2015

Understanding Cognition Across Modalities for the Assessment of Digital Resources

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Abstract

Drawing from the theories of the cognitive process, this paper explores the transmission, retention and transformation of information across oral, written, and digital modes of communication and how these concepts can be used to examine the assessment of digital resource tools. The exploration of interactions across modes of communication is used to gain an understanding of the interaction between the student, digital resource and teacher. Cognitive theory is considered as a basis for the assessment of digital resource tools. Lastly, principles for the assessment of digital resource tools are presented along with how assessment can be incorporated in the educational practice to enhance learning in higher education.

Keywords: digital resources, orality, literacy, assessment

Understanding Cognition Across Modalities for the Assessment of Digital Resources

As society ventures deeper into the digital age it becomes increasingly important to look back at the evolution of the transmission, retention and transformation of information across oral, written, and digital modalities. In putting these concepts into context one can glean insights which can be used to examine the assessment of digital resources tools. By exploring interactions across modes of communication, one can gain an understanding of the interaction between the student, digital resource and teacher. In considering cognitive theory as a basis for the assessment and evaluation of digital resource tools, assessment practices are grounded in theories of the acquisition of knowledge. Lastly, incorporating these principles of assessment into the educational practice can lead to enhanced learning in higher education and continual improvement.

In embarking on this exploration, it is important to expand the traditional definition of literacy, the ability to read and write, to one's understanding of a particular subject or field. It is also important consider a definition of cognition as, the mental process of acquiring meaning and understanding through the interpretation of experience by contemplation and reflection. The term information is used in this paper as the resulting product of cognition.

Life Before the Alphabet: Orality

The development of language marked a significant time in history, as people were able to give word to their thoughts, concepts and abstractions. Cognition, rooted one's interaction with the environment, uses language as a tool to help people negotiate relationships in social practice. Bransford and Schwartz (1999) sees learning in social practice as experiencing the world in various and new ways; forming diverse and new affiliations; and preparation for future learning. Mezirow (1991, p. 62-63) states, "Our language binds us into dialogic community that has

common meaning perspectives concerning the contexts and meanings of words." Prior to the development of the writing, oral traditions or orality was the basis of communication. It is from orality that society *first* began to transmit, retain and transform information.

Transmission of Information and Orality

In the context of this paper, the transmission of information is how information is passed on and received from one person or group to another. Here teaching can be seen as the act of passing information on and learning as the act of receiving information. Goody and Watt (1968) described the transmission of information in orality as a "long chain of interlocking conversations" (p. 29). Centered on events or interactions, the meaning of words derives from the interplay between what is being said and its context -- the situation, non-verbal expressions, and subtext (Goody and Watt, 1968). Mezirow states, central to learning "the making of meaning in comprehension is primarily a linguistic activity" (1991, p.56); "learning always involves making a new experience explicit and schematizing, appropriating and acting upon it" (p. 11). He goes on to state:

> Learning means using a meaning that we have already made to guide the way we think, act, or feel about what we are currently experiencing. Meaning is making sense of or giving coherence to our experiences. *Meaning is an interpretation.* (1991, p.11)

In orality, the interpretation of experiences through reflection is in the moment, since the revisiting of that information is highly dependent on one's ability to recall what was said. Knowledge is experienced with the spoken word, deeply socialized and often emotional (Havelock, 1982). By actively participating in storytelling people act out and identify with societal values and beliefs, in what can be a very powerful and beautiful way (Levi-Strauss, 1966). Learning, receiving information, in orality stems from immersing oneself in the words of

others; apprenticeships centered on listening, repeating and mastering the oral discourse of one's field in action (Ong, 1982). One uses discourse to develop and present ideas persuasively and in a favorable style of speaking- while incorporating ideas of others and seeking connections between ideas.

Retention of Information and Orality

In the context of this paper, the retention of information is the storing of information in the mind of the individual and by society overtime. Once transmitted, the retention of knowledge in orality is dependent on memory through mnemonic patterns which clusters information to be stored in the mind or as Gee (2003) states:

> Meaning in language is tied to people's experiences of situated action in the material and social world. Furthermore, these experiences (perceptions, feelings, actions, and interactions) are stored in the mind/brain not in terms of propositions or language, but in something like dynamic images tied to perception both of the world and of our own bodies, internal states, and feelings. (p. 37)

Mezirow (1991) asserts:

> Remembering how we have interpreted objects and events in the past involves repeating the making of an imaginative projection to interpret sensory stimuli. Frequency of making the same interpretation and emotional strength of the initial experience condition neural pathways to help us identify similar cues in what we experience and to evoke imaginative projections similar to the ones we made before. (p. 35)

With capabilities of only recalling a few thousand words, it has been argued that memory determined the length, form and function of epic stories (Havelock, 1982). Bounded by memory, orality strived to preserve information intact to continue its transmission, instead of

deconstructing it through analytic processes-- although to some degree all thought is analytical (Ong, 1982). Retained in memory, an experience in orality was highly contextualized by events in the natural world. In an attempt to understand one's surrounding myths and totem systems were often used as a way of interpreting events (Levi-Strauss, 1966). The information of a society was passed down from generation to generations through memorized stories or accounts of events.

Transformation of Information and Orality

In the context of this paper, the transformation of information is the changing of information retained by the individual and society. Orality gave people the ability to engage in social learning, perpetuate information and apply information to impact the social environment nurtured in the word. The information retained by an individual changes as new experiences challenge the assumptions used to interpret the experience that produced the information. Mezirow (1991) states:

> Meaning schemes, made up of specific knowledge, beliefs, value judgments, and feelings that constitute interpretations of experience, become more differentiated and integrated or transformed by reflection on the content or process of problem solving in progressively wider contexts. Habits of expectation or meaning schemes and perspectives are transformed through reflection on the assumptions that underlie problem solving. (p. 5-6)

Oral discourse brings light to varying ideas, values and beliefs- challenging commonly held notions. An individual's thoughts influences the perceptions of another, and rudimentary concepts are built upon in the transformation of information orally. Information retained by the individual or society in orality, dependent on memory, changes through the process of forgetting

or transmitting extraneous information (Goody and Watt, 1968). Information transmitted in orality transforms as information is conveyed inconsistently or glossed from person to person.

Immortalizing Words in Writing

As orality gave birth to the sharing of thoughts, concepts and abstractions; writing created tangible records of those thoughts, concepts and abstractions. These records gave one the ability to edit and reflect with greater ease by revisiting words, outside the event or interaction in which they originally took place. Ong (1982) argued:

> Writing from the beginning did not reduce orality but enhanced it, making it possible to organize the 'principles' or constituents of orality into a scientific 'art', a sequentially ordered body of explanation that showed how and why orality achieved and could be made to achieve its various specific effects. (p. 9)

Writing is not just record of the spoken word and reading the act of decoding writing. Writing is a mode of experience. Heath (1992) argued writing is a social phenomenon embracing the skill needed to retain and retrieve information. Through writing an individual experiences the world by engaging in the thought and concepts of others. Making meaning still derived from the interpreting experience. Although the cognitive processes used to interpret experience does not change; the transmission, retention, and transformation information is different across oral, written and digital modes. As modalities are embedded in society exercising these modalities differ across cultures. Meaning the way in which one speaks, writes or creates digital information differs across countries, generations, status, etc.

Transmission of Information and Writing

The "long chain of interlocking conversations" described by Goody and Watt (1968) is written down into a new iteration. The chain of conversation is somewhat stretched as words are

decontextualized, no longer dependent on in-person interactions, and new information makes it more challenging to see the connections between conversations. Meaning still derives from interpreting experience; from the interplay between what is being said [in writing] and its context. However, one is given the opportunity to study and reflect on the meaning unbounded by memory and person-to-person interactions. As an aid to memory, writing gives one the ability to explore ideas and events through classifying, sequential ordering and explaining (Ong 1982) with greater ease. Knowledge is still experienced and socialized, although the emotional connection is considered to be more highly associated with the spoken word. The written word loses the sensory impact of a person-to-person emotional connection as it shifts to a person-to-written representation of a person's word. Writing is used with orality to act out and identify with societal values and beliefs. Learning, receiving information, in writing is centered on both interactions with the thoughts, concepts and abstractions of people in the physical world and people in the written world. One uses oral and written discourse to develop and present ideas persuasively, concisely and in a favorable style; while incorporating ideas from the works of others, seeking connections between ideas, and maintaining a rigorous approach to analysis.

Retention of Information and Writing

The interpretation of experiences still takes place in the mind and not the modes themselves. However, the development of an alphabetic script was a technological advancement which decreased one's dependence on memory to transmit and retain information (Levi-Strauss, 1966). Since writing is a slower process than speaking and reading faster, it enables the written word to be less fragmented and uses complex lexical and syntactical devices seldom used in orality (Chafe, 1982). In capturing spoken words, Goody, (1997) identified writing as a key factor in enabling society to transmit thought and culture over time and place; communicated

outside an individual's memory. The development of grammar rules, punctuation, and

dictionaries helped control language (Ong 1983). With continual interaction between oral and

written information, society developed methods of exploring or researching written information

(Cole & Nicolopoulou, 1992).   Through critical analysis and reflection of written information,

society was able to shape and further define schools of thought, like science, history, philosophy.

Transformation of Information and Writing

The transformation of information is still initiated as new experiences challenge the

assumptions used to interpret the experience that produced the information. However, the advent

of writing gave one the ability to edit information retained in writing. Written text enables one to

review thoughts, concepts and abstractions, unbounded by memory and person-to-person

interactions, to check assumptions with greater ease which leads to corrections and resolutions of

inconsistencies. The evaluation of texts, in addition to oral discourse, brings light to varying

ideas, values and beliefs. An author influences the perceptions of another and rudimentary

concepts are built upon in the transformation of written knowledge. Similar to oral information,

written information varies as it is conveyed inconsistently or glossed from text to text.

Information can also be lost as texts go out of circulation or print. Writing gave society the

ability to further shape schools of thought to impact the social environment nurtured in the

spoken and written word.

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Going Online: Digital Information

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As the development of an alphabetic script was a technological advancement for orality,

digital technology was an advancement for both the spoken and written word. Digital

information combined spoken and written words in new ways. It opened up the world to large

compilations of stored information and created an entire generation of students that grew up with

the ease of accessing information in its various forms with a click of a button. As cognition is rooted one's interaction with the environment, digital information technology created a new mode for one to use language to help negotiate relationships in social practice.

Transmission of Information and Digital Information

In digital information, Goody and Watt's (1968) "long chain of interlocking conversations" is digitized. The chain stretches as conversations are decontextualized out of the physical world making it challenging to see the connections between conversations. However, the use of search engines has made it easier to focus on these connections. The meaning of digital information still derives from the interplay between what is being said [digitally] and its context; however the compilation of information gives one greater access to a multitude of chains of conversations. The exploration and examination of ideas and events is conducted through engagement with mass media, the aggregation of that media and the global interactions of both novice and expert users. Knowledge is experienced with the spoken and written word through a computer and it is still socialized. Again there is a loss of the sensory impact of a person-to-person emotional connection as the interaction shifts to a person-to-digitized representation of a person. Speaking, reading, writing and virtual play is used to act out and identify with societal values and beliefs.

Learning, receiving information, in the digital environment is centered on interactions with the thoughts, concepts and abstractions of people in the physical and digital world. Interaction with others is essential in all modalities for critical thinking, connecting knowledge to practice, problem solving and innovative thinking. Without this foundation, acquisition of information becomes "a form of consumption without the production of deep knowledge and the development of skills important for the future" (Gee, 2012, p 419). Learning in the digital world,

as in the written, uses discourse to develop and present ideas. In addition to the other skills

mentioned for speaking and writing, one must further develop the cognitive discernment to

process mass amounts of information in its various forms. Lankshear and Knobel (2001) stated

that purposefully engaging in problem solving in the digital world requires one to know what to

pay attention to and what to ignore, especially with features that attempt to capture one's

attention. Coiro and Dobler (2007) asserted that complex digital environments require

metacognitive regulator strategy to skillfully transition between rapid reading, searching and the

in-depth construction meaning.   Laurillard (2009) argues:

> Amid the constant change of technology and its radical effects on the nature of learning
>
> and teaching, one thing does not change: what it takes to learn; especially what it takes to
>
> learn in the context of formal education. (p. 3)

Digital information, as in the spoken and written word, is conducive to learning when it is

centered on problem solving, not the consumption of content; encourages one to think and create

like designers or authors; gives one the freedom to make choices on how to act and interact in the

environment; and is collaborative and social (Gee, 2012).

Retention of Information and Digital Information

Digital information is stored through time, place and now space as knowledge is taken

out of the physical world and placed online, further extending its shelf life and arguably its

accessibility. Digital repositories store an abundance of information that can be access almost

instantaneously from any computer. Digital tools and applications help record, store, and share

information. As with writing, the digital word uses complex lexical and syntactical devices

seldom used in orality, but is more dynamic as it fuses spoken and written words with audio,

video and other media. Leu, Kinzer, Coiro and Cammack (2004) described the Internet as

quickly and dramatically expanding knowledge and its social nature, giving one the ability to take advantage of the intellectual capital. The interpretation of experiences, even digital experiences, is still retained in the mind and not the mode.

Transformation of Information and Digital Information

The transformation of information is still initiated as new experiences challenge the assumptions. As in writing, one has the ability to edit information retained digitally through editing, but with greater efficiency and frequency than in the physical world. Novice and experts alike interact with information in the digital world, by contributing and editing information. As with written text, one can review thoughts, concepts and abstractions which leads to the challenge of assumption and corrections to resolve inconsistencies in digital information. Coiro (2009) points out that the internet creates an environment conducive to the exchange of life experiences and different points of views. The exchange, like in all modalities, transforms old ideas and builds new ones through contemplation and reflection.

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Summary and Extension

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Mezirow (1991) contends, "Meaning is construed both pre-linguistically through cues and symbolic models, and through language" (p.4). Language is tool people use to create a lasting impact on the environment by learning from the people within it. This social learning was founded on the sharing of the thoughts, concepts and abstractions produced by higher order cognitive skills. According to Reddy (1979) these thoughts, concepts, abstractions are in one's mind, not contained in the form or mode one uses to communicate (as cited in Mezirow, 1991, p.57). As society has developed from orality to writing to digitizing; the mode of transmitting, retaining and transforming information evolved building on one another while not subjugating the importance of the preceding mode. These modes of communication diversified the

embodiment of how one engages in social learning, breaking down the barriers of space and time.

New London Group (1996) argued that for critical learning in a particular subject, one needs to learn how to think, produce meaning and innovate in that subject using multiple modes at a 'meta' level- as a complex system of interrelated parts. As innovation diversifies modalities, educators are challenged remain current and responsive; effectively use various modes; and assess the use in teaching and learning. Crystal (1992) argued assessing literacy is complicated because of the increasing social demands to be literate in different ways using multiple modes in varying subjects.   Nonetheless, educators aim to enhance learning in higher education to equip students with the skills needed engage to contribute to schools of thought. By reflecting on the evolution of orality to writing to digitizing one can glean insights which can be used to examine the assessment of digital resources tools.

Assessment of Digital Resource Tools

A 2014 Nielsen report indicated that the average American spends eleven hours per day with digital media. As the keepers of information, academic librarians have born witness to the diversification of modes of communication and the growing popularity of digital media. The role of the academic teaching librarian is centered on fostering information literacy, the skills needed to find, retrieve, analyze and use information (Information literacy competency standards for higher education, 2000), in a world increasingly inundated by it. In addition to classes and consultations, librarians promote information literacy by arming students with digital resources, like libguides and video tutorials, to decode research methods and academic domains.

In exploring principles for the assessment and evaluation of digital resources it is important to remember the purpose of assessment is to improve student outcomes. Describing a basis for the assessment of digital resources, as a means of promoting information literacy, can be challenging as Bowles-Terry, Hensley and Hinchliffe (2010) point out, "Although usability testing of websites and online catalogs is conducted with some regularity at academic libraries, very little has been published regarding assessing digital resources for usability and instructional effectiveness" (p. 21). However, this can be overcome by considering cognitive theory as a basis for assessment. Incorporating these principles of assessment into educational practice can lead to enhanced learning in higher education and continual improvement. Health (1992) asserts literacy is often assessed through standardized measures of an individual's activity although literacy is a social condition. The concept of literacy, like the modalities of communication, is embedded in society and differs across cultures. What it means to have an understanding of a particular subject differs across subjects, departments, institutions, countries, etc. The assessment and evaluation of digital resources, as a means of promoting information literacy, should be based on a culturally and institutionally supported description of what it means to have an understanding of the

A Short History of Library Digital Resources

- Libguides are based on "pathfinders" publications popular in the 1970, which listed resources on a particular topic, discipline or course
- Early articles on guides from 1995-1997 focused on using new technologies
- In 1998 Dean's *The Public Electronic Library: web-based subject guides*, was credited as one of the first to develop an assessment plan of guides which involved testing, hands-on exercises and focus groups.
- 2003 Gibbons surveyed students in a pilot program format
- 2004 Barken used a one question survey assessment (as cited by Courtiois, 1992, p. 3, 5)
  - From about 2003 to 2009 checklists and rubrics were frequently used in addition to existing methods
  - In 2010, researchers began looking at best practices for assessing video tutorials

particular subject, in this case information, and the associated expectations. The Information Literacy Competency Standards for Higher Education developed by the American Library Association are an example of a cultural definition of information literacy.

The Assessment of the Transmission of Information

Mezirow (1991) states, "Most adult learning is multidimensional and involves learning to control the environment, to understand meaning as we communicate with others, and to understand ourselves" (p.89). Digital information has not altered one's higher order cognitive skills, but has added another dimension to one's environment and communications with others. In the digital environment, students learn as a result of interacting with and using programed instructional systems. Because of this concept, monitoring students' interaction and use of programed instructional systems is important in the assessment of digital resources. Gonzalez and Westbrock (2010) identified monitoring use and soliciting feedback as important best practices for the evaluation of libguides (see Appendix, Best Practices C1). To gain a better understanding about how learners are using digital resources Welch (2007) suggests reviewing webserver log files to measure reference-generated visits. She cites the E-Metric Instructional System's suggestions of "appointing a data collector, establishing data collection procedures and collecting the e-metric for the desired period of time" to determine user

Information Literacy Competency Standards for Higher Education (2000)

- The importance of continual discourse in generating new insights and discoveries;
- Research centered on asking increasingly complex questions;
- Viewing authority with skepticism and openness to new and changing perspectives while considering the resources' origins and agenda;
- That information is presented in various formats which derive from their methods of creation, production and distribution;
- Searching for information using various sources, flexibility, and alternative means;
- Respect of the time, original thought, and resources needed to create information from those seeking to use the works of others.

behaviors: services and pages learners use; if learners find the site navigable and useful; how learners learn about the site; and the motivations for visiting (p.99). She goes on to state "some institutions use in-house or commercial software to record and analyze traffic on library-generated webpages instead of the raw server statistics" (p. 99). Fuhr, Tsakonas, Aalberg, Agosti, Hasen, Kapidakis and Solvberg (2007) developed criteria and a model for viewing the interaction between the learner and system (see Appendix, Figure B1) while Ehlers (2013) developed an online learning system framework which shows the connection between learning outcomes, students and the learning management system. (see Appendix, Figure B2)

Courtois, Higgins, and Kapur (2005) asserted, little is known about user satisfaction with subject guides, which is important for gaining buy-in from stakeholders and justifying the investment of application costs and staff time. In a digital environment the learner's needs have to be anticipated and addressed in advanced (Govindasamy, 2001). Laurillard (2009) asserts:

> In designing any teaching method or learning activity, not just those that are technology-based, we have to ask "why should learners participate?"—and answer by building a sequence of activities that keeps them focused, and thinking at the right level. (p.13)

After tracking the use of their guides, Courtois, Higgins, and Kapur (2005) looked at student perception and success using the guides by constructing a single-question survey which asked if students found the guide helpful. To discover the needs of learners Grays, Del Bosque, and Costello (2008) used virtual focus groups in assessing the value of subject guides.

Dewald (1999) argued digital resources are most effective in connection with academic classes and concepts, not merely procedures, with clearly stated objectives and features that guide learners through the lesson. Since meaning is formed through the interpretation of experience by contemplating and reflecting on cues, symbolic models and the spoken and written

word with a computer serving as the mode in which students are engaging in learning; it is

important to incorporate learning theory within the programed instructional system. Habermas

(1972) detailed *instrumental learning* as task oriented problem solving to control the

environment and determine cause-effect relationships; *communicative learning* as understanding

people by exploring the values, beliefs and reasons which produce political, philosophical and

educational concepts; and *emancipatory learning* as using critical reflection to identify and

challenge personal perspective. Digital resources need to address the student's needs for using

the resource, in ways that promotes learning such as instrumental, communicative and

emancipatory learning. A study by Reeb and Gibbons (2004) found that, "In spite of the intrinsic

value of the library subject guides—surveys, usability and usage evidence indicate that students

fail to connect with them" (p. 126). They went on to stipulate that if libguides were more

experiential, learners would find them more beneficial, understand the context of the

information, and connect with broader concepts. The methods of assessing learning theory and

bridging to academic concepts in digital resources are as complex as assessing teaching in

traditional classrooms, since the basis of cognition are the same. In a digital environment it is

important to evaluate the technology affordances; which McCracken, Cho, Sharif, Wilson, &

Miller (2012) defines as "mapping technology to the kinds of interactions that lead to learning"

(p. 108). Prensky (2001) stated machine evaluations, such as multiple-choice test and simulation

can be effective assessment and learning tools (as cited by Ehlers, 2013, p. 352). Ehlers (2013)

added comments posted by students have also been used as a means of assessment.   For digital

resources connected to academic courses, product-based assessments can be used to examine the

work created with the aide of the digital resource.

The Assessment of the Retention of Information

The vastness of stored information in the digital realm gives learners access to information that can be used to answer any number of a questions. With the quantity of information and resources available digitally it is important for learners to cultivate self-directedness and for digital resources to guide students throughout their quest by helping them establish connections to repositories of knowledge and academic concepts. Laurillard (1996) stipulates that access rates to digital resources should be tracked and the information used to motivate learners. Sun and Rueda (2012) investigated the impact of computer self-efficacy and self-regulation in student engagement in distance education by surveying students using a questionnaire adapted from the Motivated Strategies for Learning Questionnaire; Situational Interest Scale; and Web Users Self-Efficacy Scale (p194). The results of the study indicated interest and self-regulation were positively correlated with all types of engagement (p. 199).

With sufficient self-directedness and motivation, learners can often compensate of lack of prior knowledge. Coiro and Dobler (2007) argue that due to the access to a repository of information in various modes, individuals with high levels of online reading skills may compensate for low levels of prior knowledge. The varying levels of prior knowledge and skills of learners should be taken into consideration when creating digital resources. Ehlers (2013) stated:

> Self-assessment should be provided at the start of the lesson to allow learners to check whether they already have the knowledge and skills taught in the online lesson. The self-assessment also helps learners to organize the lesson materials and to recognize the important materials in the lesson. (p. 38).

Self-assessments can come in many forms and include a brief quiz or short check off list that learners may review.

Although the interpretation of experience is retained in the mind of the individual, not in the mode itself, the vastness of information available digitally can lead to an overwhelming experience which inhibits interpretation information. Since an abundance of information is stored on multiple platforms it can be difficult for learners to navigate resources to meet their needs and differentiate from the resources that are not as academically relevant. Academic libraries can fall prey to presenting an overwhelming amount of information or presenting a moderate amount of information in a disorienting way. Ehlers (2013) emphasized, "The interface should not overload learners, and should make it as easy as possible for learners to sense the information, for transfer to sensory storage and then into short-term memory for processing" (p.38). The organization and retention of digital resources should be regularly reviewed for relevance, ease of use and format consistency. A learner's time should be focused on critical reflection, not spent lost in resources. Jackson and Pellack (2014) developed a self-assessment survey for institutions to assess their libguides (see Appendix D). Hosie, Schibeci and Backhause (2005) created a checklist to review the quality of learning materials, by reviewing: accessibility, currency, richness, purpose and inclusivity (see Appendix, Checklist E1). Bowles, Hensley and Hinchliffe (2010) developed best practices for creating video tutorials (see Appendix, Best Practices C2).

The Assessment of the Transformation of Information

As a dynamic environment, information in the digital world changes quite regularly. Novice and experts alike interact with information in the digital world- contribute and alter information. These interactions and contributions are important as they help learners understand

educational concepts through connectivity with others; exploring values, beliefs and reasoning

which can lead to the challenge of their own assumptions. It is this change in assumptions that is

the basis of transformative learning. Digital resources, such as libguides and video tutorials, can

be enhanced through the use of various online collaboration applications- which can give

learners the opportunity to engage the resource's author and other novice and experts in

discourse on concepts. It is in this discourse that information and academic concepts are

transformed and learners learn. Ehlers (2013) argues:

> Quality online learning provides many opportunities for assessment – opportunities that
>
> involve the teacher, but also ones that exploit the influence and expertise of peers and
>
> external experts, others that use simple and complex machine algorithms to assess student
>
> learning, and perhaps most importantly, those that encourage learners to reflectively
>
> assess their own learning. (p.49)

This fosters a community of practice and communicative learning principles, while challenging

learners to investigate the accuracy and credibility of sources.

Since both information and the digital environment changes regularly it is important to

ensure digital resources are up-to-date with the latest information. Hosie, Schibeci and Bachaus

(2005) created a checklist to review the reliability of the interface, learning goals, directions,

communication, bandwidth, accessibility, and style. (see Appendix, Checklist E2). Morian and

Swarts (2012) developed several rubrics to access various aspects of video tutorials (see

Appendix, Rubrics E2, E3, E4). As technologies are ever changing it is important to analyze the

costs of resources to the potential impact on student outcomes. Dobbs (2013) evaluated the

economic value of digital resources with a rubric that looked at the "cost per use; goal values;

increased database usage; visits and path; and subscription traffic" (p. 192; see Appendix Rubric E1).

Conclusions

Learners construe meaning through task oriented problem solving to determine cause-effect relationships; communication with others to explore the values, beliefs and reasons behind education concepts; and reflection on one's learning. Digital resources should anticipate student needs; connect to academic classes, concepts, and other resources; be academically relevant, organized, and easy to use; and have accurate and credible information. This mirrors the Information Literacy Competency Standards for Higher Education (2002) produced by the Association of College and Research Libraries; standards which can be considered when developing digital resources that are intended to promote information literacy. Surveys, checklists, rubrics, weblogs and technology affordances mapping have been used in both the creation process and the overall evaluation of digital resources. While focus groups have been used for determining student needs and preferences mainly in the creation of digital resources, product-based assessments have been used mainly to evaluate learning. Multiple choice tests, hands-on exercises and student comments have been used throughout digital resources to assess learning. In drawing from the theories of the cognitive process to explore the transmission, retention and transformation of information across oral, written, and digital modes of communication one can gain a better understanding of how these concepts can be used in the assessment of digital resource tools and incorporated in the educational practice to enhance learning in higher education.

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Appendix A

Illustration 1: Evolution of Modalities
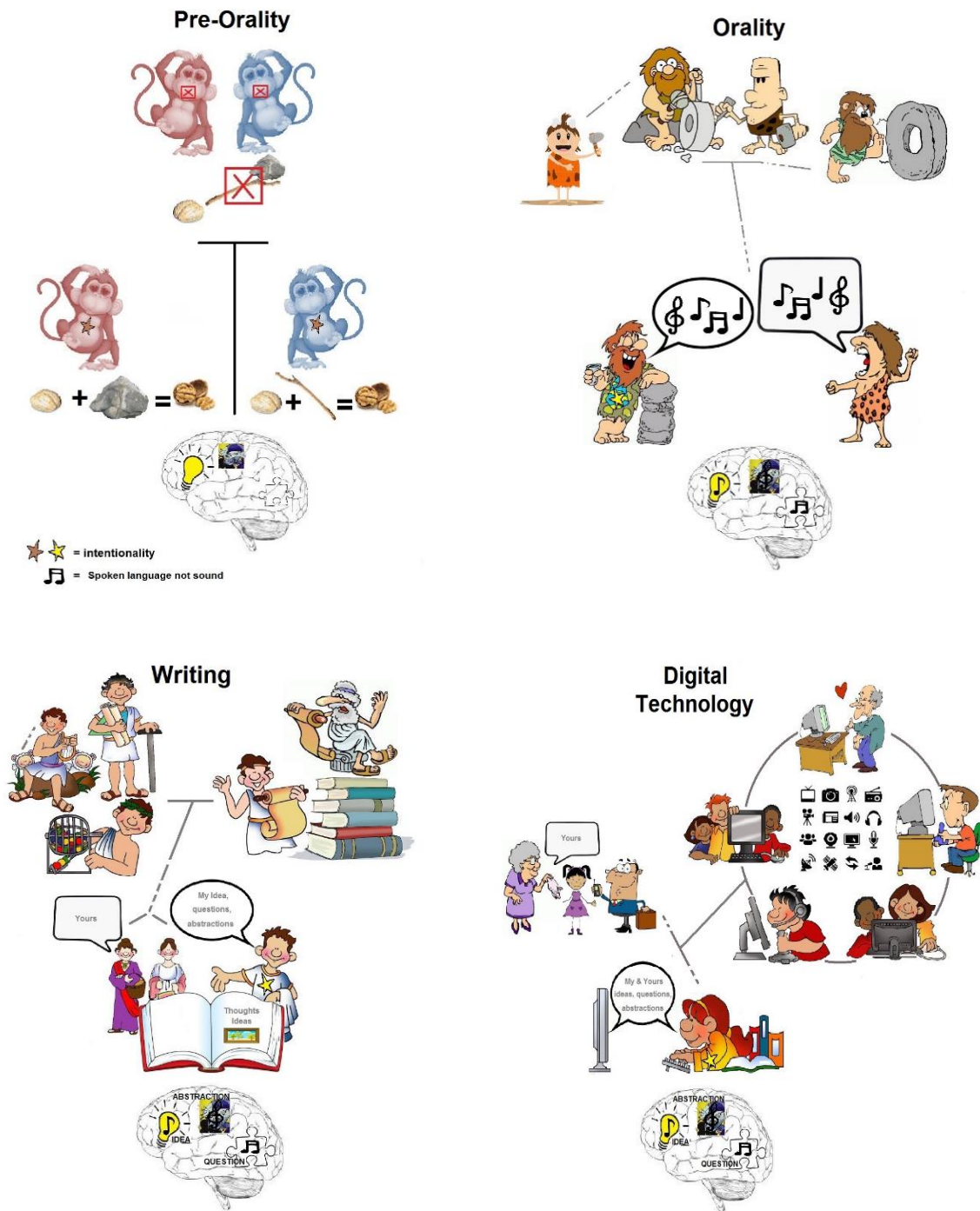
Appendix B

Diagrams to Envision Evaluation and Assessment

Figure B1: The interaction triptych model (Fuhr, Tsakonas, Aalberg, Agosti, Hansen, Kapidakis

& Solvberg, 2007, p.25)

Criteria used in the evaluation of user–system interaction include:
- Types of users and their characteristics, such as different levels of knowledge and experience.
- The information needs of the users.
- Different satisfaction factors (e.g.: functionalities and task accomplishment).
- Types of information handling strategies.
- Tasks and task procedures.
- Representation of work domains and environment.
- Collaboration between users and groups of users.
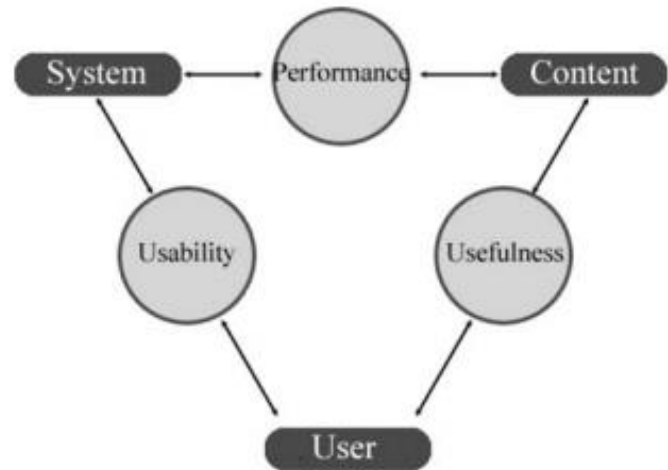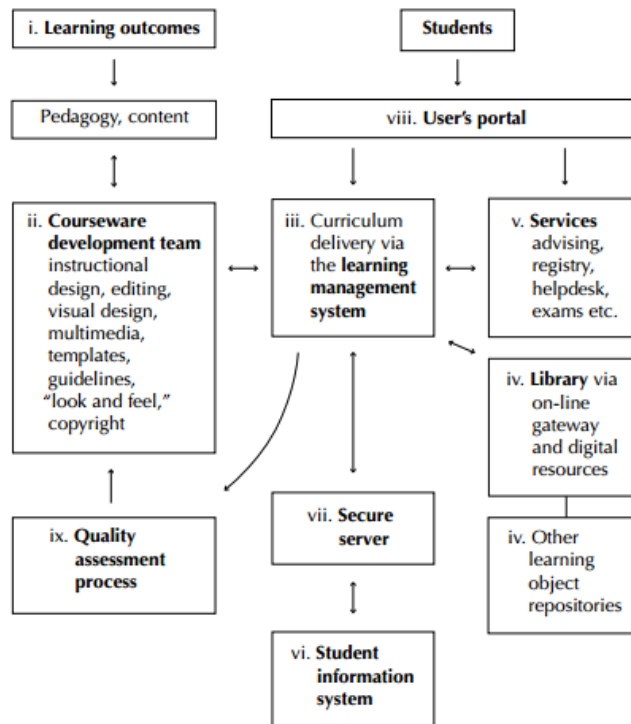

Figure B2: An Online Learning System Framework (Ehlers, 2013, p. 126)

Appendix C

Best Practices

Best Practices C1: Libguides Best Practices, New Mexico State University Library (Gonzalez, Westbrock, p. 656 Appendix)

Purpose, organization, planning
- Articulate problems with current situation and be specific in identifying specific organization needs.
- Establish buy-in with involved parties (administration, reference department, systems department, etc.).
- Plan for dissemination both internally (e.g., training) and externally (e.g. placement, naming, and marketing).

Audience awareness
- Make guides accessible to users at their point of need and point of access (e.g., course management systems).
- Use guides consistently in library instruction and in reference transactions.
- Create a consistent look and feel.

Evaluation and assessment
- Monitor the use of guides.
- Create a policy for adding/deleting guides.
- Solicit user feedback.
- Create an assessment plan.
- Share assessment with involved parties (administration, reference department, systems department, etc.).

Faculty collaboration
- Collect syllabi and create course/assignment guides.
- Use guides as basis for communication and collaboration.
- Embed links to guides in course management systems.

Maintenance
- Use available resources (e.g., student workers)
- Maintain an inventory of guides.
- Identify long-term editors who will oversee the entire collection of guides.

Best Practices C2: Video Tutorials Emerging Best Practice (Bowles-Terry, M., Hensley, M., & Hinchliffe, L. 2010, p. 26)

Pace: Speak slightly more slowly than when they do in regular conversation.
Length: Keep videos short and to the point. Consider breaking videos into 1-minute or 30-second segments.
Content: Start the video with the most important and most desirable information, usually the "how to."
Look and Feel: Students do not turn to library video tutorials for entertainment, but for information and instruction.
Video vs. Text: Depending on learning style preference, Internet connection, and complexity of the task at hand, students may choose to view an instructional video tutorial or they may prefer to read instructions on a static, text-based webpage.
Findability: Link video tutorials at the point of need and use language that students are looking for and understand.
Interest in Using Video Tutorials: Tutorials may not be students' first choice for getting help and finding information

Appendix D

Sample Survey

Internet Subject Guides Survey (Jackson & Pellack, 2004, p. 327 Appendix)

1. Do librarian in you institution develop e-resources/subject guides pages in subject areas relevant to their responsibilities? Yes/No
2. How do you ensure the validity of the links in you e-resources/subject guides pages? Do you use automated link checkers? Yes/No
3. Is the format/content of your e-resources/subject guides standardized? Yes/No
4. Do you have a policy for the formatting of them? Yes/No
5. Are all the resources listed on your guides cataloged? Yes/No
6. Are librarians expected to do e-resources/subject guides for all areas? Yes/No
7. Are librarian evaluations influenced by the quality of their guides? Yes/No
8. Do you keep statistics on the use of these pages? Yes/No
9. Do you remove guides which become outdated if there is no one to update them? Yes/No
10. Do you think creating and maintaining these pages is worth the time and effort they require? Yes/No

Appendix E

Checklists and Rubrics

Checklist E1: Resources in Quality Learning Materials (Hosie, Schibeci & Backhaus 2005, p. 546)

Learning	Description	Examples
Accessibility	Resources are organized in ways that make them easily accessed and located	Resources are separate from learning tasks Intuitive and clear organizational strategies Resources are accessible in a non-linear format
Currency	The age of resources are appropriate to the subject matter	Where possible, resources should be current and based on regular literature reviews by lecturer; Seminal works should not, however, be removed on the basis of age; Use of primary resources is made wherever possible
Richness	Resources reflect a rich variety of perspectives	Resources should represent a variety of views (including conflicting views) to allow students the opportunity to assess the merit of arguments; Resources provide for a range of perspectives; Media are used to enrich data sources
Purposeful use of the media	Media is suitable for the purpose intended	A variety of media is used where appropriate; Book-on-screen approach should be avoided; Equally, elaborate multimedia should be avoided when a simple diagram would be suitable
Inclusivity	Materials demonstrate social, cultural, and gender inclusivity	Resources include a variety of cultural perspectives where possible; Resources avoid gender and culturally exclusive terms; Separation of local and generic content to facilitate customization and adaptation

Checklist E2: Delivery Strategies in Quality Learning Materials (Hosie, Schibeci & Backhaus 2005, p. 547)

Learning	Description	Examples
Reliable & robust interface	The materials are accurate and error free in their operation	Site is accessed reliably; Navigation and orientation is seamless; Many forms of online support for learners
Clear goals, directions & learning plans	Unit information and expectation of student roles are clear	Students can find information on the web site about the unit and its requirements; Unit structure makes explicit relationships between learning outcomes, resources, activities and assessments; Instructions clearly placed and always available
Communication	The unit provides opportunities and encourages dialogue between students and between teachers and students	Information and communication channels are open and inviting for students; Students are encouraged to communicate with the teacher and other class members
Appropriate bandwidth demands	The materials are accessible without lengthy delays	Graphics and other elements checked for download times; Delivery formats employ strategies to optimize download times
Equity and accessibility	Unit materials and activities are accessible and available to all students	Web sites are accessible to disabled students; Course requirements and resourcing made explicit to students ahead of the course; Students are not hampered by firewalls or geographically sensitive restrictions
Appropriate corporate style	Units adopt a corporate style for web sites to ensure a benchmark quality of presentation	Layout and presentation should incorporate common elements on the unit homepage reflecting a corporate style; The corporate style should enhance rather than dictate a pedagogical approach; Fonts, resolution, etc, should conform to the corporate style where possible, but alternatives should be possible when needed

Rubric E1: Assessing LibGuide value as an organizational tool (Dobbs, 2013 p. 193)

VALUE Viewed:		LOW		MEDIUM		HIGH
Economic Value- LibGuides are a great product, but are they worth the money? Is your library receiving a value worthy of the cost?						
Cost per Use	☐	Cost per use is greater than $30	☐	Cost per use averages between $10 and $30	☐	Cost per use is less than $10
Goal Values	☐	0-33% of all users reach an end goal	☐	34-67% of all users reach an end goal	☐	68-100% of all users reach an end goal
Increased database usage	☐	0-33% of users leave the libguide and access a database	☐	34-67% of users leave the libguide and access a database	☐	68-100% of users leave the libguide and access a database
Visits and paths	☐	0-33% of users leave the libguide and follow a suggested link	☐	34-67% of users leave the libguide and follow a suggested link	☐	68-100% of users leave the libguide and follow a suggested link
Subscription traffic	☐	0-33% of users leave the libguide and go to a supported library tool	☐	34-67% of users leave the libguide and go to a supported library tool	☐	68-100% of users leave the libguide and go to a supported library tool

Rubric E2: Video Assessment Rubric-Physical Design (Morian & Swarts, 2012, p.19 Appendix)

Objective: Accessibility
Goal: video allows the viewer to focus on areas relevant to instruction.
Good Video: video is cropped to show only task-relevant information; Zooms and pans are used to draw the user's attention to an action, tool, or menu; Voice-over ''points'' to the video, nearly always using interface terms, to draw attention to menus, tools, etc. Pointing is sometimes reinforced with highlights and text annotations.
Average Video: The video is inconsistently cropped to show task-relevant information; Occasionally the shot is too wide or too tight; Zooms and pans are sometimes used to draw the user's attention to an action, tool, or menu; Voice-over ''points'' to the video, sometimes using interface terms, but also sometimes using generic substitutes (e.g., ''this,'' ''that,'' ''the thingy''); Highlighting and text annotations are rare.
Poor Video: Video is poorly cropped or not cropped. Shots are consistently too wide or tight; Zooms and pans are rarely used or used in uncontrolled ways; Voice-over infrequently 'points'' to the video and rarely uses interface terms. Most references are generic e.g., this, that). Erratic mouse gesturing often substitutes for verbal pointing.
Objective: Viewability
Goal: Production quality (audio, video, text) is sufficient to make content tolerably watchable.
Good Video: Audio is consistently clear. Microphone levels are set so that volume is rarely too high or low; Recording imperfections (e.g., clipping, audible breathing) are rare; Video is recorded in HD quality or a close approximation. Video can be resized legibly.
Average Video: Audio is often clear. Some videos have obvious and persistent audio production problems (e.g., clipping, distortion, uncontrolled volume, audible breathing) resulting from either poor recording, poor equipment, or a lack of postproduction. Occasionally there is no audio; Video is sometimes recorded in HD but often is not. Video has limited legibility when resized.
Poor Video: Often there is no audio. When audio is included, it is frequently distorted by poor postproduction or lack of postproduction. Audio may be marred by background noise, resulting in a lack of clarity made worse by poor voice-over techniques (e.g., mumbling, speed reading); Video is not recorded in HD and cannot be resized legibly. Video is often blurry at any size.
Objective: Timing
Goal: Video is paced to make it easy for viewers to follow content.
Good Video: The pacing of the audio is conversational. Instructions are not spoken too quickly; natural breaks are included to allow viewer to pause; Video pacing is in real time, meaning that actions are performed at a pace expected of a skilled user demonstrating to an inexperienced audience. Only occasionally is the video pacing too fast; Audio and video are synchronized, with the audio announcing a step just slightly before the step is executed.
Average Video: The pacing of the audio is inconsistently conversational, sometimes becoming too fast (so that voice-over gets ahead of steps shown) or too slow (so that voice-over lags behind steps shown); Video pacing is often in real time, meaning that actions are performed at a pace expected of a skilled user demonstrating to an inexperienced audience. However, the video may be uneven with some going too fast (twice normal speed) or too slow; Audio and video are frequently synchronized so that steps are announced before being shown; Sometimes steps are announced after they are shown or not at all.
Poor Video: When there is a voice-over, it may be conversational in pacing but is more often too fast (so that voiceover gets ahead of steps shown) or too slow (so that voiceover lags behind steps shown); Video pacing is infrequently in real time and more consistently will be too fast to enable pausing to complete steps. Or, the video could be paced slower than the material merits. While video and audio tracks may be roughly synced, steps are infrequently announced before they are shown, if they are announced at all.

Rubric E3: Video Assessment Rubric-Cognitive Design (Morian & Swarts, 2012, p.21 Appendix)

Objective: Accuracy
Goal: Content is presented without any errors of fact or execution.
Good Video: Video contains virtually no errors of fact. Almost all points spoken or demonstrated are factually accurate. Any errors are minor and are immediately corrected. Errors of execution are rare. Any errors made are minor (e.g., mistyping, unexpected results) and are almost always immediately corrected in both the audio and video. Errors do not affect task completion.
Average Video: Video may contain a few errors of fact, but almost all points spoken or demonstrated are factually accurate. Errors that do occur vary in severity, but most are corrected or at least acknowledged. Errors of execution are uncommon but one or two show up in most videos. Minor errors (e.g., mistyping, unexpected results) occur most commonly. More severe errors (e.g., failed actions, forgotten steps) also occur but less commonly. Sometimes errors are not fixed, but often they are at least acknowledged. Errors do not affect task completion.
Poor Video: Errors of fact are more common. While the narrator may be knowledgeable, the voice-over is often imprecise. Occasional false statements are made. Most errors go unacknowledged and uncorrected. Errors of execution are common. Most are narration errors, unexpected results, failed actions, abandoned tasks, and guessing. Many errors go unacknowledged and uncorrected. Some errors may be dismissed (e.g., ''Never mind, it just works''). Errors often will affect task completion.
Objective: Completeness
Goal: Content is presented in an organizing superstructure to clarify instructional goals. Content is presented with enough detail to ensure reproduction.
Good Video: Many videos begin with an overview of the task ahead. The task is named and broken into objectives, thus forecasting the structure of the video. Objectives are often verbally reinforced throughout. Often the superstructure is communicated via text on an introductory frame and with text annotations. Most steps are explained before being shown. Viewers are told why the step is performed and what is accomplished. Details such as tool selection, settings, and outcomes are both shown and verbalized. Only minor details are omitted. Techniques such as zooming are used to reinforce or clarify details in narration.
Average Video: Some begin with an overview of the task. Some break the task down into objectives to forecast the structure of the video. Within the video, the structure is sometimes unclear. Introduction and conclusion slides or text annotations are rarely used. Many task details are provided but not consistently. Some steps will be described in far less detail than shown on the video. Steps may be omitted from the video or from the voice-over. Some omitted details are relevant to the task. Only rarely are recording techniques such as zooming or text annotation used to highlight or reinforce details.
Poor Video: Most launch into a topic with no overview or stated objectives. Sometimes the topic of the video is not announced. The structure of the video is often unclear. Introduction and conclusion slides or text annotations are rarely used. If used, they are not relevant to task completion. The narration and video often omit important details of steps that need to be taken. Most often, the steps are simply performed and not explained. Or the steps may be explained but never performed. Zooming and text annotation are almost never used to highlight or reinforce details.
Objective: Pertinence
Goal: Content is related to the instructional goal and has an instructional purpose.
Good Video: Nearly all information spoken or shown is pertinent to the task. Some peripheral details may be added, but they are helpful and clarifying. No necessary information is omitted. The balance of details between what is spoken and shown is even. Video and audio are clearly edited or at least well planned. Mouse movements, highlighting, and sound effects are used sparingly and purposefully.
Average Video: There is a mixture of necessary and unnecessary information. The voice-over may ramble or contain unnecessary details. The video shows unnecessary actions, such as mouse movements, gratuitous zooms, and minor tasks. Some of these details are helpful and clarifying but some could be edited out. Rarely is necessary information omitted. The balance of details between what is spoken and shown is mostly even, although one mode may be more detailed than another. Video and audio channels are often full of useful information, but there are pauses and dead air that could still be edited out.
Poor Video: Significant chunks of voiceover or video are unnecessary or irrelevant. These videos often omit necessary information. Video is full of unnecessary mouse movements, clicking, typing, uploading, and downloading that should be edited out but is not. The balance of details between what is spoken and shown is often skewed to the audio or video channel. There are many pauses and dead air in the voice-over and music that plays without any apparent purpose.

Rubric E4: Video Assessment Rubric-Affective Design (Morian & Swarts, 2012, p.23)

Objective: Confidence
Goal: Narrator inspires confidence by presenting self as knowledgeable and skilled and also emphasizes association with reputable organizations.
Good Video: Voice-over is consistently delivered smoothly and with confidence. The voice-over and actions in the video are scripted or at least rehearsed. Occasionally the narrator will make an overt claim to credibility by referencing a company sponsor or by noting some other credentials. The production quality of the video is high. Quality equipment=software is skillfully used to create the video, audio, text, and transitions. Narrator is thoroughly knowledgeable about task.
Average Video: Voice-over is mostly delivered confidently and smoothly. While the voice-over and actions in the video are usually performed confidently, some parts seem impromptu and as a result a little incoherent and muddled. Actions taken in the video are done with a minimum of errors and pauses. Overt claims to credibility are infrequent. The production quality is good but uneven. Quality equipment=software may be used but techniques and productions skills may be lacking. Narrator is knowledgeable about task but within clear limits. There is some guessing about what actions to take.
Poor Video: The voice-over and video rarely seem practiced or even planned. Actions are not described confidently or precisely even though most of the time they tend to be performed correctly. Often the credibility of the narrator suffers because of a lack of seriousness. There are no overt appeals to credibility. Production quality is low. Poor equipment=software is used or when good equipment is used, the production skills are lacking. Narrator is knowledgeable about the task but frequently guesses and makes mistakes.
Objective: Self-Efficacy
Goal: Video persuades viewers that they can successfully complete the tasks that are the focus of instruction.
Good Video: Narrator presents self to viewer as a like-minded, similarly skilled peer. Promotes identification. Most instruction is successfully demonstrated, inviting viewers to follow along. Narrator articulates clear goals for the instruction and presents goals as obtainable.
Average Video: Narrator comes across as a peer but may undercut that image by omitting explanation of steps, by moving too quickly, or by elaborating esoteric details. Identification is strained. Sometimes the narrator relies too heavily on doing without explaining. Sometimes demonstrations lack detail, accuracy or verbalized guidance. Inconsistent mention of goals or lack of reassurance that the viewer can meet the goals.
Poor Video: Narrator does not attempt to come across as a peer or promote identification. Disparities between the narrator's skill=knowledge and viewers are emphasized through lack of explicit task guidance. Video relies primarily on doing without explaining, which discourages viewers from following along and building confidence in their abilities Goals are rarely mentioned. Little to no effort is made to reassure viewers that they can do what the narrator is showing.
Objective: Engagement
Goal: Video is designed to interest and motivate users.
Good Video: Narrator frequently builds expectations: promises about what will be demonstrated or what viewers will learn. These expectations are consistently fulfilled and acknowledged. The voice-over technique is frequently enjoyable (e.g., conversational, enthusiastic, humorous).
Average Video: Narrator sometimes builds expectations: promises about what will be demonstrated or what viewers will learn. Most expectations are fulfilled and acknowledged yet not consistently. The voice-over technique is uneven and as likely to be engaging (e.g., conversational, enthusiastic, humorous) and disengaging (e.g., boring, monotonous) by turns.
Poor Video: Narrator rarely builds expectations or promises about what will be done or what the viewer will learn. Voice-over technique is frequently disengaging. Narrators often are bored, monotonous, sarcastic, immature, unfocused, or otherwise difficult to listen to comfortably.