important if you want to produce an effective narrative instructional presentation. What would be your response this statement? Suppose you have a diverse group of students with little or no understanding of the English language. How could you arrange the media so that it has meaning for these students?
Ideal Position	If you could start the storyboard all over again, what would you do differently?
Interpretive	What do you think of the work you produced? How do you envision using this presentation format in the future?

Note. (Merriam, 1998: Yin, 2003)

APPENDIX F

TIMELINE: ACTIVITY PLAN, METHODS, AND DATA COLLECTION SCHEDULE

Appendix F

Timeline: Activity Plan, Methods, and Data Collection Schedule

CIT 743, Instructional Design of Educational Software, M, 04:00 PM-6:45 PM	
Week	Task
3	Discuss the purpose of the study with the class. Include information about observations and interviews
	Discuss the participant criterion
	Respond to student questions
	Distribute and collect student questionnaires
	Collect field notes: General observations of the cultural scene
	Render a map (diagram) of the classroom
4	Review questionnaires with the principal investigator and select participants
	Request participation from three students for the study. Send an email invitation
	Distribute and collect informed consent forms from the three participants
	Collect field notes: General observations of the cultural scene
5	Schedule interview dates, times and locations with the three participants
	Collect field notes: General observations of the participants, artifacts, and setting
6	Conduct initial background interviews with the three participants
	Field notes: General observations of the participants, artifacts and setting
7	Observations of documents: Examine participants' proposals and scripts
	Transcription: Transcribe the semi-structured background interviews
8	Conduct talk-aloud (TA) protocol of montage equations with the participants.
	Collect field notes: General observations of the participants, artifacts, and setting
	Observations of documents: storyboards scenes
	Transcription: Transcribe the TA protocol reports
9	Conduct retrospective protocols using TA video cues (reflective design thinking)
	Field notes: General observations of the participants, artifacts, and setting
	Encoding and segmentation: TA words, phrases, sentences, and gestures
	Transcription: Transcribe the retrospective protocol reports
10	Conduct concurrent protocols without verbalizations
	Field notes: General observations of the participants, artifacts, and setting
11	Encoding and segmentation: retrospective words, phrases, sentences, and gestures (e.g., pointing, facial expressions).
12	Conduct retrospective protocols (RP) using concurrent video cues
	Field notes: General observations of the participants, artifacts and setting
	Map TA and retrospective protocols
13	Conduct and audiotape a class critique
	Transcription: Transcribe the retrospective protocol reports
	Field notes: General observations of the participants, artifacts, and setting
14	Encoding and segmentation: RP words, phrases, sentences, and gestures.

APPENDIX G

TEXT DESCRIPTION EXAMPLE FOR STORYBOARD DOCUMENT ANALYSIS

Appendix G

Storyboard Text Description Examples

Know the Basics: Backcountry Camping in Yellowstone National Park, by Participant F1

Scene 1: Title: Know the Basics: Backcountry Camping in Yellowstone National Park. Emphasis is given to the *syntax of words* [text]. The design for the phrase "Know the Basics" is depicted in *block letters* [text]. "Backcountry Camping in Yellowstone National Park" is rendered in *single stroke* [text] and are *italicized* [text]

Scene 2: This is a *close-up* [shot scale] of a *young woman* [character] with long dark hair. The image occupies a large part of the scene and is slightly off center from the rule of thirds. The background of the scene is rendered to suggest *atmospheric perspective* [depth in space]. The pencil strokes are very *light* in contrast to the *dark contours* [lines] used to depict the young woman. The background also includes *roughly sketched forms* [simplification] suggesting mountains and bushes. The upper corner of the scene also includes a smaller image of the woman positioned alongside a *sign* [icon] with the words, "Yellowstone National Park."

Scene 3: This is a *wide shot* [shot scale] of *two men* [characters] positioned on the right side of the scene. One man is wearing a *wide brimmed hat* [costume] and the other is wearing a *hunter's cap* [costume] On the very far right, there is the *trunk of a tree* [prop] and on the far left there is a large, *triangular tent* [prop]. A *horizon line* [line] cuts across the vertical background, almost halfway across the scene. Behind the line, to the right, is a *light pencil rendering* of trees [depth in space]. Two other tall, pine trees are also positioned to the left, *behind the tent* [depth in space]. A linear suggestion of mountains is positioned *beyond them*, [depth in space]. One of the mountains almost touches the top of the frame.

Scene 4: This is a *wide shot representation* [shot scale] of the state of Wyoming. It is a contour drawing with *dashed line* [line] to suggest the bordering states of Montana and Idaho. A small *icon* form overlays the bottom, right side of the *map*, positioned within the top and left side of the scene and aligned within the first vertical and horizontal *implied lines* [lines] of the *rule of thirds* [composition]. *Lightly sketched* [depth of space] suggestions of Yellowstone Lake, Canyon Junction and Saw Creek are depicted.

Scene 5: This is a *wide shot* [shot scale] representation of an arrowhead shaped *emblem* [icon] for Yellowstone National Park. It is positioned on the far, right third of the frame and the words, *Yellowstone Park Service* are *stacked* [text] one over the other. The words are positioned on the top right of the emblem. To the left of the words is a tall pine tree and to the right, there are *softly sketched lines* [line], indicating mountains. The tree rests on *vertical, linear, spiked lines* [lines] that are *darker than the mountains* [depth in space] in the background. Towards the bottom of the emblem there is a *linear logo of a bison* [icon]. Lastly, positioned, along the bottom third of the frame, vertically and horizontally

positioned on the edge of the *rule of thirds* [composition] is a *Web address* [text] for Yellowstone. The word "click," is lightly rendered below it.

Scene 6: Montage: three *wide shots* [shot scale] divide the frame into vertical columns [triptych]. To the far left is a representation (map) [icon] depicting *icons* for picnic areas the shape of *picnic tables* [props] and Indian Creek in the form of a triangle. There are also *symbols* [icons] such as 21 miles and 34 km. Sites include: Golden Gate, Willow Park, Bunsen Peak and Olosidian Creek.

The center column is a depiction of *five stick figures* [icon] that are *iconic*, dark to suggest *silhouettes* [composition]. Two pairs are the same size one is much taller than the rest. The figures are on the lower park of the column. To the right of the last figure is a picnic table. A *horizon line* [line] begins around the waistline of the images. Also, *behind* [depth of space] the figures are four trees, *sketched lighter* [depth of space] than the figures. The tree heights end about a ¼" from the top of the page. *Each one is slightly different in appearance* [unity by variety]. This includes a pine tree, a tree with foliage, a bare trunk and a more *abstract pine tree* [icon] drawn in a *triangular* formation.

The far right image is full of *icons of artifacts* [icons] for camping including canteens, a first aid box, a rolled up sleeping bag, calendar, toothbrush and bottle.

Scene 7: This is a *wide shot* [shot scale] depicting a thunderstorm. The *horizon line* [lines] falls slightly below the *rule of thirds* [composition]. To the far right is a pine tree depicted in *darkly rendered lines* [lines]. The top third of the page contains a light area and around it *dark wavy lines* [Lines], suggesting a thunderstorm. Along the edges of the wavy lines, are *vertical lines* [lines] that touch the far edges of the page. Below the horizon line there is a *contour drawing* of a mountain and dark, *jagged contour lines* [lines] *suggesting thunder* [icon] vertically divides the page.

Scene 8: This is a graphic, representation/*mnemonic* [icon] for an emergency situation. To the far left, in *block letters* [text] the word STOP is shown. The letters are *stacked* [text] one over the other and positioned alongside the words "stop, think, observe and plan." To the far right of the frame, starting at the vertical edge of the *rule of thirds* [composition], four boxes equally divide the space. Each one corresponds to a part of the mnemonic. All of the images are iconic. The first box, includes the stop mnemonic and a *stick figure image* [icon] sitting on a mountain with a pine tree to the far let. The second box includes the "think mnemonic" depicting the *human brain* [icon]. The third box includes the "observe mnemonic" depicting the *human eye* [icon]. Lastly, the fourth box includes the plan mnemonic that is represented as an *OTS shot* [shot scale] of a stick figure holding a *map* [icon]. In terms of design, there is a *nice sense of balance* [balance] between the words STOP and the boxes on the right [balance]. Both are much bolder images that the mnemonic words that are positioned within the center of the page.

Scene 9: *Mid-shot* [shot scale] of a *woman with long dark hair* [character] is identified in the dialogue box as the *narrator* [narrator]. The figure is similar to the one used in the first frame and is off-center in the frame. To the far right is a logo. It is a *circle with two*

C shapes, in reflected positions [Logo]. The top part of the *logo* has the words, “leave no trace” and the bottom part of the logo has the words “outdoor ethics.”
Scene 10: *Mid-shot* [shot scale] of the back of the *woman with long dark hair*[character]. She is to the far right of the page. In the background are *contour lines* [lines] *suggesting two mountains*[icon]. Both begin at the bottom edge of the top quadrant of the *rule of thirds* [composition]. The one that is further in the background extends, horizontally across the entire frame. The other mountain ends alongside of the figure. Situated on this mountain are two large pine trees. Along the to edge of the mountain are seven, pine trees that are configured in two *staggered* rows [lines]. On the top, right, vertical and horizontal part of the frame is *three rows of words* [text]: Travel and—Camp on—Existing surface.

Scene 11: *Mid-shot* [shot scale] of the *narrator* [narrator], positioned in a *portrait position* [composition] with arms extended and slightly bent holding a *camera* [prop]. The figure occupies a third of the frame, horizontally and vertically. In balance to the frame, beginning and the top right third are the words “*Leave what you find.”* [text] Half of the frame area, under the words, contains empty *negative space* [composition]. The design balances out nicely with the other images.

Scene 12: *Wide shot*, [shot scale] concluding frame of the storyboard. The mountains divide the frame, horizontally in *staggering, overlapping perspectives*[depth of space]. The first mountain, in the foreground, divides the page, horizontally, beginning at the far left, top edge of the *rule of thirds* [composition] and ends, below the bottom right edge of rule of the thirds. On the far to of the frame, 1/8” down are the word “Produced by and the credits are not listed.

APPENDIX H

LIST OF CATEGORIES FOR STORYBOARD DOCUMENT ANALYSIS

Appendix H

List of Categories for Storyboard Document Analysis

Categories	Frames	Hand-sketched representations of ideas
Compositional features	Design principles	Balance
		White/Negative space (F1)(M1)
		Split screen (M1)
		Angles
		Inclined (M2)
		Backward leaning (M2)
		Slight angle (M2)
		Cropped image
		Image breaks out of the frame (M2)
		Depth in space
		Behind and beyond (F1)
		Overlap (F1) (M2)
		Staggering, overlapping perspectives (F1*)*
		Atmospheric perspective (F1)
		Light, pencil renderings (F1)
		Steps diminishing in size (M2)
		Descending rocks (M2)
		Simplification
		Rough suggestion of mountains (F1)
		Each one (tree) is slightly different (F1)
		Unity
		Variety (F1)
		Continuity (i.e., leads the eye) (F1) (fr. 6), (M2)
		Consistency of style (M1) (F1) (M2)
		Bracket sytagma (i.e., transitions)
		Fade-in (M1)
		Zoom- Close-up to wide shot (M1)
		Pan out (M1)
		Polyptyphs
		Diptychs
		Pentaptych
		Triptych (F1) (M1)

(table continues)

Appendix H *(continued)*

List of Categories for Storyboard Document Analysis

Categories	Frames	Hand-sketched representations of ideas
		Compositional guideline
		Rule of thirds (also depicted on the visual document)
		Completely aligned on both axis (F1) (M2)
		Aligned on one axis (F1) (M2)
		Used to suggest power (M2) frame 20.
	Explicit lines as a design element	Contours (F1) (M2)
		Dark wavy lines (F1)
		Dashed line (F1)
		Dots (M1)
		Jagged lines (F1) (M2)
		Heavy lines (M1)
		Horizon lines (F1) (M2)
		Linear, spiked lines (F1)
		Wavy lines (M2)
		Short, black stroked lines (M2)
		Horizon line (M2)
		Eye lines (M2)
		Softly sketched lines (F1)
		Staggered rows (F1)
		Vertical lines (F1)
Directive features	Implicit lines	Eye level lines to connect characters (M1) (M2)
		Implied lines (F1)
		Key points of change (F1) (M1) (M2)
		Psychic lines (M1) (M2)
	Narrative	Beginning, middle and end: (M1) (F1) (also depicted on the visual document)
		Spatial relationships (M2), (F1), (M1)
		Time relationships: (F1) (M1)
	Narrator	Social exchange
		Implicit narrator (M2)
		Explicit narrator: Shows oneself (M1) (F1)
		Identifies oneself (e.g., “Hello, this is. . .”(M1)
		Narrator shown throughout the work (F1)

(table continues)

Appendix H *(continued)*

List of Categories for Storyboard Document Analysis

Categories	Frames	Hand-sketched representations of ideas
	Narrator	Showing and telling
		Annotations (M1) (F1)
		Personalization, talks to audience, shows setting (maps), relays important information (teaching), gives examples (weather storm), Use of a mnemonic for critical information, safety tips (F1)
		Talks about relationships, personalization, introduces characters, shows the setting (map), introduces characters, talks to audience (M1), some teaching (explains what a myth is and makes analogies)
		Notation directive
		Talk about, show, start voice narration and show opening video, shows the setting (map) (M2)
		Indexical (Indices)
		Suggestion of thunder (F1)
		Suggestion of trees (F1)
		Crisscrossed tree branches (M2)
		Motion arrows (F1) (M1) (also depicted on the visual document)
Distinctive	Caricatures	Eye glass spectacles, protruding jaw (M2)
		Facial expressions (F1), (M2)
		Bear personified (M2)
		Fish smiling (M2)
		Straight line to suggest a grimace (M2)
		Wide eyed owl (M2)
		People engaged in conversations (M2)
		Bubbling mud pots (M2)
		Exploding geysers (M2)
	Drawing style	Primitive (M1)
		Cartoon style (M1)
		Contour style (F1) (M1) (M2)
Figurative	Characters	Action (M1) (F1) (M2)
		Introduces to characters (M1)
		Incidents (i.e., events) (F1)
		Plots/events (M1)
		A young woman (F1) (M1)
		Two men (F1)

(table continues)

Appendix H *(continued)*

List of Categories for Storyboard Document Analysis

Categories	Frames	Hand-sketched representations of ideas
Figurative	Characters	Man with dark hair (M1) (glasses)
		Miniature image of the same character [repeat] (M1)
		Opera singer (M1)
		Wolf, bear and moose (M1)
		Young boy (M1)
		Grandmother (M1)
		Buffalo (M1)
	Costume	Hunter's cap (F1)
		Wide brimmed hat (F1)
		Spectacles (M2)
		Fedora hat (M2)
	Props	Book (M1)
		Camera (F1)
		Trunk of a tree (F1)
		Triangular tent (F1)
		Picnic table (F1)
		Gold medal (M1)
		Small box (M1)
		Watch (M2)
	Orientation	Profile (F1) (M1) (M2)
		Silhouette (F1)
		Portrait (F1)(M1)(M2)
Graphics	Icons	Artifacts (F1)
		Arrow to suggest motion (M1)
		Map (F1) (M2)
		Logo (F1)
		Circle with two C shapes, reflected *(F1)*
		Emblem (F1)
		Mnemonic (F1)
		Eye
		Brain
		Stick figures (F1) (M1) (M2)
		Sign—Yellowstone National Park (F1)
Symbols		Text
		Italicized (F1)
		Block lettering (F1)
		Miles and km (F1)
		Rows (F1)
		Single stokes (F1)

(table continues)

Appendix H *(continued)*

List of Categories for Storyboard Document Analysis

Categories	Frames	Hand-sketched representations of ideas
Symbols		Web link (F1)
		Basic handwritten text (M1) (M2)
		Word balloon (M2)
		Triangular forms, suggesting teepees (M1)
Implicit features	Meanings	Scenes: Hidden or suggestive
		Sense of hesitancy (M2)
		Predatory position (M2)
		Double narrative (M2)
		Iconic suggestions of power (M2)
		Analogies:
		Red Riding Hood (M2)
		Analogies: Traditions suggested through characters (M1)
Theme	Story form	Global subject matter
		Camping (F1)
		Myth (M1)
		Wildlife (M2)
		e-Learning
		Contiguity (F1)
		Personalization (F1) (M1)
		Social world
		Social values (M1)
		Problem solving (F1)
	Story	Informative, show and tell (F1)
		Picture book format (M2)
		Each image is so rich in detail, it tells its own story (M2)
		Realism (F1), (M2)
		Supernatural (M1)
		Myth (M1)

APPENDIX I

TRANSCRIPTION PROTOCOL ANALYSIS CODES

Appendix I

Transcription Protocol Analysis Codes

Articulations	Expressions	Gestures	Roles and Content-Process
/ Short pause	>) Smiling	> Pointing	*E*: Interviewer.
//Long pause with reflection	[ ) One person laughing	^ Shoulder shrug	S: Interviewee
/// Long pause (silence)	[ ) [ ) Interviewer and participant laughing	¡¡¡Sitting up straight	R: Role(s)
[!!] Intonation	~~ Frown	%% Leaning forward towards the screen	CT: Content area thinking
[++] Stress	^^^ Grimace	\ \ Leaning back	DT: Design thinking
[xx] Unclear or inaudible words	*** Nodding head up and down	| Leaning to one side	NT: Narrative thinking
. . . marks a break	≥≥ Shaking	[*] Crossed arms	RT: Representational thinking
<> Internal speech (e.g., “self instructions, like “Let me see,’ ‘Wait a minute’ (Ericsson & Simon, 1993, p. 227).”		[::] Unrelated information	TT: Technology thinking
= Analogies		)) Listening	P: Problems
		[?] Chin resting on hand (thinking?)	RA: References to audience
		ø Hand on head	RN: References to narrative
		∫∫∫ Hand moving on touch pad	RR: References to representations
		÷÷ Finger Tapping	RT: References to tools
		## Raised palm	RS: References to social situations
		>< Hands gesturing forward, outward, or up	I: Interpretations
		</ One hand gesturing forward, outward, or up	ST: Strategies
		[SB] Looking at a storyboard	
		[SC] Looking at a script	
		[C] Looking at a computer screen	

Note. [brackets] indicate a placeholder for facial expressions and gestures.

APPENDIX J

THINK-ALOUD PROTOCOL (CONCURRENT PROJECT)

Appendix J

Participant F1 Think-Aloud Protocol (Concurrent Project)

Participant F1: TA Montage Equation Transcript	Categories and subcategories
1. Well. I just **imported** my uhm/ / **images in iMovie** and some of them are **smaller** then others and I'm wondering why that is, but, uhmm, I should have plenty to work with.	*(TT) Import, (RT) Form, (DT) Application, (TT) Technical issue, (DT) Judgment*
2. So, I've got my **storyboard** and I'm going to **review it** and basically **check out my plan to figure out where I want to start** with my first **montage**.	*(DT) Reference, (DT) Review, (DT) Project, (NT) Montage*
3. So, **I've got one in mind** where **I will / I need** to find the picture. Uhmm, so, **I want to** / / find the one with the map. That's where I want to start.	*(DT) Idea, (DT) Project*
4. Uhmm, ok, so, I want to first /. M**y idea is** to kind of start with the beginning **because** this is about Yellowstone and I'm talking about camping at Yellowstone.	*(DT) Idea (RT) Judgment*
5. I found this really **nice image** of one of the **signs of Yellowstone** National Park. So / and **its at an angle** ~~ where it looks like you're looking into the park. So, uhmm, I thought that was pretty cool.	*(DT) Judgment (RT) Form, (NT) Shot scale*
6. So then, next, I want to / / / **move it** / lets see / / ~~ Ok, there we go, so I've got my **sign** at the **very beginning,** uhmm [SB] [turns page].	*(DT) Edit, (RT) Form, Spatial orientation*
7. Starting at my beginning of the **storyboard**. At the **beginning**, I guess, and I'm going to go **right in, into talking** about **things that people can do recreation-wise** in Yellowstone, tailored to or focused on camping itself.	*(DT) Reference, (RT) Spatial orientation (DT) Project, (CA) Accessibility,*
8. So, I've got some **pictures** of people and different **group dynamics** of **people camping** or uhmm / **getting things set up** for **campsites**.	*(RT) Form, (NT) Semiotic meaning, (RT) Form, (RT) Function*

(table continues)

Appendix J *(continued)*

Participant F1 Think-Aloud Protocol

Participant F1: TA Montage Equation Transcript	Categories and subcategories
9. So, I've got **these guys** that are **setting up their tent.** These three guys. **So, I think that would be a good one.** And, I'm going to **put these in** and then **organize** them in the order that I want them there [ ).	*(RT) Form* *(DT) Judgment,* *(DT) Edit, Edit*
10. Ok / /, I'm also thinking maybe**, I'd like to show** some of **the features of Yellowstone**. So, I talk in the narration part of my, uhmm, narrative. **I'm talking** about **what a beautiful and unique place Yellowstone actually is** and the animals and, uhmm, plant life that **people can see** so, uhmm, **I'll add some of these as well** and then organize later [ ).	*(DT) Idea* *(NT) Semiotic meaning* *(NT) Narration,* *(CA) Knowledge acquisition,* *(DT) Accessibility,* *(DT) Project*
11. So, uhmm, let's see, of course, ∭ I'm really **wishing some of these had blown up bigger**. It's too bad. Oh well / / /.	*(TT) Technical Issue,*
12. The problem is, well, let's see. Can I change this to like zero point something? Well, I guess, I'll try. Ok, **I think what it was**, I **clicked on** the **thumbnail** to save them into this file rather then saving the entire picture itself from some of the photo-sharing sites so, that's probably, ok.	*(DT) Recall, (TT) Tool method,* *(RT) Form*
13. I've got **Dad** and his kids **canoeing** as one of the activities that they can do. Uhm, these **people** have been **hiking** and, uhmm, been **taking picture**s. So, uhmm, there's some **people eating** hot dogs it looks like fun [ ). Uhmm, **fly-fishing**. There are all these **actions** that people are doing.	*(RT) Form, (CA) Folk term,* *(RT) Form,* *(CA) Folk term,* *(RT) Form, Form,* *(CA) Folk term,* *(NT) Montage [the sequence]*
14. I'm trying to **create and idea** for a **person who is viewing this.** That this is a **place you go to and you are going to do something while you are there.** So, it's kind of an **entry point** into the content of the presentation. ∭ So, uhmm, lets see, I've got some **rock climbing** and / / /	*(DT) Idea, (CA) Accessibility, Knowledge acquisition,* *(NT) Spatial relationship,* *(CA) Folk term*

(table continues)

Appendix J *(continued)*

Participant F1 Think-Aloud Protocol

Participant F1: TA Montage Equation Transcript	Categories and subcategories
15. Ok, / I'm **looking for** some **more action photos and some action slides** to put together. There's my hiker. Ok. So I've got uhmm, my **entry slide**. So it's going to be one of the **first things the viewer sees.**	*(TT) Search**,** (NT) Semiotic meaning,* *(RT) Form, (RT) Spatial orientation, (CA) Accessibility*
16. Uhmm, ∭ **I think this should go closer down here**, to the **end**, because **then, I'm going to talk about** setting up camp, so / uhmm / let's see /. I **don't know if I like that** there. Uhmm, I'm going to **delete it** for now and I can always put it back if I'd like to.	*(DT) Judgment, (RT) Spatial orientation, Project,* *(DT) Judgment, Edit*
17. Let's see, I've got **hikers** here / /. And **canoeing** goes with **fishing** and **people** relaxing **go there.** Ok, so maybe / what I'd like to do is find /. I know I have a picture up here of **people** standing in front of one of the Yellowstone signs. Oh, this is a great one, taking a **shower** [ ) / uhmm / / / **setting up camp** and / let's see / / I used to have, / let's see / it's probably one of those blacked out humm /. Here we go / got a better one / / / [ )	*(RT) Form, Form, Form,* *Form,* *Form, Form, (NT) Montage [sequence described)*
18. **I'm looking for an image** I remember saving and I liked it because it was a group of people in front of the Yellowstone sign and I **thought it would be a nice point of prospect** to **enter into the content** of information to be presented, but, I can't seem to find it so, we will find it later /.	*(TT) Find* *(DT) Idea, (NT) Spatial relationship*
19. Now, **I've also got another one in mind** later, in my presentation where I want to talk about **what to bring ~~** basically and **how to figure out how / what you need** and whatever it is that **you need / to bring** because, if you are packing everything on your back, you don't want to take everything but the kitchen sink.	*(NT) Montage [sequence described),* *(CA) Knowledge acquisition, Knowledge construction, (NT) Space relationship*

(table continues)

Appendix J *(continued)*

Participant F1 Think-Aloud Protocol

Participant F1: TA Montage Equation Transcript	Categories and subcategories
20. So, uhmm. I thought **a really cool way to do that would be /** if a lot of **it dictates the location** / normally the **activities that you would do**. So, a lot of it ties into these images of people doing things in Yellowstone and the location you choose.	*(DT) Idea,* *(NT) Montage [sequence described), Space relationship*
21. So, **what I'm going to do is** find a picture of a map of Yellowstone and see if it will save because it **doesn't seem to be showing up**.	*(DT) Project,* *(TT) Technical Issue,*
22. So**, I'm going to go to /** I think I found it in Flickr [typing] and I'm going to **that site** and search for that map ø that I saved before and **see if I can get it to save better this time.**	*(DT) Project,* *(TT) Application method* *(DT) Trial and error*
23. That's not going in the right place [typing]. Here we go. Ok, so I'm just going to **search** for uhmm, [typing] Yellowstone National Park map and / I only want to see **thumbnails**. This time I'm actually going to **click on it** and save it [ ). Ok, I want it to be, uhmmm) and, I **don't like that one, that's too dark** [tapping on a key].	*Search,* *(RT) Form,* *(TT) Tool method,* *(DT) Judgment*
24. Let's see, **scrolling down** ∭ to try to find **the one** that I liked so much [tapping on a key]. **I remember** it being a couple of pages in if its still **brings up the same results** ∭ and / I'll see, if not, I'll find one temporarily.	*(TT) Tool method,* *(RT) Form, Recall,* *(TT) Tool method*
25. So let's see. Let's look at this one humm /. Ok maybe this one. Let's **get that one**. I see where it was. Maybe this one will be good. **Yeah, that one works.**	*(RT) Form,* *(DT) Judgment*
26. ∭ Ok. So, I'm going to save this picture / hit **control, save image** as uhmm "**map**" to the desktop and then I can just **drag it in**. Is that right? ~~ Oh, ok. ∭ It let me save it to the desktop / /.	*(TT) Tool Method, (RT) Form,* *(TT) Tool method*

(table continues)

Appendix J *(continued)*

Participant F1 Think-Aloud Protocol

Participant F1: TA Montage Equation Transcript	Categories and subcategories
27. **Where did that go?** Ok. ∫∫∫ I'm going to **minimize** everything to try to **find** this image and its hidden behind all these windows I have open and / uhmm, where did it go? Ok, **there it is**. So, **dragging and dropping** it in, maybe. Nice. ^^^ Sweet.	*(TT) Technical issue, Tool Method, Find,* *(RT) Form, Tool method*
28. Ok. So I've got my **map** ∫∫∫ and I want to edit how / so I'll go to the editing tab. **Is that right? No.**	*(RT) Form, (TT) Technical issue*

Participant M1, Think-Aloud Protocol (Concurrent Project)

Participant M1: TA Montage Equation Transcript	Categories and subcategories
1. Ok. / / / [**Referring to SB**] So, **I'm going to** make ∫∫∫ a section of this movie / and I'm going to add some photos ∫∫∫ that I collected and put them into my photos, into my iMovie.	*(DT) Reference, (DT) Project,*
2. This one is going to be / / ∫∫∫, the first one is going to be **wolves**. %%. I **put a picture of a wolf into pictures.** I'm trying to **find** the wolf ∫∫∫ I **downloaded** from the / there it is / and **drag and click** it in /. It's **not a very good picture** of a wolf. / It's a pretty poor picture of a wolf %%. So, I have to redo that one.	*(RT) Form, (TT) Import, (TT) Find, Tool method, Tool method, (DT) Judgment*
3. Then, / I already started my project. **I'm going to** take the music off of that part **because I'm not going to want the music while I'm speaking**. And then ∫∫∫, uh oh, what did I do? All right, here we go.	*(DT) Project,* *Judgment*

(table continues)

Appendix J *(continued)*

Participant M1 Think-Aloud Protocol

Participant M1: TA Montage Equation Transcript	Categories and subcategories
4. \ \ Ok, and then the next piece in the **montage** ∭ is going to be for the bears [**SB**]. %% **I'm going to** insert a picture of a bear and / ∭ I'm looking. \ \ There' a grizzly bear and I'm **putting a picture** of a **grizzly bear** inside my montage and **see if that picture turns out a lot better than the wolf picture**.	*(NT) Montage* *(DT) Reference, Project,* *(TT) Import,* *(RT) Form, (DT) Trial and error*
5. So far, they're both 4-seconds. **I'm going to have to make them a little bit longer**, **because**, I'm going to be speaking during this part **[SB**]. So, **I'm going to put a time limit** %% [SB]. Start it with **wolves**, \ \, let's say, I'll make that one / I'll start with 6-seconds ∭. **Press Ok**. Then, **I'm going to use a picture**, ∭ same with the **bear** ∭, and then, I'm also going to [SB] use a **moose** ∭, moose picture %% here. **Add that** to iMovie.	*(DT) Judgment* *(DT) Reference, Project, Edit, (RT) Form,* *(TT) Tool method,* *(DT) Judgment, (RT) Form, Form, (TT) Import*
6. **Another bad picture** of a **moose** \ \. I'm probably going to have to get another good picture. These pictures were really **blurry** ∭. **I don't know if I can get those any better or not because** they're some type of jpeg file, ∭ /.	*(DT) Judgment, (RT) Form,* *(TT) Technical Issue,* *(DT) Judgment*
7. All right. And the last one I'm going to use **[SB]** is a picture of a **buffalo**, ∭ %%, and I have quite a bit of pictures of buffalos. Somehow, **I've got good pictures and poor pictures.** / / /	*(DT) Reference,* *(RT) Form,* *(DT) Judgment*
8. Hmm, and **it downsized the pictures** so **I might have to go back** and **make those 6-seconds long** ∭. Ok. \ \ Picture of the **moose under 6-seconds** long as well [typing].	*(TT) Technical issue,* *(DT) Recall, Edit,* *(RT) Form, (DT) Edit*
9. Finally, ∭. **All of those** are a part of that Indian tribe. **I want to have** all **those types of animals** that lived with the Indian tribe that I am using for this **montage**. They all represent the wilderness and the **life** that's around her e%%.	*(RT) Form,* *(DT) Idea,* *(NT) Montage, (NT) Semiotic meaning*

(table continues)

Appendix J *(continued)*

Participant M1 Think-Aloud Protocol

Participant M1: TA Montage Equation Transcript	Categories and subcategories
10. So, I'm going to **put a picture** of a stream. Some type of stream. **Let's see what this picture looks like**. ∭. **Picture of life** with **green trees and green grass / blue sky**. Kind of to **remind you of life** in a stream.	*(TT) Import,* *(DT) Review, (RT) Form, (NT) Semiotic meaning,* *(RT) Feature, (DT) Idea*
11. So, let's see how that picture turned out ∭. That's a pretty **big file**. Yeah, **that's a good picture** ∭.	*(TT) Technical issue,* *(DT) Judgment*
12. So, now, I'm just going to **see what it looks like** \ \. [Video rewind and playback] / / /.	*(DT) Review*
13. All right, so, I'm just listening the \ \ /. Looking at the photos and listening to see if it works ∭, combined together and it's interesting, ## seeing the pictures go in and out and in and out ∭, but I don't know if I want it to go like that. **I'm going to have to change that.**	*(DT) Review* *(DT) Judgment*
14. Plus, the **music** is on, so, I'm going to have to **figure out how to take this music off of this** / part here, %%. I have to come back and do that later \ \ **I'll fix it because I'm having problems with music** ∭. For some reason it turned purple and not green [referring to music in the timeline]. I want it to be purple because it's not been purple ever before ∭.	*(RT) Form,* *(TT) Technical Issue,* *(DT) Edit, Judgment,*
15. I'm just trying to get out of iMovie. ∭. But / **maybe I can just go like this** and listen to the **sound** that way. **Make it shorter** and **then go back to my project to see here**. %%. There we go.	*(TT) Application method* *(DT) Edit,* *(RT) Form, (DT) Edit, (DT) Project*
16. All right, **I got rid of** some **music**. [?] All right and **I'm %%, going to see** if I can do ∭ the same thing again. Music [?]. Try to make it a lot less music ∭. **Take the music out** and / try to figure out how to get back to the screen I was in / ∭, oh, here we go. \ \	*(DT) Edit, (RT) Form,* *(DT) Project,* *(DT) Edit*

(table continues)

Participant M1 Think-Aloud Protocol

Participant M1: TA Montage Equation Transcript	Categories and subcategories
17. **Breaking down time** that I want the **music**. Let's try 34-seconds for the music %%, and/ now/ ∫∫∫. Let's go back to the **screen shot**. Let's see, we have 34-seconds so **let's try 36 seconds** \ \. **Let's see if that goes like that.** Uhhh / 36-seconds ## for the music to see if it goes to the end of that slide. Actually, we **need it a little less**, [++] 30-seconds. > / **30-seconds** for the music.	*(DT) Edit, (RT) Form,* *Form,* *(DT) Edit, Trial and Error,* *Judgment, Edit*
18. And ∫∫∫ then, I want to go to the **microphone** [!!] and I want to go into the timing ∫∫∫, %%, so / I'm going to **make it shorter** by pulling it to the left and just go to 30-seconds. **See how that works**. I guess it has a **picture** up there that I could be using / [?] that I didn't know %%. So, ∫∫∫ I'm going to **stop the music** right **where my face ends.**	*(TT) Tool method,* *(DT) Edit,* *Review,* *(RT) Form,* *(DT) Edit, (DT) Judgment*
19. All right. Now, I'm going to go **back to see how it turned out.** I'm actually going to play from this **slide**.	*(DT) Review,* *(RT) Form*
20. **I'm going to crop.** I want to **crop and finish that as well.**	*(DT) Edit, Project*
21. Now, I'm going to **double click to play**. Let's **see what I have** without the music. I have the **wolf**, ÷÷ the **bear** and **during this**, **I'm going to be saying, [SC]** "There was quite a variety of wildlife such as wolves, [pause], bears, and moose and buffalo, which was vital [xx] animals to stay alive ∫∫∫."	*(TT) Tool method,* *(DT) Review, (RT) Form,* *Form, (DT) Project, Reference,* *(NT) Narration*
22. So, \ \ **now I'm going to** go ahead and try to record this ¡¡¡ **sound**, %%, that I have for the **montage** and **overlay that with the pictures** to **figure out** where I've got to play ∫∫∫ the sound / /.	*(DT) Project,* *(RT) Form (verbal)* *(NT) Montage, (DT) Edit,* *(RT) Function*

(table continues)

Appendix J *(continued)*

Participant M1 Think-Aloud Protocol

Participant M1: TA Montage Equation Transcript	Categories and subcategories
23. So, I'm going to go up here to the [?] **microphone**, and I'm **going to try to record** the voice-over part of / ∭. I'm using a built in microphone and I'm going to **try to [?] play** the sound. Play, uhm, I'm thinking. / **Play projected.** Ok. ∭ %%. It shows my voice.	*(TT) Tool method,* *(TT) Trial and error* *(TT) Tool method,*
24. Uhmm, **I don't really remember how to record / **my voice on this. **I'm going to** have to come back to this part because, / [?] I want to move onto other parts of my / / **[SC]¡¡¡**	*(TT) Technical issue,* *(DT) Project,* *(DT) Reference*
25. Well, I **downloaded** part of the **Help** part of /. All right, so I'll go to / ***Play*, [typing].** No, that's Photobooth. I don't want that. / [Reading Help material].	*(TT) Tool method, (DT) Reference, (TT) Search*
26. Let me go to **Help** [++]. ***Play* voice**, / recording a voice-over. Ok. So, I'm going to go back to the Help menu [typing] and go to **record a voice-over**. Let's see what it says when I bring that up. It says %% [reading help menu], ". . . drag noise reduction slider to the right to prevent background noises ~~ from intruding into your recording." [?]	*(DT) Reference, (TT) Search,* *(TT) Search,*
27. White noise? I don't want any white noise. I'm going to use the "noise reduction" [**reading help menu].** So. I'm going to **drag the slider to the right to prevent any extra noise.** That's what I'm going to use **because, I think that will make my voice sound a lot better ∭.**	*(DT) Reference,* *(TT) Tool method,* *(DT) Edit,* *Judgment*
28. So, I'm going to go back and **try doing some of these features** before I start recording my voice.	*(DT) Trial and Error*

(table continues)

Participant M1 Think-Aloud Protocol

Participant M1: TA Montage Equation Transcript	Categories and subcategories
29. Uhmm, it said [**referring to help menu**] to move it to the right for noise reduction ∫∫∫. "Noise reduction, input volume." **I speak softly so, I'm probably going to want a little bit more input volume**. And, voice enhancement.	*(DT) Reference,* *(DT) Judgment, Edit*
30. "Play project audio while recording ∫∫∫." **I don't know what that is [?].** I'm going to **have to go back** to that in the Help menu.	*(TT) Technical Issue,* *(DT) Recall*
31. %%. [**Reading help menu**]" No, **I don't want to do that.** "Click the video frame where you want the voice-over to begin." **Ok.**	*(DT) Reference, Judgment, Edit*

Participant M2, Talk-Aloud Protocol (TA) (Concurrent Project)

Participant M2: TA Montage Equation Transcript	Categories and subcategories
1. All right, I made this uhmm, I pulled a couple of pictures off the /) morgue files [image-sharing website] / for the **montage**, >) ∫∫∫ and I'm just going to try to **move them** into **iMovie**. They're in PowerPoint right now. So, **I'm going to see** what I can do to move them ∫∫∫. I'll put them on the desktop first and then move them over / /.	*(DT) Project,* *(RT) Form,* *(NT) Montage,* *(TT) Import, application method,(DT) Project*
2. From home, I brought uhmm, my / a travel drive and ##, it has the photos that I was going to use for Yellowstone project ∫∫∫. **It's** [referring to images] been **fitting into iMovie pretty well.**	*(DT) Judgment*
3. %%. <> "Oh, it's **not going to let me**" / / /. ÷÷. >. **I'm trying to** get the pictures off of the desktop / because, I don't think I can > ∫∫∫ put the images from PowerPoint back into iMovie.	*(TT) Technical issue,* *(DT) Project*

(table continues)

Appendix J *(continued)*

Participant M2, Think-Aloud Protocol (TA)

Participant M2: TA Montage Equation Transcript	Categories and subcategories
4. Ok, **iPhoto**. Let's see / /. Ok / / /. Yeah, **I'm just opening** / I have like iPhoto and now, I have **ten windows open.**). Let's see [xx] %%. Ok.	*(TT) Application method, Tool method,* *(TT) Technical Issue*
5. ∭ So I'm in the untitled window and I'm going to try to / /. Oh **that's not going to work** / / /. Let's see / /. Oh, it's different on the Mac. It didn't work. **I'll try again**.	*(TT) Technical issue,* *(DT) Trial and error*
6. Ok, ∭, I'll **drag and highlight** it just to make sure I've got it. / <> "**Copy**." Let's see if I can even copy it up here %%. And copy. Here we go. And, / / **no paste?**	*(TT) Tool method,* *(TT) Tool method,* *(TT) Technical Issue*
7. Its just coming out as this ∭, which is really strange. Let me show you %%. **It looks as though it's zoomed in like a thousand percent**.	*(TT) Technical issue*
8. **Close that there.** Try this in here and it may have worked. **"Unreadable file,"** was one. ∭. Not recognized format. It's probably because I got these file on the / / uh, Internet.	*(TT) Tool method,* *(TT) Technical issue*
9. ∭ %%. Ok. All right. Now, where did I put my? **I'm going back** to my travel drive and back to my PowerPoint presentation.	*(DT) Project*
10. I think I just **clicked on / /.** Closed it. All right. There it is and it is still converting files ∭. All right, there we go.	*(TT) Tool Method*
11. This is my **second slide** and I'll **copy** that. I think \ \ I've now figured it out. How to copy that is.	*(RT) Form, (TT) Tool method*
12. So let me **move up here a little bit** [zoom]. **That's a little big so, / let's get more of the frame ∭.**	*(DT) Edit,* *(DT) Judgment*

(table continues)

Appendix J *(continued)*

Participant M2, Think-Aloud Protocol (TA)

Participant M2: TA Montage Equation Transcript	Categories and subcategories
13. I'm just going to take a picture of this now [screen shot] / / / ÷÷. Ok. Now, just **click and drag**. All right. Here we go. Ok / / /. I think I may have done it like ten times.	*(TT) Tool method*
14. Let's see, **picture** of / / all right and **drag it** into the / / iPhoto program and I think I may have just, / yep, put it in there ∫∫∫.	*(RT) Form, (TT) Tool method, (DT) Review*
15. **Let's try one more image** and then, I can go back to iMovie %% and try to make a presentation slide / / /.	*(DT) Project*
16. I'll **close this** because there are too many windows. %%. There's **picture** two. Where's **picture** three**? There it is** ∫∫∫.	*(TT) Tool method, (RT) Form, Form, (TT) Find*
17. Ok, let's **drag that down here**. That one didn't seem to / take too well. Let's **try that again** / / /, ∫∫∫. Just grab the corner for some reason. "**Shift, command, four / / /.**" Let's try that **one more time**.	*(TT) Tool method, (DT) Recall, (TT) Tool method (DT) Trial and error,*
18. I'm down there. %%. **Let me see if I've got it this time.** I'm just going to call it four. / Yep, four. See **four** is in / / / that is strange [ ). !!! **Four is an image of that one** %%. All right. Maybe it's around here someplace. Ahh [++], %%. ∫∫∫. **There's five and six**. So, we didn't, ahh / there it is. Ok, so I'll see if I can just **delete** those two. All right. There are my images.	*(DT) Review, (RT) Form, Technical issue, (RT) Form, Form, Tool method*
19. I'm going to open up iMovie. ¡¡¡. And so it opens. See how it goes. / / So I'm **putting this here** and that's the wrong place so, I'll **move it** ∫∫∫ there. Just **highlight** them **all** at once.	*(DT) Project, (DT) Form, Tool method Tool method, (DT) Form*

(table continues)

Appendix J *(continued)*

Participant M2, Think-Aloud Protocol (TA)

Participant M2: TA Montage Equation Transcript	Categories and subcategories
20. Ok. So I've got **this piece** here and %% it's zooming in on it for some reason / /.	*(DT) Form,*
21. **How do I get back to the rest of my / / pictures?** I'll save that. Ok, **why didn't it put it there?**	*(TT) Technical issue, Tool method, Technical issue*
22. Ok ∭. Let's **try a Ken Burn's Effect**. Uh, that's **not going to work** [ ). Ok, let's try the **next image**. Yeah, **that's not going to work**. ∭ Ok. **Looks good**.	*(DT) Edit, (DT) Trial and error, (RT) Form, (DT) Edit, (DT) Judgment*
23. Let's **increase the timeline** a bit / / and take it up there / / / and / / / uhh / / [ ) **invalid value.** Probably didn't like that. / / I'll **change the time**. Its probably value. Doesn't like that. Let's **put it down here to start**.	*(DT) Edit, (TT) Technical issue, (DT) Trial and error, Edit*
24. Ok. Let's **see what my clips are looking like**. Why is that / / /? The **wolf didn't show up**. Oh, I'm missing one. Let me get that **back in there**. For some reason I moved it / /.	*(DT) Review, (TT) Technical issue, (DT) Edit*
25. So now, I've got **all three**.	*(DT) Form,*
26. Ok, **back to the beginning** and its going **too fast** so I've got to / / %%. So the duration is for a 14th of a second is that right ∭? So, I've **need to increase** that to / let's try 10-seconds. **See what that looks like.** Same thing. I'll **increase these to 10-seconds** and increase this one to 10-seconds to give them equal time and see what it looks like / / !!!. Nice. **Play it through** and / / it **might even be too long.**	*(DT) Review, Judgment, (DT) Edit, (DT) Review, (DT) Edit, (TT) Review, (DT) Judgment*
27. Ok, so it goes right into that other **image** ##. So maybe, I **need some transition there**. %%. So to do that, let me see what I can do here. I wouldn't want anything to bounce or spin [ ). %%. Ha ∭.	*(RT) Form, (DT) Judgment*

(table continues)

Appendix J *(continued)*

Participant M2, Think-Aloud Protocol (TA)

Participant M2: TA Montage Equation Transcript	Categories and subcategories
28. Ok, so fade-out. **Let's put some fade-out in between them. And, let's see what fade-outs look like.** So, I'll put two fade-outs there and we'll increase the time. ÷÷ **Take it down to, / I don't know, 5-seconds** and maybe I'll increase the time as the images go on. So, I'll make **this one eight seconds** / / and I'll make this one / I'll leave it at ten and see what it looks like!!!.	*(DT) Edit,* *(DT) Edit,* *(DT) Edit,*
29. All right, so I'll **play it through** / ø. / / Here comes the fade-out. / It **still seems a little abrupt** but, it might be ok. Ummmmm, **fade-out** / /. Here we go. That might even still be too long. **I think you get the idea without the 10-seconds.**	*(DT) Review,* *(DT) Judgment,* *(DT) Edit,* *(DT) Judgment*
30. So, I'll click on this again ÷÷, and **take this down to 8-seconds** ÷÷. Oh, **move this one down**. Let's see like **six seconds**. !!! [ ).	*(DT) Edit,* *(DT) Edit,* *(DT) Edit*
31. Ok, let's try a different one. Let's try a cross-dissolve instead. Oh, **it can't work because, I set it to a longer duration** /. Uhm. Huh? %%. See, I don't know what some of these are so I'll just **give it a shot and see what some of these look like / /.**	*(DT) Judgment,* *(DT) Trial and Error*
32. Overlap? That might be making two images into each other / / ÷÷. **Delete** that, put that **overlap** in. ∫∫∫. Try it down here and [++] **see what that looks like**!!!. Yeah, it **seems like it's a little smoother**. Smoother fade / /.	*(DT) Edit, Edit,* *(DT) Review,* *(DT) Judgment*
33. It's not **going to the last image**. ÷÷. I wonder why that is? **Maybe they all have to be the same type of transition?** All right. **Let's see what happens** now. See, here it goes [!!], \\|.	*(TT) Technical issue,* *(DT) Judgment,* *(DT) Edit*
34. Let's play the whole thing through / /.	*(DT) Review*

APPENDIX K

THINK ALOUD, CONCURRENT PROTOCOL AND RETROSPECTIVE REPORT COMPARISONS

Appendix K

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
1. Well. I just **imported** my uhm/ / **images** and some of them are **smaller** then others and I'm wondering why that is, but, uhmm, I should have plenty to work with.	1. Yeah, I was really upset / that they were so small. I was like, "No" [!!]. After all this time to upload them. All those / rather then clicking on them ÷÷ and I just right clicked on the / thumbnail. Or thumb tags, or whatever they are, and [++] I saved them in that really small format. *** / I know that, I was trying to be efficient. I guess [ ), rather than having to click and open the full sized one. ***And, I was frustrated with that [ ). But that's ok.
2. So, I've got my **storyboard** and I'm going to **review it** and basically **check out my plan to figure out where I want to start** with my first **montage**.	2. I think right now, I'm trying to find out where the media is [ ). Where are my pictures?
3. So, **I've got one in mind** where **I will / I need** to find the picture. Uhmm, so, **I want to** / / find the one with the map. That's where I want to start.	3. I guess I'm sitting there looking through all of these. I'm thinking, <> "Oh wow, I didn't know there were so many here, sweet!" [ ). So, I was just right clicking and uhmm, **thinking** <> "Yep, I'll take that one ÷÷ and I'll take that one." ÷÷ And then, I saved. I just saved a little bit of the images and I thought "Oh, no" [!!].
4. Uhmm, ok, so, I want to first /. M**y idea is** to kind of start with the beginning **because** this is about Yellowstone and I'm talking about **camping** at Yellowstone.	**4.**
5. I found this really **nice image** of one of the **signs of Yellowstone** National Park. So / and **its at an angle** ~~ where it looks like you're looking into the park. So, uhmm, I thought that was pretty cool.	5. I ended up not actually opening >< it that way. > I had the intention of uhmm, opening, doing an **introduction**, scrolling through uhmm/ a bunch of different people ><in front of the Yellowstone National Park sign ## but, I did that and then decided, <> "I don't like that at the very beginning."

(table continues)

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
	So, I ended up changing it and uhmm, and doing like / /. It was almost like a **rhythmic montage** with the /uhmm, ÷÷ pictures from Yellowstone and then, uhmm, ÷÷ the geyser from Old Faithful and so, I ended up changing that completely [ ). I **rewrote my script** when I did that too, [xx] but I did still kept some of those pictures in there.
6. So then, next, I want to / / / **move it** / lets see / / ~~ Ok, there we go, so I've got my **sign** at the **very beginning,** uhmm [SB] [turns page].	6. [ ) The way I was going to start my presentation changed to a rhythmic montage. >< But, that wasn't in my mind ÷÷ to do that at < this stage of the / when you were filming me. I hadn't thought about doing that yet, but that's what I ended up doing.
7. Starting at my beginning of the **storyboard**. At the **beginning**, I guess, and I'm going to go **right in, into talking** about **things that people can do recreation-wise** in Yellowstone, tailored to or focused on camping itself.	7. Here, this / this is the first time, I ever sat down / with uhmm, / with any of the media software. I had just **gathered my images** and I had written my script and proposal, but I hadn't actually put it into either iMovie or MovieMaker and / started working on it / in depth / yet. So, / that's what I'm doing here.
8. So, I've got some **pictures** of people and different **group dynamics** of **people camping** or uhmm / **getting things set up** for **campsites**.	8. My idea for that was to uhmm. Just to kind of show how different people do it /. It's meant to be like **an introduction video**. So / possibly for people who have never even*** setup a tent before; never even thought about going and sleeping outside/ ever ≥≥ [++] so / a lot of people. ~~ It's hard to visualize that / who have >< never done it before. So, that was **my idea** to **show** how lots of different people do it ÷÷ and different group sizes. All those things you consider and **think about** before you just / go out [ ).

(table continues)

Appendix K *(continued)*

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
	The different tools and //items you need to bring and have.So, that was my idea to, do that, and I ended up using it /, a lot of it, but not using it as extensively as I planned ¡¡¡. I hadn’t thought about making the gear section of it [ ). All
9. So, I’ve got **these guys** that are **setting up their tent.** These three guys. **So, I think that would be a good one.** And, I’m going to **put these in** and then **organize** them in the order that I want them there [ ).	9. I’m starting to work on one of the montage pieces because, those guys are setting up their camp and then, / / /. Yeah, in the order I wanted them so, I guess this is where I start thinking in a more **montage** specific [ ) mindset.
10. Ok / /, I’m also thinking maybe**, I’d like to show** some of **the features of Yellowstone**. So, I talk in the narration part of my, uhmm, narrative. **I’m talking** about **what a beautiful and unique place Yellowstone actually is** and the animals and, uhmm, plant life that **people can see** so, uhmm, **I’ll add some of these as well** and then organize later [ ).	10. I’m **trying to sort out my thoughts** on **how** I’m going to **piece** this together and what to do. I already had ideas about my **montage**. I put one of those in my storyboard, but uhmm, uhmm [xx]. [ ) [ )
11. So, uhmm, let’s see, of course, ∫∫∫ I’m really **wishing some of these had blown up bigger**. It’s too bad. Oh well / / /.	11. I’m going back trying to find them and save them in a larger format so that way they aren’t microscopic [ ) in my, in my presentation.
12. The problem is, well, let’s see. Can I change this to like zero point something? Well, I guess, I’ll try. Ok, **I think what it was**, I **clicked on** the **thumbnail** to save them into this file rather then saving the entire picture itself from some of the photo-sharing sites so, that’s probably, ok.	**12.**
13. I’ve got **Dad** and his kids **canoeing** as one of the **activities** that they can do. dogs it looks like fun [ ). Uhmm, **fly-**	13. Activities / I talked about in the beginning of this. I had uhmm, >< planned to show a bunch of different activities you

(table continues)

Appendix K *(continued)*

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
Uhm, these **people** have been **hiking** and, uhmm, been **taking picture**s. So, uhmm, there's some **people eating** hot **fishing**. There are all these **actions** that people are doing.	could do so, ## because that's a very important part of planning your trip because, it depends on where you go.
14. I'm **trying to create and idea** for a **person who is viewing this.** That this is a place **you go to and you are going to do something while you are there.** So, it's kind of an **entry point** into the content of the presentation. ∫∫∫ So, uhmm, lets see, I've got some **rock climbing** and / / /	14. So, my idea was to **link** location, > what you want to do and uhmm, your group. How all three of those elements play off of each other / in the planning process? ^
15. Ok, / I'm **looking for** some more action photos and some action slides to put together. There's my hiker. Ok. So I've got uhmm, my **entry slide**. So it's going to be one of the **first things the viewer sees.**	15. I had that in mind. That was one of the definitive ÷÷ parts of my storyboard.
16. Uhmm, ∫∫∫ **I think this should go closer down here**, to the **end**, because **then, I'm going to talk about** setting up camp, so / uhmm / let's see /. I **don't know if I like that** there. Uhmm, I'm going to **delete it** for now and I can always put it back if I'd like to.	16. I ended up using that with the kind of **montage lesson** that we did in class in mind, but I kind of /. I used that, and your website, to create my whole project / with the idea of purposefully placing images / aligned together and that.
17. Let's see, I've got **hikers** here / /. And **canoeing** goes with **fishing** and **people** relaxing **go there.** Ok, so maybe / what I'd like to do is find /. I know I have a picture up here of **people** standing in front of one of the Yellowstone signs. Oh, this is a great one, taking a **shower** [ ) / uhmm / / /	17. Uhmm, that was part of my montage. My idea was to do a bunch of different shots of not only people camping / like setting up their different camping spots. [*] So that would be an example of a **montage**. Uhmm, you know to convey a message that there's ≥≥ no one right way to do it. Uhmm, different people do it in different ways

(table continues)

Appendix K *(continued)*

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
setting up camp and / let's see / / I used to have, / let's see / it's probably one of those blacked out humm /. Here we go / got a better one / / / [ )	
18. **I'm looking for an image** I remember saving and I liked it because it was a group of people in front of the Yellowstone sign and I **thought it would be a nice point of prospect** to **enter into the content** of information to be presented, but, I can't seem to find it so, we will find it later /.	**18.**
19. Now, **I've also got another one in mind** later, in my presentation where I want to talk about **what to bring ~~** basically and **how to figure out how / what you need** and whatever it is that **you need / to bring** because, if you are packing everything on your back, you don't want to take everything but the kitchen sink.	19. That I knew that I ÷÷ I wanted to put those images or find images to convey that message ## that people in your **group**, plus location and the things you want do ≥≥ dictates what you are going to bring.
20. So, uhmm. I thought **a really cool way to do that would be /** if a lot of **it dictates the location** / normally the **activities that you would do**. So, a lot of it ties into these images of people doing things in Yellowstone and the location you choose.	20. So I did one that was group, wait. It was **group** *** ÷÷ plus location, equals, uhmm, your equipment. It was one of my **montage** components of my presentation.
21. So, **what I'm going to do is** find a picture of a map of Yellowstone and see if it will save because it **doesn't seem to be showing up**.	21. What I had done was, gone out and looked for any image that I thought I might be able to use. So, that's what I uploaded and / / I know I was working on / the map [!!] I know that was part of one montage that went in the intellectual montage that I had.

(table continues)

Appendix K *(continued)*

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
22. So**, I'm going to go to /** I think I found it in Flickr [typing] and I'm going to **that site** and search for that map ø that I saved before and **see if I can get it to save better this time.**	22. I ended up, I knew that was one that I definitely wanted to do and / but my images I didn't have them the way I wanted them because some of them were so small so that's why I had to go back and look for more.
23. That's not going in the right place [typing]. Here we go. Ok, so I'm just going to **search** for uhmm, [typing] Yellowstone National Park map and / I only want to see **thumbnails**. This time I'm actually going to **click on it** and save it [ ). Ok, I want it to be, uhmmm) and, I **don't like that one, that's too dark** [tapping on a key].	23. And then I found the map. Uhmm, so, that's what I was thinking there.
24. Let's see, **scrolling down** ∭ to try to find **the one** that I liked so much [tapping on a key]. **I remember** it being a couple of pages in if its still **brings up the same results** ∭ and / I'll see, if not, I'll find one temporarily.	24. Yeah, yeah. *** Uhmm, /I know exactly the image that I'm talking about and I ended up finding it. I didn't find it here, but I found it later.
25. So let's see. Let's look at this one humm /. Ok maybe this one. Let's **get that one**. I see where it was. Maybe this one will be good. **Yeah, that one works.**	25. Uhmm, / Flickr, I used, I used pretty extensively. And there were people ÷÷, uhmm / who uploaded things and then people in class when I showed my presentation noticed it and <>) ÷÷ "Oh, those people were there too." And same people throughout so I kinda liked that / uhmm resource, I guess, that Flickr provided. But uhmm, / uhmm, I ended up using that as part of my montage to show the different activities that people can do because this couple went there apparently and/ did all that kind of sight-seeing and uhmm. So I made that as part of my montage / or a **montage element** to use in the presentation.

(table continues)

Appendix K *(continued)*

F1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
26. ∭ Ok. So, I'm going to save this picture / hit **control, save image** as uhmm "**map**" to the desktop and then I can just **drag it in**. Is that right? ~~ Oh, ok. ∭ It let me save it to the desktop / /.	**26.**
27. **Where did that go?** Ok. ∭ I'm going to **minimize** everything to try to **find** this image and its hidden behind all these windows I have open and / uhmm, where did it go? Ok, **there it is**. So, **dragging and dropping** it in, maybe. Nice. ^^^ Sweet.	**27.**
28a. Ok. So I've got my **map** ∭ and I want to edit how / so I'll go to the editing tab. **Is that right? No.**	**28.**

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
1. Ok. / / / [**Referring to SB**] So, **I'm going to** make ∭ a section of this movie / and I'm going to add some photos ∭ that I collected and put them into my photos, into my iMovie.	1. [?] Ok, so I'm, > this is the hardest part for me just verbalizing my thoughts because when I'm thinking about something, it's really hard to do both ##. \ \ I think that's like what we talked about when we were talking about how when you're doing those **e-learning principles** /, where if you have like some kind of a visual, / (motioning hands, sort of in a counting way), you don't want visual-audio / and then / reading too.

(table continues)

Appendix K *(continued)*

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
	Like, if you have a picture, you might want a picture and something on / visual [+ +] picture / that's visual, but, you don't want words on top of that. You could have audio, but then you either have to have a picture, minus the words or a picture/ or else you have too many going the same >.
2. This one is going to be / / ∫∫∫, the first one is going to be **wolves**. %%. I **put a picture of a wolf into pictures.** I'm trying to **find** the wolf ∫∫∫ I **downloaded** from the / there it is / and **drag and click** it in /. It's **not a very good picture** of a wolf. / It's a pretty poor picture of a wolf %%. So, I have to redo that one.	2. I was more concerned about getting my project, you know ##, something that was worthwhile / to have on tape then / because when we were doing the **montage**. I figured, well, <> "What do I need to be speaking about in order to do this?" ## So that you have something that's worthwhile on tape too?" I thought it was pretty /. And then, I had to use the Help Menu to figure out how to do something on there.
3. Then, / I already started my project. **I'm going to** take the music off of that part **because I'm not going to want the music while I'm speaking**. And then ∫∫∫, uh oh, what did I do? All right, here we go.	3. %%, >, Right now, I'm just working on the sound. / [?]
4. \ \ Ok, and then the next piece in the **montage** ∫∫∫ is going to be for the bears [**SB**]. %% **I'm going to** insert a picture of a bear and / ∫∫∫ I'm looking. \ \ There' a grizzly bear and I'm **putting a picture** of a **grizzly bear** inside my montage and **see if that picture turns out a lot better than the wolf picture**.	4. [?] And, I was pretty much just trying to get all the pictures right, and some turned out **fuzzy** [hands gesturing]. I was figuring out how could I get these pictures so they're not fuzzy. I figured, instead of, you know, with an Apple [finger drawing on table], you can cut. You can just drag and click. Drag to the desktop and it just shows up. And that didn't work well as downloading them and I had to figure out how to make it work.
5. So far, they're both 4-seconds. **I'm going to have to make them a little bit longer**, **because**, I'm going to be speaking during this part **[SB**]. So, **I'm**	5. > And, now, I'm working on the time part. So, I'm trying to time it so where, %% ><, people can actually sit there and look at it.

(table continues)

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
going to put a time limit %% [SB]. Start it with **wolves**, \ \, let's say, I'll make that one / I'll start with 6-seconds ∭. **Press Ok**. Then, **I'm going to use a picture**, ∭ same with the **bear** ∭, and then, I'm also going to [SB] use a **moose** ∭, moose picture %% here. **Add that** to iMovie.	
6. **Another bad picture** of a **moose** \ \. I'm probably going to have to get another good picture. These pictures were really **blurry** ∭. **I don't know if I can get those any better or not because** they're some type of jpeg file, ∭ /.	6. What I was doing here was making sure the pictures were clear that were downloaded. They were not fuzzy anymore. See, I said blurry. So, artistically they were blurry and I did not want to have blurry pictures. And I figured out the **issue** was just downloading to my desktop instead of dragging them to my desktop. Because the file /, it seemed like, it was a smaller photo of the picture so when I put it on here it was really blurry. / More **pixilated** / / /.
7. All right, and the last one I'm going to use **[SB]** is a picture of a **buffalo**, ∭ %%, and I have quite a bit of pictures of buffalos. Somehow, **I've got good pictures and poor pictures.** / / /	7. ##, I think, a lot of times, "I'm looking at the still picture and it's not doing anything" <>"What am I supposed to be doing?" ^. And when you're looking out >, you're actually kind of forced to look what else is in the scene or what's coming next. >< Say, pan up on a still picture. You can actually see, "Oh you're thinking about what's going to be up there." I've been thinking about that so ><, / *Do you mean visual grammar? Is that what you're talking about?* Um hum. Um hum. / / /

(table continues)

Appendix K *(continued)*

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
8. Hmm, and **it downsized the pictures** so **I might have to go back** and **make those 6-seconds long** ∭. Ok. \ \ Picture of the **moose under 6-seconds** long as well [typing].	8. S: Yeah, made it smaller. *E: Do you know why?* S: Uhh, I don’t know why it does that [+ +]. I don’t know why it makes them /.. I don’t know why it does that. I mean, you just drag them to the desktop from / / I took them from the morguefile and downloaded them. Or, dragged them to the desktop.
9. Finally, ∭. **All of those** are a part of that Indian tribe**. I want to have** all **those types of animals** that lived with the **Indian tribe** that I am doing for this **montage** and **they all represent the wilderness and the life** that’s around here %%.	9. %%, So, now, I’m trying to put in my script in with the montage for part two. So, I’m kind of timing it out. !!!.
10. So, I’m going to **put a picture** of a stream. Some type of stream. **Let’s see what this picture looks like**. ∭. **Picture of life** with **green trees and green grass / blue sky**. Kind of to **remind you of life** in a stream.	10. And, I really **didn’t have a plan** going into the **montage on this day so, /** I’m trying to figure out what else I can do to keep talking.).
11. So, let’s see how that picture turned out ∭. That’s a pretty **big file**. Yeah, **that’s a good picture** ∭.	11.
12. So, now, I’m just going to **see what it looks like** \ \. [Video rewind and playback] / / /.	12. Now, I’m just looking at / to see what it looks like (**music playing**) without any narration. And I was just looking and seeing if it was working here.
13. All right, so, I’m just listening the \ \ /. Looking at the photos and listening to see if it works ∭, combined together and it’s interesting, ## seeing the pictures go in and out and in and out ∭, but I don’t know if I want it to go like that. **I’m going to have to change that.**	13. And, I was going to change that in and out. So, I didn’t know if that would work or not so I / / because, I could edit the movement of the photos. And I was also trying to think about / all of the **issues that we learned about in class**, like, <>”How am I supposed to do this?” And I had to review that a little bit.

(table continues)

Appendix K *(continued)*

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
	Like the **thirds issue.** And then the **eye-levels**. You know of the animals. You wanted them the same because, you don’t want the eyes to look at the picture here and then the next shots over here. You know? You’re moving you face or eyes too much
14. Plus, the **music** is on, so, I’m going to have to **figure out how to take this music off of this** / part here, %%. I have to come back and do that later \ \ **I’ll fix it because I’m having problems with music** ∫∫∫. For some reason it turned purple and not green [referring to music in the timeline]. I want it to be purple because it’s not been purple ever before ∫∫∫.	14. I was **trying** to figure out what else I needed to do so I could keep myself talking ><.
15. I’m just trying to get out of iMovie. ∫∫∫. But / **maybe I can just go like this** and listen to the **sound** that way. **Make it shorter** and **then go back to my project to see here**. %%. There we go.	15. Yeah, the images were already put into iMovie so /. I mean, I pretty much had this part of it. The **montage** done.
16. All right, **I got rid of** some **music**. [?] All right and **I’m %%, going to see** if I can do ∫∫∫ the same thing again. Music [?]. Try to make it a lot less music ∫∫∫. **Take the music out** and / try to figure out how to get back to the screen I was in / ∫∫∫, oh, here we go. \ \	16. !!!. I’m thinking, thinking. <>”Where’s the sound?”
17. **Breaking down time** that I want the **music**. Let’s try 34-seconds for the music %%, and/ now/ ∫∫∫. Let’s go back to the **screen shot**. Let’s see, we have 34-seconds so **let’s try 36 seconds** \ \. **Let’s see if that goes like that.** Uhhh / 36-seconds ## for the music to see if it goes to the end of that slide. Actually, we **need it a little less**, [++] 30-seconds. > / **30-seconds** for the music.	17. Thinking pose. I notice I’m not talking as much when I do that.

(table continues)

Appendix K *(continued)*

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
18. And ∭ then, I want to go to the **microphone** [!!] and I want to go into the timing ∭, %%, so / I'm going to **make it shorter** by pulling it to the left and just go to 30-seconds. **See how that works**. I guess it has a **picture** up there that I could be using / [?] that I didn't know %%. So, ∭ I'm going to **stop the music** right **where my face ends.**	18.
19. All right. Now, I'm going to go **back to see how it turned out.** I'm actually going to play from this **slide**.	19.
20. **I'm going to crop.** I want to **crop and finish that as well.**	20.
21. Now, I'm going to **double click to play**. Let's **see what I have** without the music. I have the **wolf**, ÷÷ the **bear** and **during this**, **I'm going to be saying, [SC]** "There was quite a variety of wildlife such as wolves, [pause], bears, and moose and buffalo, which was vital [xx] animals to stay alive ∭."	21.
22. So, \ \ **now I'm going to** go ahead and try to record this ¡¡¡ **sound**, %%, that I have for the **montage** and **overlay that with the pictures** to **figure out** where I've got to play ∭ the sound / /.	22. So, now, I was thinking, well, I guess, I'll put some sound into it. And now, I'm trying to figure it out / /
23. So, I'm going to go up here to the [?] **microphone**, and I'm **going to try to record** the voice-over part of / ∭. I'm using a built in microphone and I'm going to **try to [?] play** the sound. Play, uhm, I'm thinking. / **Play projected.** Ok. ∭ %%. It shows my voice.	23. <> "How do I record my voice?" And, I had forgotten how to record my voice. I'm thinking, thinking. I can't think. "Where is the sound?"
24. Uhmm, **I don't really remember how to record /** my voice on this. **I'm going to** have to come back to this part because, / [?] I want to move onto other parts of my / / **[SC]¡¡¡**	24.

(table continues)

Appendix K *(continued)*

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
25. Well, I **downloaded** part of the **Help** part of /. All right, so I'll go to / ***Play*, [typing].** No, that's Photobooth. I don't want that. / [Reading Help material].	25. So then, I'm going to have to type, up in the Help Menu. Now, I know how to use iMovie a lot better from doing this project.
26. Let me go to **Help** [++]. ***Play* voice**, / recording a voice-over. Ok. So, I'm going to go back to the Help menu [typing] and go to **record a voice-over** intruding into your recording." [?] Let's see what it says when I bring that up. It says %% [reading help menu], ". . . drag noise reduction slider to the right to prevent background noises ~~ from	26. ><. I'm just trying to figure out /. A lot of times, I'll just go to different things to figure out different items to figure out where I want to /. How to fix my problems.
27. White noise? I don't want any white noise. I'm going to use the "noise reduction" [**reading help menu].** So. I'm going to **drag the slider to the right to prevent any extra noise.** That's what I'm going to use **because, I think that will make my voice sound a lot better ∭.**	27. [ ) [ ) (Listening and %%). I'm just reading really fast. [ ) [ ).
28. So, I'm going to go back and **try doing some of these features** before I start recording my voice.	28. %%. Uhm, you know, I just wanted to make sure I was doing it the right way and there's no right, I guess no reason to it /. I just really, I could have chosen another format and I was thinking about doing **Audacity**, but this already had – and ^ I never used the / the iMovie recording and it seemed like it would work.
29. Uhmm, it said [**referring to help menu**] to move it to the right for noise reduction ∭. "Noise reduction, input volume." **I speak softly so, I'm probably going to want a little bit more input volume**. And, voice enhancement.	29. Obviously there were **problems** in recording, uhm, sound in this program.

(table continues)

M1: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
30. “Play project audio while recording ∫∫∫.” **I don’t know what that is [?].** I’m going to **have to go back** to that in the Help menu.	30. And so, since I’m unfamiliar with the sound part and the editing of iMovie, I had to look it up in the Help Menu/ / /.

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
1. All right, I made this uhmm, I pulled a couple of pictures off the /) morgue files [image-sharing website] / for the **montage**, >) ∫∫∫ and I’m just going to try to **move them** into **iMovie**. They’re in PowerPoint right now. So, I’m going to see what I can do to move them ∫∫∫. I’ll put them on the desktop first and then move them over / /.	1. All right. Yeah [++], I spent most of this time just trying to figure out how to use the, a / programs. I had never /. That was my first time using the program. So, it was all new to me and / > I think almost the entire time I’m here, >< I was trying to figure out how to open and drop things and stuff.
2. From home, I brought uhmm, my / a travel drive and ##, it has the photos that I was going to use for Yellowstone project ∫∫∫. **It’s** [referring to images] been **fitting into iMovie pretty well.**	2. Ok. Yeah, I was trying to come up with a theme from the things you had already shown me / ><, in the class. Just trying to figure out how to do the montage. So, to start, / %%, I had a wolf ><and then a World War I scene and death >< and just all trying to / /. Then I was kind of one set ÷÷ and I wanted this all to turn into a, an Aztec skull >. And then, there was a / something else there with Mexico >< and / no, no, it was Day of the Dead >< and then Pancho Villa ><. So, it’s kind of flowing into Mexican history >< with a death theme still there ><. And Pancho Villa [++] killed many persons so he kind of fits in with the death scene [ ) too ><.

(table continues)

Appendix K *(continued)*

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
	Then, it goes, the last slide / is probably the weakest one of the >< three because it just had different colors that made up the Mexican flag.
3. %%. <> "Oh, it's **not going to let me**" / / /. ÷÷. >. **I'm trying to** get the pictures off of the desktop / because, I don't think I can > ∭ put the images from PowerPoint back into iMovie.	3. ><I think, I was dragging them on to the desktop / and when they were / on the desktop they came out nice and clean >< and crisp and once I put it inside the program, then, > they came out a lot more pixelly. >< They're not that bad, but \ \ I like the screen clean and crisp images unless there's a reason | not to have it that way.
4. Ok, **iPhoto**. Let's see / /. Ok / / /. Yeah, **I'm just opening** / I have like iPhoto and now, I have **ten windows open.**). Let's see [xx] %%. Ok.	4.
5. ∭ So I'm in the untitled window and I'm going to try to / /. Oh **that's not going to work** / / /. Let's see / /. Oh, it's different on the Mac. It didn't work. **I'll try again**.	5.
6. Ok, ∭, I'll **drag and highlight** it just to make sure I've got it. / <> "**Copy**." Let's see if I can even copy it up here %%. And copy. Here we go. And, / / **no paste?**	6. ><I was trying to think of something better to lead from Pancho Villa into something / better %%, but I just couldn't quite figure it out.
7. Its just coming out as this ∭, which is really strange. Let me show you %%. **It looks as though it's zoomed in like a thousand percent**. *E: Ok, try dragging it from the desktop into iPhoto.*	7. That was my problem, but I, [?] didn't lose any of the, a, intention of the, a, montage. I mean you can still see the images well enough. It just looks a little less professional because they were pixelly ><.

(table continues)

Appendix K *(continued)*

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
8. Ahh. That' a good idea. I'll try that ∭. **Close that there.** Try this in here and it may have worked. **"Unreadable file,"** was one. ∭. Not recognized format. It's probably because I got these file on the / / uh, Internet.	8.
9. ∭ %%. Ok. All right. Now, where did I put my? **I'm going back** to my travel drive and back to my PowerPoint presentation.	9. Uhm, here, I'm? %% Looks like I'm still trying to figure out how to use the program [!!].
10. I think I just **clicked on / /.** Closed it. All right. There it is and it is still converting files ∭. All right, there we go.	10. I wanted to have a couple of slides transition from one theme into another. And, I wanted to transition a/ three times ÷÷ because there was supposed to be nine slides ><. So, sets of three ÷÷, which I think you wanted anyways. I wanted it to kind of tie into each other ÷÷ so one would, a, / the last slide or the last set would feed ÷÷ into what happens in the next set. > %%. So, here I'm just trying to learn how to use that program. It's a really nice program. / / It just takes a minute or two / to figure it out so \ \ , | /. [?] Yeah, and I think, uhh / that's what you had in mind with the montage slides right? *E: Yes. And that's what you were doing here?*
11. This is my **second slide** and I'll **copy** that. I think \ \ I've now figured it out. How to copy that is.	11.
12. So let me **move up here a little bit** [zoom]. **That's a little big so, / let's get more of the frame ∭.**	12.
13. I'm just going to take a picture of this now [screen shot] / / / ÷÷. Ok. Now,	13.

(table continues)

Appendix K *(continued)*

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
just **click and drag**. All right. Here we go. Ok / / /. I think I may have done it like ten times.	
14. Let's see, **picture** of / / all right and **drag it** into the / / iPhoto program and I think I may have just, / yep, put it in there ∫∫∫.	14.
15. **Let's try one more image** and then, I can go back to iMovie %% and try to make a presentation slide / / /.	15. > Yeah. I'm starting it here.
16. I'll **close this** because there are too many windows. %%. There's **picture** two. Where's **picture** three**? There it is** ∫∫∫.	16. I've got the wolf and, I'm doing the first set of three. And, I think I brought these pictures in from / [?]. Yeah, I got these pictures from home and I brought them in. So, it's already / I had an idea of what I wanted to do with the first three.
17. Ok, let's **drag that down here**. That one didn't seem to / take too well. Let's **try that again** / / /, ∫∫∫. Just grab the corner for some reason. "**Shift, command, four / / /.**" Let's try that **one more time**.	17. So, a, I don't know if I a /. Yeah so / / /, I'm still trying to >< move things around.
18. I'm down there. %%. **Let me see if I've got it this time.** I'm just going to call it four. / Yep, four. See **four** is in / / / that is strange [ ). !!! **Four is an image of that one** %%. All right. Maybe it's around here someplace. Ahh [++], %%. ∫∫∫. **There's five and six**. So, we didn't, ahh / there it is. Ok, so I'll see if I can just **delete** those two. All right. There are my images.	18. >< That was a / that was my first set, so I kind of wanted to have three images that tied into each other. >< So, I had a wolf and >< World War I trenches which / is kind of a / a metaphor for just war and conflict and the wolf kind of ties in with that. I wanted a meaner / The wolf looks a little too nice. I think. I don't like / I wanted a meaner wolf. You know? Starved and vicious, but it was kind of like a wolf walking off in the woods.

(table continues)

Appendix K *(continued)*

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
19. I'm going to open up iMovie. ¡¡¡. And so it opens. See how it goes. / / So I'm **putting this here** and that's the wrong place so, I'll **move it** ∭ there. Just **highlight** them **all** at once.	19. I had plenty of technical issues. Uh, just learning a new program you know / even if it's really simple to use like this one was. There's going to be [ ) a lot of technical issues. Uh /
20. Ok. So I've got **this piece** here and %% it's zooming in on it for some reason / /.	20.
21. **How do I get back to the rest of my / / pictures?** I'll save that. Ok, **why didn't it put it there?**	21.
22. Ok ∭. Let's **try a Ken Burn's Effect**. Uh, that's **not going to work** [ ). Ok, let's try the **next image**. Yeah, **that's not going to work**. ∭ Ok. **Looks good**.	22. One complaint I had was it seemed to loose some quality of the images though ><. / I don't know because, they were a lot less pixelly before they a / before they went into the show \\| and then they came out a lot more pixelly / in the show.
23. Let's **increase the timeline** a bit / / and take it up there / / / and / / / uhh / / [ ) **invalid value.** Probably didn't like that. / / I'll **change the time**. Its probably value. Doesn't like that. Let's **put it down here to start**.	23. \\| It was probably something I did I'm sure. >< But, but a / in the process of putting all the slides together, I ended up with slides with totally different times / /. I don't know how that happened ≥≥.
24. Ok. Let's **see what my clips are looking like**. Why is that / / /? The **wolf didn't show up**. Oh, I'm missing one. Let me get that **back in there**. For some reason I moved it / /.	24. %% Looks like I'm learning how to use the uh, how to use the time there. Maybe, the timing?
25. So now, I've got **all three**.	25.
26. Ok, **back to the beginning** and its going **too fast** so I've got to / / %%. So the duration is for a 14^{th} of a second is that right ∭? So, I've **need to increase**	26. The timing thing got me last time. But when >< I played it through the last time it. Like it was no problem ><. / / But, I think I could use it again / / /.

(table continues)

Appendix K *(continued)*

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
that to / let's try 10-seconds. **See what that looks like.** Same thing. I'll **increase these to 10-seconds** and increase this one to 10-seconds to give them equal time and see what it looks like / / !!!. Nice. **Play it through** and / / it **might even be too long.**	
27. Ok, so it goes right into that other **image** ##. So maybe, I **need some transition there**. %%. So to do that, let me see what I can do here. I wouldn't want anything to bounce or spin [ ). %%. Ha ∫∫∫.	27. So [!!] I thought ÷÷ that was nice little transition. Because it kind of leads you into that. Which we only had three images. I mean if I had more images ><, it would be kind of nicer to do that montage a little slower so it's not so abrupt.
28. Ok, so fade-out. **Let's put some fade-out in between them. And, let's see what fade-outs look like.** So, I'll put two fade-outs there and we'll increase the time. ÷÷ **Take it down to, / I don't know, 5-seconds** and maybe I'll increase the time as the images go on. So, I'll make **this one eight seconds** / / and I'll make this one / I'll leave it at ten and see what it looks like!!!.	28. *You did it with only three images?* Well, just that one little part >< it was three images and then it moves on to the next three images and /
29. All right, so I'll **play it through** / ø. / / Here comes the fade-out. / It **still seems a little abrupt** but, it might be ok. Ummmmm, **fade-out** / /. Here we go. That might even still be too long. **I think you get the idea without the 10-seconds.**	29. Yeah, I was thinking there, it was little/ too abrupt because it went from >< wolf, >< to trench warfare, >< to a death. You might miss somebody.
30. So, I'll click on this again ÷÷, and **take this down to 8-seconds** ÷÷. Oh, **move this one down**. Let's see like **six seconds**. !!! [ ).	30.
31. Ok, let's try a different one. Let's try a cross-dissolve instead. Oh, **it can't work because, I set it to a longer**	31. The fade-in and fade-out. / / %% That seemed to be the best and / something I would / /. It wouldn't work with one of the

(table continues)

M2: Think Aloud, Concurrent Protocol and Retrospective Report Comparisons

Design session	Reporting session
duration /. Uhm. Huh? %%. See, I don't know what some of these are so I'll just **give it a shot and see what some of these look like / /.**	durations for a longer period. >< I tried/ a couple of other ones. A little error message came up saying you had to have the slide up for longer [xx]. So, I just used fade-in and fade-out.
32. Overlap? That might be making two images into each other / / ÷÷. **Delete** that, put that **overlap** in. ∫∫∫. Try it down here and [++] **see what that looks like**!!!. Yeah, it **seems like it's a little smoother**. Smoother fade / /.	32. ><. Just, learning how to flow slides into each other and a / more smooth transition from one slide to the next.
33. It's not **going to the last image**. ÷÷. I wonder why that is? **Maybe they all have to be the same type of transition?** All right. **Let's see what happens** now. See, here it goes [!!], \\|.	33. Ah! Looks like it's almost done there. / / /
34. Let's play the whole thing through / /.	34. I think I'm going to play it.

APPENDIX L

RETROSPECTIVE MONTAGE PROTOCOL CATEGORIES FOR THE MONTAGE EQUATION TASK

Appendix L

Retrospective Montage Protocol Categories for the Montage Equation Task

Categories	Subcategories	F1	F1 %	M1	M1 %	M2	M2 %
CT							
	Accessibility	1	6	1	2	-	-
	e-learning principle			1		-	
	Folk term	-		-		-	
	Knowledge acquisition	5		-		-	
	Knowledge construction	-		-		-	
	Prior knowledge			-		-	
DT							
	Construct	1	31	-	26	-	22
	Edit	1		7		3	
	Idea	6		-		2	
	Judgment	1		2		2	
	Project	-		-		-	
	Recall	11		6		8	
	Reference	6		1		-	
	Review	5		10		5	
	Trial and error	-		-		2	
NT			19		7		14
	Narration	-		-		-	
	Montage	11		2		7	
	Space relationship	2		1		4	
	Semiotic meaning	4		-		3	
	Shot scale	1		3		-	
	Time relationship	1		1		-	
RT			20		14		25
	Feature	-		3		6	
	Form	18		8		13	
	Function	1		2		4	
	Spatial orientation	1		1		2	
TT			19		21		14
	Application method	2		4		1	
	Import	-		-		1	
	Find	5		-		-	
	Search	1		-		-	
	Technical issue	4		7		9	
	Tool method	7		10		3	
Total percent			100		100		100
Total number	Subcategory steps	95		70		75	
Total percent	Categories implemented		100		100.0		80.0

APPENDIX M

MONTAGE EQUATION DESCRIPTIVE TEXT DOCUMENT EXAMPLES

Appendix M

Montage Equation Descriptive Text Document Examples

Participant F1

Intellectual montage: Yes. An emotional series of relationships are centered on one concept.

Sit
+
Think
+
Observe
+
Plan
=
National Park Service

Equation 4A: A photograph of the backs of two campers are sitting long the bottom half of the frame. The figure on the right is wearing a cerulean blue jacket with a raised hood. The figure on the left is wearing a red, baseball cap, green hooded jacket, and grey backpack. In the background there is an open field containing sparse green grass, bare patches of sand, and rock formations

Signification: an image of the two campers is shown in this montage sequence that is meant to signify one of the guidelines of the National Park Service. That is the need for visitors to stop, sit, plan and wait for help to arrive when they are lost in the park.

Logical linking: Contrast
Type of shot: wide shot
Type of icon: iconic sinsign
Image quality: Extremely pixelated
Composition: Symmetrical
Rule of thirds: No

Equation 4B: Descriptive elements: A representation of a black and white, x-ray of the human head is shown in a full profile view.

Signification: the x-ray representation was used in this montage equation to signify the guidelines for of the National Park Service and also to suggest the importance of visitor's thinking about their situation when they are lost in the park.

Logical linking: Contrast
Type of shot: Close up

Type of icon: iconic sinsign-indexical. The eye points to the buildings
Image quality: Good
Composition: Asymmetrical
Rule of thirds: No

Equation C: Descriptive elements: A photograph of the human eye is shown in complete detail including curled, lower eyelashes, iris, pupil and a lens contain a reflection in the foreground. On close inspection the reflection contains a building and this effect proposes an indexical object that was most likely missed during the assembly this montage.

Signification: A photograph of a human eye was used in this montage equation. It signifies the guidelines proposed by the National Park Service. The message, for park visitors, is to check their surrounding if they are lost in the park before taking any kind of action. However, the image of buildings in the reflection of the eye interferes with the tended message.

Logical linking: Contrast
Type of shot: Close up
Type of icon: iconic signsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Equation D: A photograph of a map and compass are shown. There are also topographic indications of roads, riverbeds, and bordering territories. Each one is depicted in a variety of colors and includes contour lines. The compass points north and the letter "N", on the compass, is set in red text. It signifies a navigation device.

Signification: The photograph of the map and compass were used in this montage to signify one of the guidelines for of the "National Park Service," that is, to plan what to do in an emergency. It suggests the importance of visitor's understanding their location when they are lost in the park and the importance of examining their surrounding terrain before taking any action.

Logical linking: Contrast
Type of shot: Close up
Type of icon: iconic signsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Participant M1

Intellectual montage: Yes. This is a dynamic, emotional series of relationships centered on one concept. Further it has many of the elements of a full intellectual montage in the last equation.

Moose
+
Buffalo
+
=
Life

Equation A: This montage was developed and embedded in the final narrative movie and was discussed during the TA protocol analysis.

Descriptive elements: A photograph of a moose is shown partly submerged in a riverbed. Tall stalks of wild, green and brown grass surround its form. The creature's mouth stops short of an undulation of reflective water that captures the moose's form. This rippled effect combined with the moose's brown, soaked fur suggests this is a moment captured in time.

Signification: The moose image was used in this montage equation to signify the conception of life by inferring its significance as a part of this region's ecosystem.

Logical linking: Contrast
Type of shot: Mid-shot
Type of icon: iconic sinsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Equation B: Descriptive elements: A photograph of a buffalo fills the frame and creates the visual sensation of a form that is comprised of mass, muscle, texture and color. The creature's black, curled, horns are topped with orange dirt, its fur is orange and brown and its snout is black and bold. Towards the far right of the frame, one eye looks off into the distance. Exactly what interests this creature is unknown, but its relationship with the two other frames in this equation is meant to provide a clue.

Signification: Similar to the moose, the buffalo image was used in this montage equation to signify the conception of life by inferring its significance within this region's ecosystem. Further the shedding areas of its fur indicate the perpetual cycles of life that affect this animal. As creatures of the earth both animals rely on resources such as the riverbed that is shown in the next scene. Equally important, in the final narrative, for which this montage was created, the buffalo takes on a mythical significance as told by the narrator about the beliefs of an indigenous group of people.
Logical linking: Contrast

Type of shot: close-up
Type of icon: iconic signsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Concept: Life (Equation B) A photograph of a tranquil riverbed scene is shown. The aim was to call attention to a cerulean blue sky, drifting white clouds, lush green fields and multicolored colored rocks of oranges and browns. On the top, right side of the frame, leafy green trees are show, horizontally receding and overlapping the blue sky. To the left of the frame, tall wild, green grass grows on an incline and ends by the water's edge.

Signification: The tranquility of the riverbed scene was used to signal a natural resources and a force of nature that supports life. (Reference with Renior's River)

Logical linking: Contrast
Type of shot: wide-shot
Type of icon: iconic sinsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Participant M2

Intellectual montage: Yes. This is a dynamic, emotional series of relationships centered on one concept.

Skull sculpture
+
Feminized skeleton
+
=
Mexican Revolutionary figure

Equation A: A photograph of a skull sculpture, of Aztec origin, is set against a dark maroon colored background. The form is composed of red clay and the right side is encircled with double arcs that are filled with an equidistance number of linear slabs. The facial expression on the skull includes two round holes for eyes, a vertical rectangle for a nose and a wide rectangle, spanning the entire lower part of the face for the mouth.

Signification: The Aztec skull sculpture signifies the historical past and a part of Mexican culture in relation to the people of Tenochtitlan who performed human sacrifices. Thus, the death theme in this intellectual montage is further extended through this shot.
Logical linking: Contrast

Type of shot: Wide-shot
Type of icon: iconic sinsign
Image quality: Good
Composition: Asymmetrical
Rule of thirds: Yes

Equation B: A photographic portrait of feminized skeleton is adorned with Victorian-style trappings that include a wide-brimmed, black hat, dangling earrings and a scoped neckline embellished with embroidery. The skeleton's hat contains an exceedingly large brim that spans from one end of the frame to the other. Set against a red colored background, the brim aligns perfectly with the top, horizontal rule of thirds.

Signification: The skeleton image used in this montage was meant to signify, a Latino holiday, known as *The Day of the Dead* (i.e., Día de los Muertos). The holiday entails a day of pray and remembrance for friends and family who have died.

Logical linking: Contrast
Type of shot: Close-up
Type of icon: iconic sinsign
Image quality: Pixelated
Composition: Symmetrical
Rule of thirds: Yes

Concept: A black and white photograph of the Mexican Revolutionary General Poncho Villa is positioned, slightly off-center within the frame. His eyes are half closed and his thick, dark mustache extends along the sides of his face. It is a provocative portrait as the general's hat, a round sombrero, encircles the entire top half of the space and his solemn expression could be interpreted in a number of different ways. Further, the series of parallel bullets, positioned on leather, crisscrossed holster around the general's neck proposes other inferences as well. The portrait captures the complexity of the general's character.

Signification: Because General Poncho Villa was a controversial figure that has been both revered in Mexico and wanted, in the past, by the United States, there are many meanings here that could affect this portraits' message. Intentionally used here to signify death, one must interpret whether the artist intended to make inferences to the General's rebellious actions. It should be noted, in the Talk Aloud protocol, discussed later in this chapter, this was the artist's intent. Consequently, this image, as conceived in this arrangement of emotional interactions, carries political indexical inferences as well.

Logical linking: Contrast
Type of shot: Mid-shot
Type of icon: iconic sinsign
Image quality: Slightly pixilated with noise
Composition: Asymmetrical
Rule of thirds: Yes

APPENDIX N

ENCODED CATEGORIES AND SUBCATEGORIES OF RETROSPECTIVE TRANSCRIPTS

Appendix N

Participant F1: Encoded Categories and Subcategories of Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
1. So here, I'm pulling, I'm **scrolling through** and **finding**, I have all my **pictures** that are **big enough** now [ ). Uhmm, and as you can see, I've **added** a bunch more things.	*(TT) Tool method,* *Find. (RT) Form, Feature,* *(TT) Import*
2. This is one of my **montage equations** that I started creating [ ) the last time you videotaped me.	*(NT) Montage*
3. **I couldn't figure out why** the black screen is there. I had just **dragged** it and got a black slide (*iMovie timeline effect view) / / /.	*(TT) Technical issue,* *Tool method*
4. This is when I'm thinking about **how to communicate**, uhmm, the **concept** of **what to bring** [++] along with you [ ).	*(CA) Accessibility* *(DT) Idea*
5. So, I had **found**, uhmm, a bunch of **images** for, uhmm, as far as **gear** and **what to take** and **why to take certain things** [hands clasped].	*(TT) Find,* *(CA) Folk term* *(RT) Form (visual), (RT) Function*
6. And uhmm, how **to communicate** that without bombarding with a bunch of images of messy **campsites** because that's definitely **not the message** that I **wanted to convey**.	*(CA) Accessibility,* *(CA) Folk term, (NT) Semiotic meaning*
7. So, I remember thinking, it's a **good picture** because it >< **fits in here, but, it's also kind of messy**, which is not part of the **leave no trace message ##** I was **trying to convey.** So, I wasn't sure that I liked that picture.	*(RT) Form,* *(RT) Function, (DT) Judgment,* *(NT) Semiotic meaning,* *(DT) Idea*
8. I'm thinking right now and so that's why, I **pulled in** the **camera** thinking <> "Give it some **shot variety,"** to kind of **show them**, / / your campsite should look either exactly the same or it should look cleaner after you leave.	*(TT) Tool method* *(RT) Form, (NT) Shot scale,* *(RT) Function,* *(CA) Accessibility*
9. I was always taught if there's liter at your campsite when you get there, you shouldn't just leave it and >< say, <> "It's not my trash." >< Pick it up. Because if everyone did that, *** no trash would ever get picked up. So, uhmm, **that's kind of what I was thinking**.	*(DT) Idea*

(table continues)

Appendix N *(continued)*

Participant F1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
10. The **eye** / was part of my uhmm. The eye / was part of my **montage** that had been >< **disrupted by the black boxes** and I didn't know why they were there. So that's why I'm **moving** those images around now.	*(RT) Form,* *(NT) Montage,* *(TT) Technical issue,* *(DT) Edit*
11. Now, I'm going to try to **create** the ≥≥ **beginning** [++] **slide** because I had an idea. Very scatterbrained this day, I guess [ ).	*(DT) Construct,* *(RT) Spatial orientation,* *(RT) Form*
12. Well, **I thought** I **needed to** ><, I actually used this in my presentation. I wanted to **convey the message** of, / if **you** get >< **stuck in** an emergency, or if **you're in an emergency situation,** now is not the / time to loose your mind and freak out.	*(DT) Judgment,* *(NT) Semiotic meaning,* *(NT) Event*
13. The >< **wilderness association** has a **mnemonic** "STOP." Sit, think, observe and plan so, ≥≥ I was putting that together, here, and then saved this slide as an **image** to **put into** my / ÷÷ narrative presentation **to convey / >< that message,** I guess / / /.	*(DT) Reference* *(NT) Semiotic meaning,* *(RT) Form* *(TT) Import* *(CA) Knowledge construction*
14. And I took a **page** from your book [referring to student investigator's lecture slide]. **I liked how** in a lot of your presentations you had the images ÷÷ on the side and the words >< on the **right or left of the images**, corresponding images. Uhmm, I was thinking **contiguity** here, so / uhmm, / /.	*(DT) Reference* *(DT) Judgment,* *(RT) Spatial orientation* *(RT) e-learning principle*
15. Now, I had it **typed** up and went away. I wonder if I **accidentally deleted** it. I don't remember doing that [ ). <> "That's funny" / / /.	*(TT) Tool method,* *Technical issue*
16.Yeah, that's what I'm **creating** here is that screen. It was the >< white screen that has that on the **right hand side** and >< I **pulled** in **elements** from my **montage** that I had made.	*(DT) Construct* *Spatial orientation* *(DT) Edit, (NT)* Montage
17. ÷÷ Of **people** sitting, ÷÷ the **brain** and then ÷÷ the **eyeball** and ÷÷ the **compass** with the **map**. So, I ended up **making that a montage** in < this slide. >< <> "**Drive the point home**" [ ). Yeah.	*(RT) Form, Form, Form, Form, Form* *(NT) Montage,* *(DT) Function*

(table continues)

Appendix N *(continued)*

Participant F1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
18. This, uhmm, < this **mouse** or whatever you call that part is really **hard for me to use** on the Mac because, ÷÷ I wanted to right click and I wanted to ÷÷ click on the thing so that was, <> "Kept trying to do that and ÷÷ nothing would happen" and I had **to click down here [ ).** So, I hadn't, I hadn't had a lot of experience using that so, I had to get used to using the mouse that way.	*(TT) Tool method, Technical issue* *Tool method*
19. / / You can see, I'm pulling **my images in** here / / / [aligning the images and text in the timeline].	*(DT) Edit*
20**. It's amazing how slow I am on the Mac** [ ). If I was on my PC, >< I'd be done [ ). But, I like Mac now, more and more ***. That's what I use at school and I use my laptop and desktop at home, which are both XP.	*(TT) Technical issue*
21. Now I'm trying to **size** those and **crop** them to the way I **like them** / and put them **next to the words** and then, I'm **getting** my next **images**.	*(DT) Edit, Edit, Judgment, (RT) e-learning principle, (TT) Import, (RT) Form*
22. There's my "**Think**"' / it's the think part of it [referring to the mnemonic]. I **thought** it was / rather then to just have someone like [?], [ ) you know, I thought that was kind of cool.	*(RT) Form, (DT) Reference, (DT) Judgment*
23. Actually, just **typed** in **brain** into /, I think that one was **Flickr** and that's what came up and I thought <> "Oh, that's cool" [!!] ~~.	*(TT) Search, (TT) Application method*
24. Trying to **size** them and make them match the word and >< **line u**p with the word **so, uhmm, it makes sense**.	*(DT) Edit* *(RT) Spatial orientation, Function*
25. This one, I remember **cropping down** because the **dimensions** didn't work right. Or to match up and **align** with the rest of them and I **didn't know how** to do that other than cropping it. I **ended up using** a different **eyeball** altogether, ¡¡¡.	*(DT) Edit, Feature, (RT) Spatial orientation, (TT) Technical issue, (DT) Judgment, Form*
26. I used the **tool in PowerPoint** ***. I ended up, I just **cropped** it right there. Yeah.	*(TT) Application method, (DT) Edit*

(table continues)

Appendix N *(continued)*

Participant F1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
27. And now, I'm **looking** for the last / I had a compass **image**, but I saved it as a gif file instead of a jpeg so it wasn't, it **wasn't registering**. It was, uhmm. So I went back to try and **find** the compass. *E: What do you mean it wasn't registering?*	*(TT) Search* *(RT) Form,* *Technical issue* *Find*
28. I don't know. <). It **wouldn't show me** what it was [ ). Uhmm, so it went, I was **trying to find** the **compass** and it wasn't **in my images** anymore so I **had to go back** and find it again. That's what I'm doing right now.	*(TT) Technical issue,* *Find,* *(RT) Form,* *(DT) Recall*
29. Here, %% I'm still **looking for that compass** I used. I'm **trying to see** / / / that one. I was looking for an **image** that could **convey the message of "planning"** and I was really happy to find that one because **I liked that one in particular, a lot,** and I did end up using it and, uhmm.	*(TT) Search,* *(RT) Form,* *(NT) Semiotic meaning,* *Judgment*
30. And here [++] I'm **looking** for an **image** that jogged my memory of another one, uhmm, that I was looking for and I **didn't have it saved in the right format** so I went back to **find** it and save it again.	*(TT) Search, (RT) Form,* *(TT) Technical Issue,* *Find*
30. I was looking [adjusting seat], I didn't save it in the jpeg format and I wanted it in that so that way so I could **pull it** into / iMovie, well, / that was when I was using iMovie, but I changed to MovieMaker / / /.	*(TT) Tool method,* *(TT) Application method*
31. There's the compass [ ).	*(TT) Find*
32. I'm in Flickr [++]. / / / I think what I had done was just **typed** into the **search**, uhmm, "Plan" and possibly "Yellowstone." And now, I'm just kind of searching around to see what's out there / / /. Now, I **found it** and I **put it in there** [ ). All that time *** [ ).	*(TT) Application method,* *(TT) Tool method,* *Search,* *Find,* *Import.*

(table continues)

Appendix N *(continued)*

Participant F1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
33. I think that one **didn't end up** / the **dimensions** / /. I don't think it ended up working **the way I wanted them**. The dimensions did end up working to be **aligned**. I had wanted them to align correctly. / / / ¡¡¡ Yeah, it's not showing up.	*(TT) Technical issue,* *(RT) Feature,* *(DT) Judgment,* *Spatial orientation,*
34. Uhmm, I'm **moving**. Well, I was **working on** the mnemonic screen and then, uhmm, I was looking at **moving it >< into** the presentation, but I was looking at **the clip**, trying to find a place where I could do it ##.	*(DT) Edit, Construct,* *(TT) Import,* *(RT) Form (visual)*

Participant M1: Encoded Categories and Subcategories From Retrospective Transcript

Retrospective narrative transcript segments	Encoded categories/subcategories
1. [*] So, I'm **opening** iMovie and / / I'm looking through some of the **pictures**.	*(TT) Application method,* *(RT) Form*
2. >< I had the **script** right next to me so I could **see what things >< I wanted to put in there.** >< The **script** really helped me just to think about / the process of what I needed to do for the narrative. So, I could just **put >< in** all the **pictures** and then think about the narration. >< **Like how long** I needed to make those pictures / and how long the narrative was going to take **##/.** So, %% that's what I was doing here, \ \ >< when **I was working on %% ><** the narration part.	*(DT) Reference, (DT) Judgment* *(DT) Reference* *(TT) Import, (RT) Form,* *(DT) Function,* *Edit*
3. I would usually / **guess a time** for the narration. So I would >< **make a picture go for that long** and then I would **put** the narration in there**.** And then, **if** the narration was too short [++] or it went over; not too short, but went too long, I would have to make the picture length [++] >< longer, in iMovie. **Or if** I did it where the / / the narrative was too short, and it didn't pick up the whole space, I would >< just /, after I made the photo long, \ \ make it shorter again. >< So, that was just part of the editing process.	*(DT) Trial and error,* *(DT) Edit (visual),* *Edit (verbal),* *Trial and Error*

(table continues)

Appendix N *(continued)*

Participant M1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
4. Right here, I'm just taking a look at all the **pictures** that I have and I'm trying to ## **add** them as I **look over at my script** [the participant is already in the application].	*(RT) Form,* *(TT), Tool method,* *(DT) Reference*
5. All right. Right > here I'm **adding pictures** of the characters that I had in my, / in the narrative part. So I'm adding the buffalo. And I kept, / I **tried to** keep the **same kind of picture** with ÷÷ the **buffalo** and ÷÷ the **grandfather**.	*(TT) Import, (RT) Form,* *(RT) Form, (RT) Feature, (NT) Agent, Agent*
6. I had to >< **change** /. One of the things I did was, you know, >< I had to **change** the **script** of the story a little bit because I couldn't find pictures of the characters. So that was >< difficult for me because %% I was looking, ÷÷ trying to **find** free files.	*(DT) Edit, (RT) Function,* *(DT) Reference* *(TT) Find*
7. I had the **pictures** that >< **I wanted**, but sometimes it was hard to find the **pictures that you really wanted**. And [++] you wanted to try to >< keep the same **style** of picture ## too. Because I **didn't want to have a lot of different styles** like >< black [!!] and white photo here, >< **picture** photo here that they are the same / >< characters you know?	*(RT) Form,* *Idea* *(RT) Feature,* *(DT) Judgment,* *(RT) Form*
8. > We were talking about **screenshots**. / / / And screen shots worked really [++] well. / >< I had known about that, but **forgot about the command key** for it. So, once I realized I could do that, I remembered the command key and I / did a lot better at **making clear photos** >< as well as being able to **clip the pictures** and **edit the pictures** the way I wanted too / / /.	*(TT) Tool method,* *(TT) Technical issue,* *(DT) Edit, Form (visual)* *Edit*
9. I had to get out my jump drive, I believe. Oh no, that's my script / / /. <> I'm thinking, "Did I remember my **script** or did I leave it at home?" And I brought it [!!] >).	*(DT) Reference*
10. ~~ So, I'm still looking at the **script** and seeing **what / > I need** to **put in**. %% What **pictures**, I **need** to put in and how I need to edit **them**.	*(DT) Reference,* *Idea, (TT) Import,* *(RT) Form*

(table continues)

Participant M1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
11. Actually, ^^^ I thought it was going to be longer than 10 minutes from the **beginning**, ••• but actually it only turned out to be seven or eight minutes or something like that.	*(RT) Spatial orientation*
12. I **could have** >< **added more features** into the narrative. Like I could have made a shot >< lengthier / /, but it started to come down to time constraints. >< \ \ So I wanted to make sure / to get everything in that I was supposed to, **to have a story**.	*(DT) Judgment,* *(RT) Function*
13. And I did [!!] do a lot of >< **editing** on the story part because I **thought** <> "Oh, this is going to be way to long." **I don't want** it to be like twenty minutes long. >< So I cut down the script of the story / / /.	*(DT) Edit,* *Judgment,*
14. When you talked about a > **"**Wiki," / **I was thinking about making this a >< podcast.** Like I said, for > my web page that I have **for >< my class** and then **kids could go look at this anytime** they wanted to.	*(DT) Idea,* *(CA) Accessibility,* *(RT) Function*
15. One good thing is we have an LCD projector at my school. >< We can, **put it right up** [display] on the LCD projector / / /.	*(TT) Tool method*
16. I think the hardest part >< was **figuring out how to use a story** [++] **to help you teach something**. That was the hardest part [*] I think.	*(DT) Idea,* *(RT) Function*
17. And here >, I'm talking about how the **ducking** [adjusting background music]. It just didn't work quite right. *** For some reason **there was a glitch**. I don't know why ^ / / /. And I'm trying **to figure out this issue** with the ducking, which took quite some time [*].	*(DT) Edit* *(TT) Technical issue,*
18. One of the other things that I didn't want to do was to have to **figure out how to use Audacity** >< and like <> "Oh, I'm going to have to redo all of my audio." And then, in Audacity, >< **try to figure out** how to put it in there. And then that would be **another couple of hours** that I would have to spend working with Audacity or GarageBand.	*(TT) Technical issue,* *(TT) Technical issue,* *(DT) Judgment*

(table continues)

Appendix N *(continued)*

Participant M1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
19. But then, **after using > this awhile**, I found **if I put my >< whole ÷÷ music file in first,** that I'm going to be doing for the **music** part, and ÷÷ then put my recording in then, **it seemed to work. >< So, maybe the order** that I had to put it in /was wrong.	*(DT) Trial and error,* *(TT) Import* *Form (verbal), Judgment*
20. \ \ I was thinking about well, <> **"How should I make this interesting?"** To kind of put some humor into it. And **that's why I tried to use it,** [++] / >< **to introduce the myth.**	*(DT) Idea* *Judgment, (RT) Function* *(NT) Folk term*
21. I wanted to use it >< to **teach the kids something**. I wanted to teach them /. I **just didn't want to have it like, >< "This is a myth**." If I am using it for my class, I could say >< "Ok, this is what myths are," and then give them an example of a myth and then have >< them do an assignment at the very end about myths.	*(CA) Accessibility,* *Knowledge acquisition*
22. Because than its kind of **like the hook** ><. **You teach them and then >< hook them and then they get to write their own**. So, that's what I kind of wanted to do with mine is to >< use it as a **teaching tool** / and [++] a >< **self-guided teaching tool**, which is like, <> "All **they** have to do is watch this."	*Knowledge construction* *(RT) Function,* *(CA) Accessibility*
23. Then, **let's say I'm ## absent one day** and I want to teach them about myths, ## **they** just **watch this** and then ## they write their own myth and ^ I don't even have to be there.	*(DT) Project* *(CA) Accessibility, (RT) Function,* *(CA)* *Knowledge construction*
24. One of the things, I did with the **intro** [++] is, I **put humor into it.** Like the >< **hippo was an >< oral tradition**. Like "Ahh." Like it's >< saying something and **the kids might get a laugh** out of that. Or, you know, **Michael Jordan**. Hopefully there's >< some kind of connection there. I also put a > **Harry Potter** book in there /.	*(DT) Idea,* *(NT) Semiotic meaning,* *(CA) Accessibility,* *(NT) Semiotic meaning,* *(NT) Semiotic meaning,* *(NT) Montage [the three images form an intellectual montage sequence]*

(table continues)

Appendix N *(continued)*

Participant M1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
25. Because >< [paraphrasing narration] "Myths aren't just stories, any old stories. Myths are stories that are >< past down from generation to generation, about some ## unnatural or some ## natural occurring event that is [hands clasped] hard to explain."	*(NT) Narration,* *(CA) Knowledge acquisition*
26. **They couldn't explain it** [referring to Native Americans]. So, they had to have some other way to explain it. **So, I created a myth.** They didn't know science or how to explain it through science.	*(CA) Prior knowledge* *(RT) Construct*
27. %% One thing I did do when I was thinking through this**,** uhmm**,** was **trying to theme music**. Like **when a certain ## character would come along,** it would be a different music. So I had like >< **the buffalo theme** [++] and >< **the boy theme** and >< the **grandfather theme** music. Uhmm, and, I also ## tried to use this **theme music for >< the whole story** which is like the theme that I start with, ÷÷ introducing it, and then, ÷÷ at the end, I have the same music, at the end. Kind of like the theme that goes along with the story. So, [*] I really tried to use that as well in the music **to help the narrative out** too.	*(DT) Idea,* *(RT) Feature,* *(NT) Space relationship,* *(RT) Function* *(DT) Judgment*
28. [*] %% The biggest thing here too [!!] /. The music, you were able to >< **click a button** and then you were able to >< **edit the music and how long it went**, but then / >< some of the buttons, I was **confused** on [?]. There's a > button that you press that you drag the ÷÷ music back and forward, to where you want it to end, and there's another one where you could ÷÷ press and you could ÷÷ click on it to start. So, I think [*] I was confused on the buttons here.	*(TT) Tool method,* *(DT) Edit, Form (verbal),* *(TT) Technical issue*
29. And then I'm going to **get more clips** of pictures here.	*(TT) Import*

(table continues)

Appendix N *(continued)*

Participant M1: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
30. [*] Uhmm, I was using the **pictures of the rocks** [++] to put in there **because the mountain in the story turns into**, ## **shatters himself**. Or, the mountain becomes ## stones and rocks and he >< shatters himself. So, >< **punishment for killing** the buffalos; >< the **boy** killing the buffalos. **He becomes slower** so that's why there are rocks. >< So he walks over the rocks.	*(RT) Form (visual), Judgment, (NT) Semiotic meaning* *(NT) Event, Agent, Semiotic meaning*
31. All the native American **images** are from the morgue file.	*(RT) Form (visual), (TT) Application method*
32. I included a picture of the world. **Map** of the world to try to get in /. I think I was >< **talking about** how like / how by using this picture, >< **I was using it to** just kind of **look over all ÷÷ the land** and **using it to talk about how things are explained** around the world / through myths.	*(RT) Form (visual), (NT) Narration, (DT) Idea, Function, (CA) Knowledge acquisition*

Participant M2: Encoded Categories and Subcategories From Retrospective Transcript

Retrospective narrative transcript segments	Encoded categories/subcategories
1. %% I wanted **to put a few transitions** in / /, which is what I used the time to do here / / and / I **added credits** at the **end**. I also put an > **explanation** of what the project was going to be used for at the **beginning** [?] / /. I didn't do anymore voice narrations **because I already had finished** all of that.	*(DT) Edit, Form, Spatial orientation, Function, Judgment*
2. Here, %% I think, I'm **getting an image** of a wolf / / Did I replace the image? I think **I replaced an image** that I had shown earlier. At least, I was trying to.	*(TT) Edit, (RT) Form, (DT) Edit*

(table continues)

Appendix N *(continued)*

Participant M2: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
3. I had a lot of **animal slides** at the end/ > **talking about the animals of Yellowstone** | because the **idea** of the > / presentation was to **show it to a class** that does a ## Yellowstone **drawing assignment**. </ So, they have an idea of the sort of **things they could draw in a picture**.	*(RT) Form, (NT) Narration, (DT) Idea,* *(RT) Function,* *(CA) Knowledge construction,* *(CA) Knowledge acquisition*
4. So, **I do one of those projects with the kids**. You know, **I can actually </ use this in the class now** [?].	*(CA) Accessibility,* *(DT) Project*
5. I uhmm usually </ if I'm doing a topic that has a lot **of visual images** for it. Then, I just </ **show a little presentation** to the **kids** before we / talk more about the topic. ## Lecture about it a little bit. So then they could > look at it and **get an idea of Yellowstone / </ the images of Yellowstone.**	*(RT) Form, Function,* *(CA) Accessibility,* *Knowledge acquisition*
6. And I do a little example drawing in front of them and then ## I let them go ahead and, you know, **we'll talk** about the National Parks and *** stuff like that so.	*(CT) Accessibility*
7. %% I **tried to have two themes**. > One was the **environments** of Yellowstone and the second theme was the, I guess you'd could call it / > the **"Characters."** The wildlife of Yellowstone.	*(DT) Idea,* *Function,* *Function*
8. And, I think I'm using this > time here to put a **transition slide** between those two themes because [?], I **realized**, I just had them ## run right across each other. | So, I wanted to put a > little slide in **as a break** *** / /.	*(DT) Edit,* *(TT) Technical Issue,* *(RT) Function*
9. And uhh, %% I didn't write out everything I was going to say [referring to the script], I just, **I just ÷÷ wrote down a ÷÷ couple of points I wanted to hit on** / and then, I just </ went ahead and did it in </ one shot [referring to the voice recording].	*(DT) Judgment*

(table continues)

Appendix N *(continued)*

Participant M2: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
10. [?] %% **I think if I had a script, I would just end up going into a *** monotone, mundane voice** and / / because, I have kind of a low voice anyway so </ I'm always at risk of sounding pretty flat so [ ). If I'm reading from </ a script I don't think it would have worked as well.	*(DT) Judgment*
11. Here, %% I'm, / I think I'm > **adding** a **slide** on the **front** of the, uhh / a slide to the front of the presentation explaining what the presentation is for.	*(TT) Import, (RT) Form, Spatial orientation, Function*
12. I ended up </ adding four slides / [?] during this time and they were all just kind of **transition slides**.	*(TT) Import, (RT) Function, Form*
13. I **didn't want to** add anything more to the body of the / ## Yellowstone show **because I'd already done the narration** and > I didn't want to start cutting into the narration.	*(DT) Judgment*
14. %% If I had, if I took ## another picture and put it in there then it would be a picture without a narration and I would have to </ come back and add more narration to it. And I **already had kind of a </ nice flow** to the **narration**, I thought. So, I didn't want to start </ putting more pictures in because then they would break that up.	*(DT) Judgment*
15. > Plus, I didn't have, a, I used a > headset at home to do the narration and I **didn't have it ## with me**. So, that wasn't really an option either [ ).	*(TT) Technical issue*
16. Uhmm, > I used PowerPoint. You can click on, "**Record Narration**" and then you can ÷÷ manually click through the slides. So you can ÷÷ set your own pace. > That's all I did.	*(TT) Application method, Tool method,*

(table continues)

Appendix N *(continued)*

Participant M2: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
17. And ÷÷ a friend of mine has got </ one of those really nice mics for/ you know, picking up sound better ***. I've used his mic before and it sounds really nice. So, mine has a little bit of **background** </ **static**. It's just a headset [?]. I think at one point I **adjusted it** and you could hear > scratching. So it would be nice to have a \ \ better piece of equipment here.	*(TT) Technical issue,* *Tool method*
18. Here, I'm still **adding my slides in**. Just sort of **transition slides** and > you don't see the technical problems I had with the other program > because, I know this program better [referring to PowerPoint].	*(TT) Import,* *(RT) Form*
19. I think that's just **the part** that says what / the intention of the show is / for.	*(RT) Function*
20. Oh, there we go I'm having > **problems** because **it's [text]** going across. It's going out of the box. So, a, I was just trying to **get it all spaced in right**. Yeah, just saying what the **project's intentions** were.	*(TT) Technical issue,* *(RT) Form,* *(DT) Edit, (RT) Function*
21. Oh, here I'm just **making** /, this is going to be the **title slide**. > Just has / %% the "Animals and Environments of Yellowstone National Park." / / I'm just trying to get the **font to the size I like** / / / [?].	*(DT) Construct,* *Function,* *Edit*
22.Oh, [?] I think I was / what did I? **I threw this picture in** at the end / for [++] probably the credits, I think /. It's just a picture of **Old Faithful** / /.	*(DT) Edit,* *Form*
23. Is that one of the **original ones** that I came with? / / I can't remember / /. I think I'm working on the **end credits** here / / /.	*(RT) Form,* *Construct*
24. I'm back in **Google** for some reason. / / Still **looking for images**. Maybe I was looking for images and text about Yellowstone. / / / Yeah, I'm at Yellowstone National Park homepage now right. %% Yeah, I'm back [?].	*(TT) Application method, Search*

(table continues)

Appendix N *(continued)*

Participant M2: Encoded Categories and Subcategories From Retrospective Transcripts

Retrospective narrative transcript segments	Encoded categories/subcategories
25. And then > and a / / getting uhm / **/ getting this into** iMovie was interesting too [Quicktime?] I solved that problem. I just dragged > it and **dropped it in** and it **became an iMovie**.	*(TT) Application method*
26. I was looking to **see how it was flowing**. Just seeing how the slides are going. One > into the > next one. Just if something [++] awkward that doesn't seem / / like if I had an > **animal picture** mixed up with >the **pictures of the environmen**t / that would be something to catch I guess / /.	*(TT) Review,* *(RT) Form,* *(RT) Form,*
27. I think I was **trying to get it to play**, but the sound wouldn't come up when I was in this mode of **Photoshop** [PowerPoint]?	*(TT) Technical issue,* *(TT) Application Method*
28. I guess, I decided that **slide was too big**.	*(DT) Judgment*
29. And I had to come back and > **redo** a slide at the ø **end** because, I **didn't like** the ending. / How I'd </ **voiced over** the ending ***. So that's the only slide, I ever re-did for the voice-over / /.	*(DT) Edit,* *(RT) Form,* *(DT) Judgment*
30. For some reason I **decided not to put** the video into it. The video I had, like I had a few clips of </ the bubbling mud and like </ the buffalo getting up and walking around. Clips like that.	*(DT) Judgment*
31. I tried and **I had problems getting the video in to play right** so I just **got rid of it**. In the >, PowerPoint slide when I put the video into it. It wasn't working when I first put it in.	*(TT) Technical issues,* *(TT) Tool method [Delete], Application method*

APPENDIX O

TAXONOMY OF THE NARRATIVE MULTIMEDIA DESIGN PROCESS

Appendix O

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Content area thinking	
Accessibility	"I'm trying to create and idea *for a person who is viewing this* . . . " (F1, CP) " . . . *things that people can do* recreation-wise in Yellowstone, *tailored to or focused on camping itself*" (F1, CP1).
	"It's meant to be like *an introduction video*. So possibly for people who have never even setup a tent before; never even thought about going and sleeping outside" (F1, RP1)
	"This is when I'm thinking about *how to communicate*, the concept of what to bring" (F1, RP2)
	"*The kids could go look at this anytime* they wanted to" [referring to a wiki] (M1, RP2) "That's what I kind of wanted to do with mine is to use it . . . as a *self-guided teaching tool*" (M1, RP2) "One of the things, I did with the intro is, I put humor into it" (M1, RP2). "*The kids* might get a laugh out of that" [use of celebrity characters such as Magic Johnson] (M1, RP2) "I do a little example drawing in front of them and then I let them go ahead and, you know, *we'll talk* about the National Parks and stuff like that" (M2, RP2).
e-learning principle	" …corresponding images [referring to images and text]. I was thinking *contiguity* here . . ." (F1, RP2) "Trying to *size* them—make them *match the word* and *line up* with the word so, it makes sense" (F1, RP2
	"You could have audio, but then you either have to have a picture, minus the words or a picture/ or else you have too many going the same' [making an analogy with talking aloud and working] (M1, RP1) "I was more concerned about getting my project, you know, something that was worthwhile / to have on tape"
Folk term	"Rock climbing" "Fly-fishing" "Wilderness Association" (F1, CP) "Campsites" (F1, RP2) "Myth" (M1, RP2)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Knowledge acquisition	"I'm also thinking maybe, *I'd like to show* some of the *features of Yellowstone*" (F1, CP)
	"My idea for that was to . . . Just *to kind of show how different people do it* "[set up camp" (F1, RP1) "All the different tools and items you need to bring and have" "I hadn't thought about making the gear section of it "(F1, RP1)
	"I had planned to show a bunch of different activities you could do so, because that's a very important part of planning your trip" (F1, RP1)
	"If I am using it for my class, I could say 'Ok, this is what myths are and then give them an example (M1, RP2)
	"I was using it [Map] to just kind of look over all the land and using it to talk about how things are explained around the world through myths" (M1, RP2)
	"I also put *an explanation of what the project was going to be used for* at the beginning*"* (M2, RP2)
	"If I'm doing a topic that has a lot of visual images for it, *I just show a little presentation* to the kids *before* we talk more about the topic" (M2, RP2).
Knowledge construction	"I want to talk about what to bring **. . .** and *how to figure out what you need* . . ." (F1, CP)
	"*Drive the point home*" [referring to the mnemonic and emergency situations] (F1, RP2) "I wanted to use it—I wanted to teach them. *I just didn't want to have it like, 'This is a myth'*" (M1, RP2) "You teach them and then hook them and then they get to write their own" [myth] (M1, RP2) "So they have *an idea* of the sort of *things they could draw* in a picture" (M2, RP2)

(Table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Design thinking	
Construct	"I'm going to try to *create* the beginning slide" "That's what I'm *creating* here is that screen (F1, RP2)
	"They couldn't explain it [referring to Native Americans]. So, they had to have some other way to explain it. *So, I created a myth*" (M1, RP2)
	"Oh, here I'm just *making*, this is going to be the *title slide*" (M2, RP2) "Putting together"
Edit	"I'm going to *put these in* and then *organize* them in the order that I want them there" (F1, CP)
	"So, I'm going to *stop the music* right *where my face ends*" (M1, CP) "So the duration is for a 14th of a second is that right? So, I'll need to increase that . . ." (M2, CP).
	"Right now, *I'm just working on the sound*" "And, *I was pretty much just trying* to get all the pictures right, and some turned out fuzzy" "*I'm working on the time part*. So, *I'm trying to time it*" (M1, RP1)
	"It was probably something I did I'm sure. But, but *in the process of putting all the slides together*, I ended up with slides with *totally different times*" (M2, RP1)
	"This one, I remember *cropping down* because the *dimensions* didn't work right" (F1, RP2) "Sized," "Cropped" "Moving" (RP2, F1)
	"And here, I'm talking about how the *ducking*. It just didn't work quite right" [adjusting background music] (M1, RP2) "I think I'm using this time here to put a *transition slide* between those two themes . . ." (M2, RP2)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Idea	"I thought *a really cool way to do that would be* if a lot of *it* [images] *dictates the location* . . . (F1, CP)
	"I want to have all *those types of animals* that lived with the Indian tribe . . ." (M1, CP) "One thing I did do when I was thinking through this was . . . *trying to theme music"* (M1, RP2) "I was thinking about *making this a podcast*." (M1, RP2)
	"The *idea* of the presentation was to *show it to a class* that does a Yellowstone *drawing assignment*" (M2, RP2)
	"I *tried to have two themes*. One was the *environments of Yellowstone* and the second theme was the, I guess you'd could call it the *characters" (M2, RP2)*
Judgment	"*I think* this should go closer down here, to the end . . . " (F1, CP) "I speak softly *so, I'm probably going to want a little bit more input volume*" (M1, CP) "Somehow, *I've got good pictures and poor pictures*" "*Another bad picture* of a moose" (M1, CP) "That's a little big so, let's get more of the frame" (M1, CP)
	"It *still seems a little abrupt*, it might be ok . . . fade-out?" "*Might even still be too long*" (M2, CP) "Yeah, *it seems like it's a little smoother*. Smoother fade" (M2, CP)
	"Yeah, I was thinking there, it was little/ too abrupt because it went from >< wolf, >< to trench warfare, to a death" (M1, RP1)
	"I did a lot of editing on the story part because *I thought* "Oh, this is going to be way to long" (M1, RP2 "I didn't write out everything …I just wrote down *a couple of points I wanted to hit on*" (M2, RP2) "The dimensions didn't work" (F1).

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Project	"I'm going to go *right in, into talking* about *things that people can do recreation-wise*" (F1, CP) "So, *now I'm going to* go ahead and try to record this sound" (M1, CP) "*I'm going back* to my travel drive and back to my PowerPoint presentation" (M2, CP)
Recall	"Ok, *I think what it was,* I *clicked on the thumbnail*" (F1, CP) "I'm going to *have to go back* to that in the Help menu" (M1, CP) "That one didn't seem to take too well" (M2, CP)
	"I think right now, I'm trying to find out where the media is. Where are my pictures?" (F1, RP1) "What I was doing here was *making sure the pictures were clear* that were downloaded" (M1, RP1)
	"All right…I spent most of this time just *trying to figure out how to use the, a programs*" (M2, RP1) "I was trying to think of something better to lead from Pancho Villa into something better. But I just couldn't quite figure it out" "*I wanted to have a couple of slides transition* from one theme into another" (M2, RP1)
Reference	"Starting at my beginning of the *storyboard*" (F1, CP) "So, I've got my *storyboard* and I'm going to *review it* and basically *check out my plan to figure out where I want to start*" (F1, CP1)
	"I'm going to be speaking during this part [looking at storyboard]" (M1, CP) "So, I'm still looking at the script" (M1).
	"I *rewrote my script* when I did that too, but I did still kept some of those pictures in there" (F1, RP1) "I already had ideas about my *montage*. I put one of those in my *storyboard*" (F1, RP1) "*I had that in mind*. That was one of the *definitive parts of my storyboard* [action photos]" (F1, RP1)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Reference cont.	"I used that, and your website, to create my whole project / with the idea of purposefully placing images aligned together and that" (F1, RP1)
	"I'm trying to *put in my script in with the montage* for part two. So, I'm kind of timing it out" (M1, RP1)
	"And I took *a page from your book* [referring to student investigator's lecture slide]" (F1, RP2) "So, I'm still looking at the *script* and seeing *what I need to put in*. What *pictures, I need* to put in and *how I need* to edit them" (M1, RP2)
	"The script really helped me just to think about the process" (M1, RP2)
Review	"I'm going to *review it* and basically *check out my plan to figure out where I want to start" (F1, CP)* "All right. Now, I'm going to *go back to see how it turned out*" (M1, CP)
	"Ok, so I'm, [adding photos] *this is the hardest part for me just verbalizing my thoughts* because when I'm thinking about something, *it's really hard to do both*" (M1, RP1)
	"Now, I'm just looking at to see what it looks like (*music playing*) without any narration. And I was just looking and seeing if it was working here" (M1, RP1)"
	"Ok. Let's *see what my clips are looking like*" (M2, CP) "I was looking to *see how it was flowing*. Just seeing how the slides are going" (M2, RP2)
Trial and error	**"**I'm going to *that site* and *search* for that map … and *see if I can get it to save better this time* (F1, CP) **"**I'm *going to try to record* the voice-over part … I'm using a built in microphone" (M1, CP) "I don't know what some of these are. I'll *give it a shot and see what some of these look like*" (M2, CP)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Trial and error cont.	"I found *if I put my whole music file in first . . . it seemed to work*" (M1, RP2). "I would usually *guess a time* for the narration. So I would *make a picture go for that long* and then I would put the narration in there" (M1, RP2)
Representation thinking	
Function	" …*overlay that with the pictures* to figure out where I've got to play the sound" (M1, CP)
	"And, I wanted to transition three times because there was supposed to be nine slides" (M2, RP1)
	"So, I remember thinking, it's a good picture because it *fits in here*" (F1, RP2)
	"So I had . . . *the buffalo theme* and *the boy theme* and the *grandfather theme* music" (M1, RP2)
	"I had to *change the script* of the story a little bit—I couldn't find pictures of the characters" (M1, RP2) " . . . the theme goes along with the story. So, I really tried to use that as well in the music *to help the narrative out* too (M1, RP2)
	"I realized I just had them [images] run right across each other. So, I wanted to put *a little slide* in *as a break" (M2, RP2)*
Feature	"Picture of life with *green trees and green grass, blue sky*" (M1, CP)
	" . . . you wanted to try to keep the same *style* of picture too" (M1, RP2) "I didn't want to have a lot of different styles like *black and white* photo here, *color* photo here that they are the same characters you know?" (M1, RP2)
	"Pictures that are big enough"

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Form (visual or verbal)	"Compass," "Map" "Oh, this is a great one, *taking a shower*" "*setting up camp*" (F1, CP)
	" ...picture of a grizzly bear" (M1, CP) "Wolf" "I've got *all three*" [Images of animals] (M2, CP)
	"A bunch of different *people* in front of the *Yellowstone National Park sign*" "There's my hiker" (F1, RP1) "Where's the sound?" (M1, RP1)
	"I had a wolf and then a World War I scene and death … Aztec skull …Mexico (M2, RP1)
	"Gear" "eyeball" (F1, RP2) "*Map* of the world" "the music" (M1, RP2) "I added *credits* at the end" (M2, RP2) "I had a few clips of the *bubbling mud* and like the *buffalo getting up and walking around*" (M2, RP2)
Spatial orientation	"So it's going to be one of the *first things the viewer sees*" (F1, CP) "The dimensions did end up working to be *aligned*. I had wanted them to align correctly" (F1, RP2)
	"Left of the images," "Align."
Narrative thinking	
Action or event	"*...stuck in* an *emergency*, or if you're in an *emergency situation* . . . (F1, RP2).
	"*Punishment* for *killing* the buffalos" (M1).
Agent/Existent	"I tried to keep the same kind of picture with the *buffalo* and the *grandfather*" [main characters] (M1, RP2)
	Buffalo, Grandfather, Boy (M1)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Narration	" So, I talk in the narration part . . . about . . . the animals and, plant life that people can see" (F1, CP).
	"*...during this, I'm going to be saying:* 'There was quite a variety of wildlife' . . ." (M1, CP) "I'm going to be speaking during this part" (M1, CP)
	"I had a lot of animal slides at the end *talking about the animals of Yellowstone" (M2, RP2)*
Montage relationships	"There are all these *actions* that people are doing" [relational, rhythmic] (F1, CP)
	"... *they* [animals] *all represent the wilderness and the life* that's around here" [intellectual] (M1, CP) "for *the montage"* (M2, CP)
	"It was almost like a *rhythmic montage* with . . . pictures from Yellowstone and then, the geyser from Old Faithful and so, I ended up changing that completely [talking about the introduction] (F1, RP1)
	"My idea was to do a bunch of different shots of not only *people camping* like *setting up their different camping spots*" (RP1)
	"Just trying to figure out how to do the montage" "So, it's kind of flowing into Mexican history with a death theme still there. And Pancho Villa' (M1, RP1)
	"Of *people* sitting, the *brain* and then the *eyeball* and the *compass* with the *map"* (F1, RP2) "The *eye* [image] was part of my *montage*" (F1, RP2)
	"Hippo" " Michael Jordan" " Harry Potter" [to oral traditions] (M1, RP2)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Reflection Semiotic meanings	"Myths are stories that are past down from generation to generation" (RP2, M1) "…different *group dynamics* of people camping" [connotative] (F1, CP) "Kind of to *remind you of life* in a stream" [reference to an image of the landscape] (M1, CP)
	"...you know to convey a message that there's no one right way to do it … different people do it in different ways [set up camp]" (F1, RP1) "I wanted those images to convey that message that people in your *group*, plus location and the things you want do dictates what you are going to bring" (F1, RP1)
	"I had a wolf and World War I trenches which is *kind of a metaphor* for just war and conflict and the wolf kind of ties in with that" "I wanted a meaner wolf. You know? Starved and vicious "(M2, RP1)
	"*Sit, think, observe and plan* . . .I was putting that together, here, . . . *to convey that message*" (F1, RP2) "*...leave no trace message* I was *trying to convey*" (F1, RP2) "Mnemonic, STOP" (F1, RP2),
	"I put humor into it. Like the hippo was an oral tradition" (M1, RP2).
Shot scale	"I pulled in the camera [image] thinking "Give it some shot variety . . ." (F1, RP2)
	"And when you're looking out, you're actually kind of forced to look what else is in the scene or what's coming next. Say, pan up on a still picture. You can actually see, "Or you're thinking about what's going to be up there" (M1, RP1) "Like the *thirds issue*. And then the *eye-levels*. You know of the animals. You wanted them the same because, you don't want the eyes to look at the picture here and then the next shots over here" (M1, RP1)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Space relationship	"So, it's kind of an *entry point* into the content of the presentation" (F1, CP)
	"So, sets of three, which I think you wanted … I wanted it to kind of tie into each other" (M1, RP1) I'm trying to sort out my thoughts *on how* I'm going to *piece this together* and what to do" (F1, RP1) "I thought it was going to be longer than 10 minutes from the *beginning*" (M1, RP2) "I also put an explanation of what the project was going to be used for at the *beginning"* (M2, RP2)
	"So I had like the buffalo theme and the boy theme and the grandfather theme music" (M1).
Time relationship	"The beginning slide"
Technology thinking	
Application method	"I think I found it in *Flickr* [typing] and I'm going to *that site* and search for that map" (F1, CP) "I'm just trying to get out of iMovie" (M1, CP)
	"I pulled a couple of pictures off the *morgue files* [image-sharing website] (M2, CP)
	"*Flickr*, I used pretty extensively" (F1, RP1).
	"I took them from the morguefile and downloaded them" "So, here I'm just *trying to learn how to use that program*" (M1, RP1)
	"I used the *tool in PowerPoint*. I ended up, I just cropped it right there" (F1, RP2)
	"I used PowerPoint" (M2, RP2)
	"I think that one was *Flickr* and that's what came up" (F1)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Import	"I just *imported* my . . . images . . . (F1, CP)
	"*Add that* to iMovie." (M1, CP) "I'm just going to try to *move them into* iMovie." (M2, CP)
	"I was looking at *moving it into* the presentation. I was looking at the clip . . ." (F1, RP2) "Right here I'm *adding pictures* of the characters that I had in my, in the narrative part" (M1, RP2) "Here, I'm, I think I'm *adding a slide on the front* of the presentation" (M2, RP2) "Put it in there"
Find	"It wasn't in my images anymore so *I had to go back and find it* [map] again" (F1, CP) "Now, I *found it* [map image] and I put it in there. All that time" (F1, RP2)
	"And then *I found* the map. Uhmm, so, that's what I was thinking there" (F1, RP1)
	"That was difficult for me—I was looking, trying to *find* free files" [on image-sharing sites] (M1, RP2)
Search	"Ok, so I'm just going to *search* for [typing] Yellowstone National Park map" (F1, CP) "All right, so I'll go to *Play*, [typing in search field]. No, that's Photobooth. I don't want that" (M1, CP)
	"I'm in Flickr. I think what I had done was just *typed* into the *search*, *Plan* and *Yellowstone*" (F1, RP2)
	"I'm back in Google for some reason. Still *looking for images*" (M2, RP2) "I'm trying to see"

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Technical issue	" …some of them [images] are *smaller* then others and I'm wondering why that is . . ." (F1, CP)
	"*It downsized the pictures* so *I might have to go back* and make those 6-seconds long" (M1, CP)
	"It's not *going to the last image*. I wonder why that is? *Maybe they all have to be the same type of transition?* (M2, CP)
	"Rather then clicking on them I just right clicked on the thumbnail. Or thumb tags … I saved them in that really small format. I know that, I was trying to be efficient. I guess rather than having to click and open the full sized one." This one [image], I remember cropping down because the dimensions didn't work right—or match up and align with the rest of them. I didn't know how to do that other than cropping it. I ended up using a different eyeball [image] altogether…" (F1, RP1)
	"So, *artistically they were blurry* and I did not want to have blurry pictures. And *I figured out the issue* was just downloading to my desktop instead of dragging them to my desktop" "it was a smaller photo of the picture so when I put it on here it was really blurry. More *pixilated*" (M1, RP1) "*How do I record my voice?"* And, I had forgotten how to record my voice" (M1, RP1)
	"When they [images] were on the desktop they came out nice and clean and crisp and once I put it inside the program, then, they came out a lot more pixelly' (M2, RP1)
	"The eye was part of my montage that had been *disrupted by the black boxes* and I didn't know why they were there. So that's why I'm moving those images around now." (F1, RP2) "*I couldn't figure out why* the black screen is there. *I had just dragged it* and got a black slide" (F1, RP2) "I had a compass image, but I saved it as a gif file instead of a jpeg so it wasn't, it *wasn't registering*" (F1, RP2)

(table continues)

Appendix O *(continued)*

Taxonomy of the Narrative Multimedia Design Process

Cognitive activities	Evidence of words and phrases from concurrent and retrospective protocol reports
Technical issue cont.	"And I'm trying *to figure out this issue with the ducking*, which took quite some time" (M1, RP2)
	"I… *forgot about the command key*… once I realized I could do that, …I did a lot better at *making clear photos"* (M1, RP2)
	"I tried and *I had problems getting the video in to play right* so I just *got rid of it*" (M2, RP2)
	"I think I was *trying to get it to play*, but the sound wouldn't come up when I was in this mode . . ." (M2, RP2). "Accidentally deleted"
Tool method	"So, I'm going to save this picture. *Hit control, save image as . . . map* to the desktop" (F1, CP). "So. I'm going to *drag the slider to the right to prevent any extra noise*" (M1, CP)
	"So then, I'm going to have to type, up in the Help Menu" (M1, RP1)
	"I think**,** I was dragging them [images] on to the desktop" (M2, RP1)
	"Typed," "Right clicked" "Kept trying to do that and nothing would happen" [mouse] (F1, RP2)
	"...screen shots worked really well" (M1, RP2)
	"You can click on, *Record Narration* and then you can manually click through the slides. So you can set your own pace. That's all I did [referring to PowerPoint] (M2, RP2).

APPENDIX P

NARRATIVE DOCUMENT OBSERVATION NOTES EXAMPLE

Appendix P

Narrative Document Observation Notes Example

Collected Wednesday, Feb. 18, 2009, 4:00 PM (also see Appendix R).

1. Narrator: Participant M1 (demonstrates ethos, logos and pathos) (Grabe & Zhou, 2003).
2. Title: Explaining Myths: Buffalo and Eagle Wing
3. Theme: "General meanings or mini frames for a report" (Altheide, 1996, p. 30): Myth, culture, and ceremonies are shown.
4. What type of narrative is demonstrated: Both oral traditions and peripeteia. Peripeteia as when a "sudden reversal of circumstances, swiftly turns a sequence of events into a story…" (Bruner, 2002, p. 5).
5. Dramatic portrait? Yes. Events, characters, climax? Yes. This fits with the post-structuralist notion of storytelling (Herrnstein Smith, 1980).
6. Length of movie: 06:51.
7. Source of images: morguefiles.com.

   Kinds of representations: Photographs of clothing, artifacts, ceremonies and a map of the Western U.S. The map identifies the Great Basin area.
8. Accessibility: Yes. Participant M1 is the narrator. He speaks to students, shows his image and explains the project.
9. Demonstrates a concept? Yes. Oral traditions, geysers and animals are demonstrated.
10. Folk terms: Blackfoot Indian tribe (i.e., Niitsítapi people) and the Great Basin area.
11. Information dispensed: Yes. Participant M1 explains what a myth is and why and how the Niitsítapi people used myths to explain the unknown.
12. Problem solving? Yes. An extended writing assignment based on myths is introduced (see Participant M1's written proposal and standards in Chapter 4).
13. Encourages reflective discourse? Yes. Script examples include "Look at the Geyser? How did it get there?"
14. Action/Events: The origin of the Niitsítapi people are described and existents such as a young Native American boy, grandfather, buffalo and mountain are introduced and shown in different situations.
15. Existents (characters): Boy, grandfather, buffalo, and mountain
16. Existent interactions: Grandfather and buffalo; buffalo and mountain
17. Narrator is seen: Yes (both at the beginning and end of the presentation)
18. Narrator is heard: Yes, throughout the movie.
19. Reflection: A broken promise.

20. Semiotics: Grandfather represents wind.
21. Bait/Suspense: Will the boy hunt?
22. Time relationships: From boyhood to manhood.
23. Space relationships: The mountain become rocks. The buffalo, boy and grandfather are shown in different situations.
24. Thought? Yes. Refers to prior knowledge. Contemporary myths such as Harry Potter and Michael Jordan are shown as examples in the presentation. Also see the storyboard analysis in Chapter 4 and Participant M1's credit slide in Appendix R for further examples.
25. How important were the script changes? The grandmother existent in the original script was changed to a grandfather existent because stylistic images could not be found to effectively portray the grandmother. A few setting changes were made for the same reasons. None of these changes effected the storyline.
26. Screen proportions are 16:9.
27. Technical problems? Yes. The sound stops abruptly in some of the frames and fades require more attention. Examples include clipped music at 04:09. The self-portrait contains noise and black slides (empty frames) are also shown in the presentation.
28. Change of music? Yes. See scene 46.

APPENDIX Q

NARRATIVE INSTRUCTIONAL PRESENTATION

TEXT DESCRIPTION DOCUMENT CODES

Appendix Q

Narrative Instructional Presentation Text Description Document Codes

Codes		
	EX CU Extreme Close-up	CFOS: Changed from original script
	CU Close-up	AS: Additions to script
	MS Mid-shot	DKG: Ducking music
	WS Wide Shot	SFX: Sound effects
	EX WS Extreme wide shot	NDKG: No ducking of music
	CRP: Cropped	NMUS: No music
	WEV: Worms Eye View	CMU: Change of music
	AERV: Aerial view	MUSB: Music begins
	OTS: Over the shoulder	[++] Inflection emphasis
	PSY: Psychic lines	INF: Inflection of character
	EM: Eye Match	VO: voice over
	ZN: Zoom In	I MTG: Intellectual Montage
	ZO: Zoom out	MTG OP: Montage of parts
	FI: Fade in	(NS, CFS) Not shown, changed from storyboard
	FO: Fade out	NS: Not shown
	RPE: Ripple effect	SC: Script change from original
	REPEAT: Repeated image	TECHP: Technical problem
	PAN: Panning of a scene	
	MOP: Movement of picture	
	ROT: Rule of Thirds	

APPENDIX R

NARRATIVE INSTRUCTIONAL PRESENTATION TEXT DESCRIPTIONS

Appendix R

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
00:05 Scene 1	Title: Myths Cue: Music "Jaracanda"	[Text & Music] 1. TEXT: White text on a black background
00:06 Scene 2	Cue: Myth-1 a traditional story, esp. one concerning the early history of a people or explaining some natural or social phenomenon, and typically involving supernatural beings or events.	[Text & Music] 2. TEXT: White text on a black background
00:17 Scene 3	Dialogue: My name is Mr. … [PAUSE] And I would like to introduce you to a type of story called myths CFOS (Changed from original script).	[Photograph & Music] 3. CU, Centered, self-portrait of the narrator wearing a dark pair of reflective glasses and a dark black shirt. *Expression:* Stern/solemn *Image quality:* Underexposed with noise. TECHP ZI left, EX CU, CRP
00:25 Scene 4	Cue: Picture of book DKG A myth is different than a story like Harry Potter AS; NDKG	[Photograph & Music] 4. CU, ZI, right to left, CRP, Yellow book with red text and illustration of a young boy with his left hand raised above his head.
00:33 Scene 5	Dialogue: It is about tradition. Cue: [NBA Champ picture] [PAUSE] SC But of course, not this type of tradition: [PAUSE]	[Photograph & Music] 5. MS, ZIO right to left, CRP, Celebrity photograph of Michael Jordan, in action, Wearing red jersey, athletic wear, consisting of a read tank top and red shorts with the word *Bulls* and the number 32 partially hidden by his left hand. An orange basketball is in the other hand. Green, leafy trees are in the background. *Facial Expression:* Mouth and eyes wide opened
00:42 Scene 6	DKG, An oral tradition of stories that are passed down through generations. NDG Cue: Opera singer voice and picture (NS, CFS)	[Photograph & Music] 6. CU, left of frame. Image of a hippopotamus, partially submerged in undulated water with mouth wide opened and teeth, plate and vocals showing. Further back in the frame another hippopotamus is shown.

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
00:49 Scene 7	Dialogue: The following legend comes from the Blackfoot Indian Tribe. NDG Ducking needed here	[Photograph & Music] 7. CU, FI, ZI, from bottom of frame, to WS. Partially cropped white teepee set against a green lawn and blue sky. The flapped, entry to the teepee is open. A small figure dressed in red is partially shown in the background.
00:57 Scene 8	Dialogue: who lived north of Nevada. In an area called the Great Basin. Cue: Map of Great Basin (Map doesn't point to of circle the area) (SC) There were and…DKG	[Map] 8. MS, ZI, CRP, from top right of frame to the left there is a green map with black borders, depicting the Western half of the US. FO
01:03 Scene 9	Dialogue: . . . today, quite a variety of wildlife (SC) [PAUSE] Cue: Animal pictures NS Such as wolves [PAUSE]	[Photograph & Music] 9. WS, FI, ZI. A wolf with a grey and white face and white and grey body centered in the frame.
01:08 Scene 10	Dialogue: Bears [++] [PAUSE]	[Photograph & Music] 10. MS of a brown bear to the far left, occupying half the frame of the frame. The mouth is partially opened, PSY lines. To the right, there is a huge grey and brown fractured rock. Further back in space are areas with green leafy trees showing through.
01:13 Scene 11	Dialogue: Moose [PAUSE] NDKG	[Photograph & Music] IMTG (Montage), 11. MS, FI, (See montage description)
01:14 Scene12	Dialogue: and buffalo [PAUSE] AS	[Photograph & Music] IMTG (Montage 12. MS, FI, (See montage description)
01:18 Scene13	Dialogue: These animals were important to the Blackfoot Indians so, they could live in the Great Basin. Cue: Mountains (NS, CFS)	[Photograph & Music] IMTG (Montage 13. WS, FI, (See montage description)

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
01:25 Scene 14	Cue: boy picture Dialogue: So let me tell you about a boy [PAUSE] SC	[Photograph & Music] 14. MS, centered image of a young boy, dressed in a Native American headdress. The headdress is constructed of yellow and blue beads in a repeating, rectangular pattern. The headdress contains a band that is strapped around the young boy's head. A round beaded disk is also positioned on his forehead. The disk contains a series of repeating yellow and blue circles. To the right of the frame, people can be seen engaged in conversations, and aerial perspective is used in the picture to soften their appearance. To the far right of the frame, and in focus, is a dark colored young man dressed in a long white and green robe. His white headband includes both spiked and dangling red, yellow and brown feathers. Facial expressions of existents: Boy: suggests awe or fascination with his surroundings. Man: Solemn
01:30 Scene 15	Dialogue: A grandfather DKG SC, NDKG	[Photograph & Music] 15. CU, profile CRP portrait of and elderly, Native American male figure is shown with white, long hair and a partial headdress of red and brown feathers. A red cloth covers his shoulder. The background is blurry and is predominantly blue with patches of pale yellow and green. Facial expression of existent: Solemn ZI

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
01:33 Scene 16	Dialogue: And a buffalo DKG Lost sound	[Photograph & Music] 16. WS, ZO, centered image, ¾ profile of a brown and grey colored buffalo facing a green field that is covered in mist on the entire right side of the frame. Beyond the horizon line, along the top rule of thirds, there is a a slight incline covered with snow, patches of sunlight and shadows. White clouds are behind the incline and extend past the edge of the frame.
01:37 Scene 17	Cue: Buffalo picture [NMUS for 10 sec. then CMUS] NDKG	[Photograph, pause, Music] 17. MS, RPE, (See montage description)
01:54 Scene 18	Cue: Pool picture Dialogue: Pool New music score	[Photograph & Music] 18. WS, ZO, A blue stream of undulated water fills the bottom third of the frame. To the left is a tree filled with orange, brown and green colored leaves. In the background, above the stream's horizon line, green colored bushes and tall evergreens fill the space. FO to black.
02:01 Scene 19	NMUS (music stops abruptly)	BLACK
02:01 Scene 20	Cue: Buffalo picture, NMUS Dialogue: The buffalo walked to a mountain one day and said, "Would you liked to be changed into something?" DKG	[Photograph & Music] 19. WS, ZO, centered image, ¾ profile of a brown and grey colored buffalo facing a green field that is covered in mist along the right side of the frame. Beyond the horizon line, along the top rule of thirds, there is a mountain covered in snow with patches of sunlight and shadows. White clouds extend past the edge of the frame.
02:11 Scene 21	Dialogue: "Yes," [++] replied the mountain. "I would like to be changed into something nobody would want to climb over."	[Photograph] 20. WS, WEV. The bottom, third of the frame is filled with yellow and green colored foliage. The middle, third of the frame contains a rocky, stair-stepped, grey mountain. Sparse evergreens cover some of its protruding angles.

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
02:18 Scene 22	Dialogue: "All right," [++], said the buffalo. "I will change you into something hard that I will call 'stone.' You will be so [++] hard that no one will want to break you and so smooth that no one will want to climb you."	[Photograph] 21. MS, RPE, (See montage description), REPEAT, FO
02:31		22. BLACK
02:31 Scene 23	Cue: picture of a boy (theme song of boy) Dialogue: The next day the buffalo met a boy who lived with his grandmother. They grew to become friends. New music score (short)	[Photograph & Music] 23. CU to MS FI, REPEAT (01:25)
02:40 Scene 24	Dialogue: None SC, NMUS	[Photograph] 24. CU, Centered portrait of an elderly, Native American male with long, white hair. Spiked red and black colored feathers and one large black feather are positioned on the back of his head. A black band is tie around his neck. His face is weathered, showing signs of age such as the deep creases in his skin. Looking upwards, his gaze extends past the frame.
02:40 Scene 25	Cue: (fade music out) SC Cue: Grandfather picture Dialogue: [Inflection of character, INF] "I want always to be with my grandson. I want to be changed into anything that will make it possible for me to be with him, wherever he goes."	[Photograph] 25. CU, FI, profile CRP portrait of and elderly, Native American man with white [REPEAT, 01:30]
02:59 Scene 26	Dialogue: So the buffalo brought the boy back to the land of the buffalos and taught him to run swiftly. SC	[Photograph & Music] 26. MS. Contains more details of the boy's yellow shirt containing a black, triangular pattern on the right sleeve and black ribbing along the neckline. FI, REPEAT (01:25, 02:31). Downward MOP [Movement of picture]

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
03:09 Scene 27	Dialogue: The grandfather could go with him, for he had been changed into wind. CS Cue: wind effect	[Photograph] 27. MS, CRP, REPEAT [02:12], centered section of the mountain scene is shown in a closer view. A sparse green bush blows in the wind and the crevices of the grey, rocky mountain are in closer view.
03:18		BLACK
03:23 Scene 28	Dialogue: DKG The boy was now known as Eagle Wing because he was ran so quickly, but promised Buffalo never to kill the buffalo. NDKG [music, repeat score]	[Photograph & Music] 28. MS, centered image of a young, Native American male with dark long hair, arranged in braids. On his neck are red and black colored beads. His arms are bare with the exception of a beaded cuff that is embellished with red, yellow and black icons. He is wearing a breastplate, consisting of buckskin cords dangling in four vertical rows. The top of the breastplate also consists of blue, black red and yellow triangles, long straps of beige leather and a long set of beads that are cascading down along the front of his chest. He is dancing. An American flag can be seen to the right of the frame.
03:34 Scene 29	Cue: Tribal picture Dialogue: One day [the boy, now a man, decided to go back to his tribe] and was asked to go hunt the buffalo. [If he could kill a buffalo he would then become the chief of his tribe. SC [Music stops abruptly] [a new music score begins halfway into showing this image]	[Photograph & Music after dialogue] 29. MS of two, middle aged, Native American males dressed in ethnic costumes are shown. Both are wearing headdresses containing spiked, porcupine and turkey feathers. The man to the left is wearing predominantly white feathers and a black tunic shirt, decorated with colored triangular patterns of red, white, yellow and blue. Around his neck are rows of pipe beads and a beaded collar. The man to the right is wearing predominantly red feathers and a blue tunic shirt and beaded breastplate with diamond shaped patterns of red, white, yellow and blue. Around his neck is a beaded collar and his braids are wrapped with colored blue and white cords.

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
03:54 Scene 30	Dialogue: None	[Photograph & Music] 30. MS, CRP, PAN. This is a panned image that begins with a dark brown adult buffalo grazing and light beige colored calf standing in the background in a grassy field. Next, a WS of dark brown colored bull comes into view. The bull's gaze extends out of the frame towards the viewer. PYSH
04:01 Scene 31	Dialogue: None	[Photograph & Music] 31. WS, PAN. The pan begins within a setting of six adult buffalos who are positioned in a staggered formation as they graze within a field of tall, wild grass. Two of the buffalos are positioned in the middle horizontal section of the frame. As the frame moves downwards, three other buffalo appear in the distance.
04:07 Scene 32	Dialogue starts abruptly: (This is not part of original script) …Buffalo decided to go on a walk. Well [PAUSE] the boy was hunting. MUSB, DKG [PAUSE] other wild buffalo. Before he came back, the buffalo became tired and thirsty and so, decided to get a drink from a pond that was nearby. NDKG TECHP, AS	[Photograph & Music] 32. WS, PAN portrait of a buffalo, walking in a field of tall, wild yellow grass. The creature is positioned vertically, slightly off the center and horizontally along the bottom edge of the frame. The wild grass extends across the center of the page. Beyond it is a forest of evergreens in an array of sizes. FO
04:25 Scene 33	Dialogue: None Cue: Water Source Picture SC	[Photograph & Music] 33. WS, PAN, ZO of a pond filled with yellow colored flowers, stumps of trees and a few Millard ducks perched on the top of them. The edge of the pond extends across the center of the frame and along its edge are tall stalks of green grass and evergreen trees behind them.

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
04:30 Scene 34	Dialogue: DKG. The buffalo had seen what had happened. He could do nothing about it [PAUSE] so, he ran to the mountain [PAUSE] and asked a favor. SC	[Photograph & Music] 34. MS, ZI, RPE, (See montage description), REPEAT, FO
04:39 Scene 35	[Good music fade-out]	35. BLACK & Music
04:43 Scene 36	Dialogue: NMUS. The mountain had become stone. [PAUSE]. Buffalo asked stone [PAUSE] to break itself into pieces so they could teach the boy a lesson.	[Photograph] 36. WS, PAN, ZO of a pond with islands of flat, grey rocks, slightly exposed above the water. FO
04:55 Scene 37	Dialogue: NMUS. So stone shattered himself into millions of tiny, sharp pebbles. SC.	[Photograph] 37. WS, FI, of multicolored rocks in shades of grey, brown beige and white.
05:06 Scene 38	Dialogue: DKG. And this is how [PAUSE] the boy [PAUSE] that turned to a man [PAUSE] was punished for killing the wild buffalo. NDKG, SC	[Photograph & Music] 38. REPEAT 03:23 of Scene 28 in CU, PAN
05:20 Scene 39	Cue: Picture of Mr. Strauss Dialogue: DKG. The story of Buffalo and Eagle Wing explains why there are rocks [that are made into tiny pebbles. [PAUSE] [++] The story is made to explain how they came to be. Cue: Music “Jaracanda” NDKG	[Photograph & Music] 39. REPEAT, in CU, of self-portrait, 00:17, Scene 3 FO
05:34 Scene 40	No dialogue	[White text on a black background] 40. TEXT: Cue: Myth -1 a traditional story, esp. one concerning the early history of a people or explaining some natural or social phenomenon, and typically involving supernatural beings or events.

(table continues)

Appendix R *(continued)*

Narrative Instructional Presentation Text Descriptions

Time	Script	Scene descriptions
05:46 Scene 41	Cue: Water Source Picture Dialogue: DKG. Look at the geyser. How did that get there? [++] The Indians had a way to explain this through a myth. See if you can create your own myth about how Old Faithful works. NDKG, NS	[Photograph & Music] 41. WS, centered image of a geyser erupting along the first horizontal rule of thirds with mist and water filling the right side of the frame.
06:08 Scene 42	Cue: DKG. Picture of Mr. Strauss Dialogue: Thanks for listening and keep story telling alive! NDKG.	[Photograph & Music] 42. REPEAT, but as an EX CU to ECU, ZI, of self-portrait, 00:17, Scene 3 FO
06:12 Scene 43	Cue: Picture of piece of paper.	[Photograph & Music] 43. WS, image of two hands holding a sheet of white paper with bullet points and a black pen pointing to one of the points.
06:18 Scene 44	Cue: Change of music	[White text on a black background & Music] 44. TEXT, Scrolling text: Starring Mr. ….as Himself Mr. ….as Buffalo Mr. … as Grandfather Mr. … as Eagle Wing
06:29 Scene 45		[White text on a black background & Music] 45. TEXT: Sound Apple Inc. Sound Bites Theme Music Jaracanda Eagle Wing Theme Elysium Buffalo Theme Time Lapse
06:42 Scene 46	Cue: Fade Music [4th music score does not relate to this work]	[White text on a black background & Music] "Morguefile.com Great site!" 46. TEXT
06:51 Scene 47		47. BLACK screen

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