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Shared knowledge among instructional multimedia design experts

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Abstract

The research focuses on exploring the shared knowledge among the instructional multimedia design and development experts comprising of software designer, graphic designer, subject-matter expert and instructional designer. A critical need exists for a solid understanding of the factors that influence team decision making and performance in order to identify interventions that can affect the decision making process and improving performance. The knowledge shared by the team is categorized into three groups of multimedia design principles encompasses of basic principles, authoring principles and design principles. The shared knowledge from the team is extracted through the Modified Delphi Technique. The outcome of the research will be synthesized as the shared knowledge among the experts and the basis for developing the empirically-based design guideline of multimedia design principle. The research provides a window to some of the factors underlying team acquisition and performance of a complex skill. Hence it is valuable in diagnosing team performance successes and failures in multimedia design and development. With an understanding of team cognition, hence, training and designing interventions can target the cognitive underpinnings of team performance. The ability to assess team cognition and predict team performance has far reaching implications for evaluating progress in the design and development process of multimedia. Predominantly, understanding the cognition underlying team performance facilitates interventions (design, training, selection) to improve performance in instructional multimedia design production.

Keywords:Shared Knowledge;Instructional Multimedia Design, Empirically-based Design Guideline ; Modified Delphi Technique

This research focuses on exploring the knowledge shared by multimedia courseware design and development experts comprising software designers, graphic designers, subject matter experts and instructional designers (Lee & Owens, 2001; Cooke et. al., 2001). The shared knowledge lies from the overlap of knowledge between multimedia designers, graphic designers, subject-matter experts, and instructional designers in the process of designing and developing instructional multimedia courseware. It is important to explore the mental processes among the experts, as it captures accurate and complete descriptions of cognitive processes and decisions. The outcome is most often a description of the performance objectives, equipment, conceptual knowledge, procedural knowledge, and performance standards used by experts as they perform a task (Clark & Estes, 1996; Feldon & Clark, 2007).

Clark (2006) further defined the exploration of the mental processes as Cognitive Task Analysis (CTA), a method of analyzing and representing the knowledge and cognitive activities that workers utilize to perform complex tasks in the work domain. It focuses primarily on how workers function in cognitively demanding domains. It is most useful in developing training programs, means to assess performance, and criteria to select people for certain jobs. It also provides insights on creating effective decision support systems and other software systems.

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Cooke and Breedin (1994) advocate CTA as one of the major contributions to instructional technology that have resulted from the "cognitive revolution" in psychology and education starting in the 1970s. CTA does not seek to replace behavioral task analysis (or the analysis of documents and research to support training) but instead adds to existing methods that help capture the covert mental processes that experts use to accomplish complex skills. The importance of CTA is based on compelling evidence that experts are not fully aware of about, 70% of their own decisions and mental analysis of tasks, and so are unable to explain them fully even when they intend to support the design of training, assessment, job aids, or work (Clark & Estes, 1996; Feldon & Clark, 2007). Predominantly, CTA-based performance descriptions strongly suggest huge potential benefits for designers and learners when applied in training and job aids (Cooke et. al., 2001).

Shared knowledge is the common and complementary knowledge and shared perspectives that exist among the experts of multimedia design and development. In other words, this research focuses on the team cognition of multimedia design and development. Team cognition emerges from the interplay of the individual cognition of each team member and the team process behaviors. A critical need exists for a solid understanding of the factors that influence team decision making and performance in order to identify interventions that can affect the decision making process and improve performance (Klinger et al., 1993; Salas, Bowers, & Cannon-Bowers, 1995; Hall & Regian, 1996).

Previous research, Keppell (2004), addresses the gap in the field of instructional design and outlines a number of key principles to be considered while interacting with subject matter experts. Without effective principles for interacting with the subject matter expert, valuable time will be lost in understanding and organizing the content.

Thus, this research provides a window to some of the factors underlying team acquisition and performance of a complex skill and can thus be valuable in diagnosing team performance successes and failures in multimedia design and development. With an understanding of team cognition, hence, training and design interventions can target the cognitive underpinnings of team performance. The ability to assess team cognition and predict team performance has far-reaching implications for evaluating progress in the design and development process of multimedia. Predominantly, understanding the cognition underlying team performance facilitates interventions (design, training, selection) to improve that performance.

METHODOLOGY

The research categorized the knowledge that the team shared into three groups of multimedia design principles: basic, authoring, and design principles. The Modified Delphi Technique was applied in order to extract the shared knowledge from the team. The outcome of the research was a set of multimedia design principles agreed upon by the experts, which became the basis for the development of the empirically-based multimedia design guidelines.

The design of content for the Modified Delphi Technique instrument did not begin with an open-ended or unstructured question. The content for the instrument was based on a review of available literature related to the three categories of principles, which are basic, authoring, and design principles. Face validity for Round 1 instrument was verified as the items are based on the guidelines and subsequently confirmed by the panel of experts.

The Delphi Technique approach uses the consensus method to determine the extent of an agreement over a particular issue being deliberated (Stewart et al., 1999). An advantage of this technique is that the panel does not meet. Therefore, opinions could be expressed without influence from others (Czinkota & Ronkainen, 1997; McGill, 1988; Robbins, 1996; Stewart, et al., 1999). The selected experts remain anonymous to one another throughout the technique, with only group ratings to be reported.

The modified three-round Delphi procedure involves a series of questionnaires in which a questionnaire is subsequently formulated and built from responses to the proceeding questionnaire (McCoy, 1997). The number of rounds could vary from two to ten, but the Delphi process stops when a reasonable level of consensus is achieved and sufficient information is obtained (Delbecq et al., 1975; Lang, 1998; Ludwig, 1997) or the predetermined number of rounds have been completed (Bauder, 1999). Only two rounds of questionnaires are used in this study (Jones & Reid, 1999; Pollard & Hayne, 1998). Martino (1972) characterized the basic Delphi Technique as a four-round process; however, a number of experiments have shown that modifying the basic method can shorten the process. As stated by Martino (1972, p. 27): "If time is short, and an initial list of events can be obtained by some other method, two rounds may well be sufficient to clarify the issue, even if not to reach full agreement on the part of the panel."

Delbecq et al. (1975) stated that a Delphi panel size of 3–4 is too small but a reasonable group size is 15–20. However, Linstone and Turoff (1975) cited that the ideal number to serve on a Delphi panel is 5–10. For the purpose of establishing content validity of the multimedia design principles, the number of experts is more than 10 due to its consistency with Dalkey's finding (as cited in Martino, 1972) that the reliability and average group error is a function of panel size. Hence, this research involves 12 experts in multimedia design.

The selection of individuals to serve on the panel of experts was made through peer survey and not through random selection of a population. This is because the success of the Delphi Technique depends on informed opinions; it is important that individuals be identified as experts according to their training, experience, and knowledge in the area of instructional technology, software development, instructional design, and graphic design; they should be subject matter experts who are experienced in multimedia design. The individual should also be willing to participate in the two-round Delphi Technique (Judd, 1972; Taylor & Judd, 1989; Jacobs, 1996).

Central tendency was analyzed via SPSS, focusing on the median and interquartile range (IQR). The median better reflects the opinion of every expert and is the most accurate statistical descriptor for group responses (Dalkey et al., 1972; Martino, 1972). In order to explain the movement of a group response towards consensus, interquartile range was calculated to show the spread of opinions for each item around the median. A narrow IQR indicates that there is fairly close consensus among the experts (Schmidt, 1997).

Initially, the job scope of the experts was mixed between an education and non-education background. However, the result of the first round showed significantly less consensus among the experts due to the high difference in opinions between experts from an education background and those from a non-education background. Thus, it was difficult to obtain consensus with the high difference in job performance and application of principles. Therefore, the researcher narrowed the job scope of experts involved in data collection for the second round of the Delphi Technique to merely within the education background (Pill, 1971; Oh, 1974). The basis for the development of empirically-based multimedia design principles (EMDP) is derived from the consensus of experts from the education background.

FINDINGS AND RESULTS

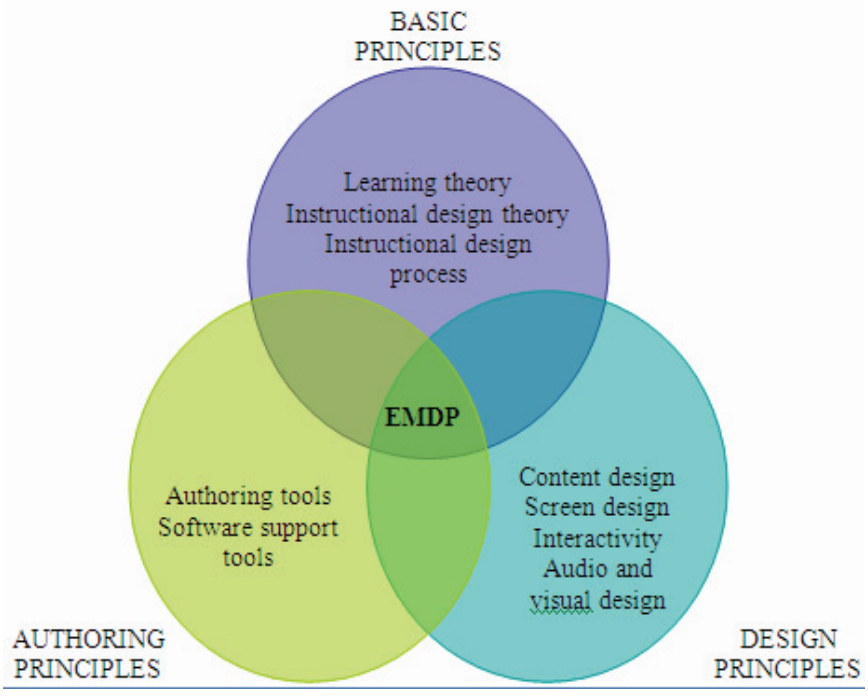

Figure 1: Empirically-based Multimedia Design Principles (EMDP)

EMDP, as illustrated in Figure 1, are divided into three major groups of principles: basic, design, and authoring principles. Nine components of principles are derived from the three major groups. The basic principles

comprise learning theory, instructional design theory, and instructional design process. Authoring tools and software support tools are categorized under authoring principles. Finally, the design principles consist of components such as content design, screen design, interactivity, and audio and video design. Initially, in the first round of the Modified Delphi Technique, the list of principles comprised 9 components of principles with 148 principles. After the second round, with the same number of components, the number of principles was increased to 164 principles.

This was due to the additional principles that were added in the second round. The theory of adult learning (andragogy) was added to the learning theory. The maintenance phase was added to the instructional design process. Facebook was added in the authoring tools. The instructional design theory included ARCS—the four-factor theory to explain motivation: attention (A), relevance (R), confidence (C), and satisfaction (S)—and another principle ABCD, the basis of learning objectives: audience (A), behavior (B), condition (C), degree (D). The design principles included the principles of art, elements of design, principles of organization, compositional techniques, and rule of thirds. In addition, self-critique, conceptual, marketability, and consistency principles were also added to the design principles. All of the additional principles were considered as items with high consensus, having the smallest quartile deviation score (0) and the highest median score (5).

The deleted principles involve the cognitive principle of depth of processing in learning theory, materials coverage of analysis phase in instructional design process, and video as a medium for a lesson summarization in audio visual design. In the constructivist theory, principles being deleted are stages of development, multiple reality representation, and reflection. In addition, in instructional design theory, the Laurillard Conversational Framework and the application of Hypercard and Linkway softwares are deleted from the authoring tools principles. The deleted principles were considered as items with no consensus, having the highest quartile deviation score (≤ 1) and the lowest median score (1–3.49).

RECOMMENDATIONS

In order to improve the EMDP, other researchers should focus on the suggestions of experts from the education area, as these experts provides better insights and perspectives on the application of principles in designing multimedia. A longer duration of research is highly significant to carry out future research. More time is needed to gain information from the experts. Hence, in future, more rounds can be implemented in the Delphi Technique.

CONCLUSION

In conclusion, analyzing the shared knowledge among the experts involved in designing instructional multimedia is worth exploring. The outcome of the research contributes to a new finding, improved multimedia design principles. Hence, the application of these principles is hoped to be able to improve the quality of instructional multimedia products.

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