The Crucial Roles of the Instructional Designer and the Subject Matter Expert in Multimedia Design

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Abstract: This paper examines a study which developed and began testing a process to assist instructional designers in eliciting unfamiliar content from subject matter experts and in conceptualizing that content. It explored the development, trial, training and application of the "Content Production Process" (CPP). Three major insights were gained into the use of the CPP. Firstly, the novice instructional designer found that knowledge map construction was useful for assisting him to think carefully about the unfamiliar content. Secondly, the knowledge map appears to have been a useful "communication prop" for assisting the instructional designer in interacting with the subject matter experts. Thirdly, the instructional designer found that combining a "teachback" procedure with the knowledge map provided a powerful means of checking his understanding of the content against that of the expert. The CPP offers a process for improving the interviewing process in multimedia instructional design.

Nature of the Problem

Imagine attempting to design an instructional unit in an area in which you have no understanding or expertise. How would you approach the unfamiliar materials? What are your choices? You can read textbooks or reference materials or you could talk to experts in the area. Subject matter experts, however, are often busy people. How can you optimize your time spent with the subject matter expert? How can you elicit a sufficient quantity and quality of information so that instructional design is possible? What questions would you ask of the subject matter expert? This paper addresses the relationship between the instructional designer and subject matter expert and examines more particularly a possible method for eliciting and conceptualizing unfamiliar content knowledge from the subject matter expert so that efficient and effective instructional design can proceed.

Research on instructional design has not adequately addressed the conceptualization by the instructional designer of unfamiliar content as presented by a subject matter expert. Many researchers in the field of instructional design acknowledge the importance of this conceptualization (Brien & Towle, 1977; Bratton, 1981, 1983; Cram, 1981; Wallington, 1981; Rutt, 1985; Armstrong & Sherman, 1988; Morrison, 1988a; Tessmer, 1988a, 1988b; Rodriguez, Stephens & Arena, 1991; Davidove, 1993; Maple, 1994; Lee, 1994; Ingram, Heitz, Reid, Walsh & Wells, 1994; Yancey, 1996); however, only general heuristics and suggestions have been offered. There appears to have been no systematic efforts to develop a comprehensive strategy for the conceptualization and elicitation of subject matter knowledge.

This crucial skill of an instructional designer is a potential "bottleneck" for the development of instructional materials in project-based multimedia environments. For example, an instructional designer may be required to design multimedia in content areas as diverse as mining, engineering, taxation, alumina processing, beef production and medicine. It is not possible to be conversant in all of these diverse content areas, and the instructional designer must rely on subject matter experts to assist with this content. Without an effective strategy for interacting with the subject matter expert, valuable time will be lost understanding and organizing the content, hence the need for an efficient and effective method to assist in the instructional designer–subject matter expert interaction (Keppell, 1997).

Instructional Designers and Subject Matter Experts

Instructional Designer

Instructional designers tend to be process-oriented individuals as they can apply instructional design principles to a wide range of content areas. The designer usually begins by analyzing goals, needs and learner characteristics in an attempt to understand the instructional problem. The scope and content of the subject are then identified. These areas represent the "problem space" of the instructional designer. One of the designer's main jobs is to select, sequence, synthesize and summarize the content for instructional purposes and deliver the desired product. “Despite having *no content expertise,* the designer has a set of representations based on a *"design model"* which can guide the development of an effective training program” (Nelson, Magliano & Sherman, 1988, p. 32) (italics added).

The *design model* is the designer's accumulated knowledge of how instruction should be developed. It is the amalgamation of general experience, educational background and instructional experience. The design model is analogous to a script. Scripts are knowledge packages in memory which allow individuals to understand routine activities (e.g. eating in restaurants, visiting the dentist). They are prototypical or stereotypical information useful in everyday occurrences. Schank and Abelson (1977) suggest that we have hundreds of stereotypical situations coded in memory, each having idiosyncratic variations. The designer has a generic script which can be applied with variations to new instructional problems. This design model is one of the most important characteristics required by the designer in approaching a new instructional problem. The advantage of the generalized script is that it is adaptable to new instructional problems. The concept of the script suggests how a designer can approach unfamiliar content. The aim of the designer in the interaction with the subject matter expert will be to "formulate a working content structure within which the information and skills to be taught can be formed into a sequence and hierarchy" or other appropriate structure (Wallington, 1981, p. 30).

Subject Matter Expert

As the name suggests the subject matter expert (SME) or the content expert is an authority on a particular domain of knowledge from whom the designer is attempting to elicit knowledge. The SME may be the client in the business, academic or military setting. Nelson, Magliano and Sherman (1988) suggest that "experts'" knowledge structures are more highly organized and well integrated" (p. 30) than those of novices. “Experts tend to "chunk" or organize information into more highly structured patterns and to complete the task more quickly than novices. Experts also appear to represent problems differently than novices because of their superior ability to recognize patterns, infer relationships, disregard irrelevant information, and recall similar problems from past experience” (Nelson, Magliano & Sherman, 1988, p. 33). One of the SME’s functions in training is to provide accurate content to the design team. In this study SME’s have two roles: (1) providing a clear description and explanation of the content area being examined, and (2) assisting the designer's conceptualization by clarifying and verifying the content.

Phases of the Study

Phase 1: Development of the Process

The CPP was developed by using an eclectic approach. Ausubel’s concept of "intellectual scaffolding" forms an important part of the CPP (Ausubel, 1960, 1963, 1968). When instructional designers are working with SME's their aim is to create a conceptual scaffold and then attach content elicited in the subsequent interactions with the SME. As designers create this conceptual scaffold (knowledge map) and elaborate the content they begin to conceptualize the relationships within the content. It seemed that some form of graphic organizer might be an appropriate tool for representing successive iterations of the instructional designer's attempts to conceptualize unfamiliar content, and of the various forms available the knowledge map was selected (Breuker, 1984; Dansereau, 1991a, 1991b). In addition to helping the instructional designer conceptualize unfamiliar content (Wedman, 1987), it was thought that there would emerge a second advantage of making the instructional designer’s perceptions public for the subject matter expert to examine.

Phase 2: Personal Trial of the CPP

The personal trial of the CPP helped to crystallize the researcher's conceptualization of the process. Initially, it was necessary to keep pace with the SME and attempt to obtain an overview of the content area. A second phase began with the SME viewing the map and understanding the role of the instructional designer within the interaction. At this point in the interaction the SME appeared to become more cooperative and provided more detailed explanations because a certain rapport had been developed. A third phase involved both the designer and SME collaborating to achieve the goals of the interaction. The fourth phase centered on cultural understanding with the instructional designer feeling more effective in conceptualizing the content when the content could be viewed from the SME's point of view. After the trial an effort was made to formalize the process to allow it to be taught to another instructional designer.

Phase 3: Training a Novice Designer to Use the CPP

The training program addressed both the declarative and procedural knowledge required by a novice designer when working with SME's in a "real" setting. The novice designer was trained for a total of thirty-three hours in all aspects of the CPP. Personally teaching the process to John provided the researcher with the opportunity to observe the process in action and document the proceedings. John achieved competency in all aspects of the CPP as it was conceived at that point and was ready to work with SME's in a real setting. He had shown competence in both declarative and procedural knowledge in relation to the CPP.

Phase 4: Case Stories

These case stories investigated the designer–SME interaction within the real-world context of a military setting. They attempted to focus on discovery, insight and understanding from the perspectives of the designer and the SME's being studied. In this way they attempted to "illustrate conclusions to which the author ... was ... already committed" (Biddle & Anderson, 1986, p. 238). Such case stories are intended to provide new insights and understandings and "... not provide conclusions, however, that reflect evidence" (p. 238).

This case focussed on how one instructional designer aided by the CPP interacted with, elicited and conceptualized unfamiliar content. Through the process of the case it was possible to examine the situation in depth, detail and from a holistic perspective. This portrayal provided a solid basis for examining what took place in the interaction. The following important areas emerged during the case: (1) Strategies for conceptualizing the content, (2) the knowledge map as a communication prop, (3) the teachback function and the knowledge map.

Strategies for Conceptualizing the Content

Throughout the five interviews in the case John appeared to become more adaptable and flexible in his interactions with the SME's. As the interviews progressed, John's ability to react to the situation was more noticeable. He appeared more comfortable with clarifying the content when he was unsure of its meaning. In his initial interactions, John often allowed Steve (first SME) to complete a lengthy explanation before he sought clarification. In later interviews with Bob (second SME), John was able to seek more regular explanations. As John became more conversant and more confident with the interaction his questioning also became more specific.

John's preferred approach to gaining an initial understanding of the content was to obtain an overview of the area. He appeared to need to see the conceptual terrain of the content area before examining the area in more depth. This was consistent with the author's own application of the CPP. John commented that he needed to do this so that he could see the extent of the information that needed to be covered. It may represent a heuristic that designers need to use in the process of interacting with SME's.

John also found that the knowledge map was a useful tool which assisted him when wrestling with unfamiliar content and displaying the content to the SME. John suggested that the construction of the knowledge map "forced me to think about what was said" and "focuses my thinking". The use of the knowledge map appeared to assist John in thinking more carefully about the content. Holley and Dansereau (1984, p. 8) suggest that the creation of a knowledge map may force the constructor to process the content in "greater semantic depth". Furthermore, Holley and Dansereau also suggest that reorganizing the information in the form of a knowledge map may activate both the spatial and verbal processing systems, allowing the developer to gain a deeper understanding of the information.

The Knowledge Map as a Communication Prop

The use of the knowledge map in the designer–SME interview may act as a communication "prop" to improve the interpersonal nature of the interview. The interaction with the SME can sometimes be a stressful experience which may be lessened by the use of a visual prop in the form of the knowledge map. The knowledge map appeared to assist John in handling the sometimes difficult interpersonal aspects of the interview. "And it really helps me, because when you're dealing with someone who you don't really know very well ... I'm nervous ... and rather than sort of concentrating and talking to him and looking at him in the eye, I could focus attention on the map".

The knowledge map may also help to focus the attention of the SME and designer on the most important parts of the content. Accurate content on the map may not require further attention. It may not be necessary to further explore this information because the SME has verified the accuracy of the content. John used the map in this sense by check-marking accurate information on the map as it was examined by the SME. In this sense the map may act as a communication device that confirms the knowledge shared by the designer and SME. The focus of the interview can then be concerned with the areas that are most in need of attention.

The knowledge map appeared to assist both the SME and designer in recognizing *gaps* in the flow of the sequence and in the information; for example, Steve instantly recognized the absence of safety procedures in the map John had created on the C7 rifle. Likewise, once John had created the map on landmines, he himself, was able to pinpoint gaps in the information that he addressed in the subsequent iteration. McAleese (1988), in the context of developing expert systems, suggests that experts were able to recognize and pinpoint inconsistencies on a concept map.

Lambiotte, Dansereau, Cross and Reynolds (1989, p. 332) suggest that knowledge maps are "computationally efficient" in that they "facilitate faster search and recognition of relevant information" (p. 332). Efficiency is defined in terms of how the knowledge map representation assists attention focusing, knowledge assimilation and knowledge searching of new information. The presentation of the knowledge map to the SME may activate both the spatial and verbal systems thus increasing the processing efficiency of the information.

The Teachback Function and the Knowledge Map

In the initial conception of the CPP it was envisaged that the designer would stop at certain points throughout the interaction and teach the material back to the SME. This proved far too ambitious for a designer who is totally unfamiliar with a content area. It was not possible for the designer to gain sufficient familiarity with the content to teach back the material to the SME. John also felt uncomfortable with this practice. “I still think the toughest nut to crack for me is the teachback, I could just go over it and kind of lecture him, but I really felt uncomfortable doing that”. Therefore it seems more reasonable to assume that the designer must concentrate on obtaining the big picture and must postpone paraphrasing and asking in-depth questions until a later point in the interaction. A great deal of reflection and problem-solving was required to develop a conceptualization of the SME's content area.

In spite of the original prediction, interspersing the teachback procedure (Gregory, 1986; Pask, 1975) in the interviews may actually interrupt the SME in the midst of an explanation and prove counterproductive to the overall goal of the elicitation process. A SME may require total concentration when explaining a complex sequence. If the instructional designer interrupts the SME, the SME may lose the train of thought and be prevented from explaining crucial information. The SME may also simply become irritated at being interrupted, thus affecting the rapport between the designer and the SME.

It would appear that the teachback procedure is more appropriately used at the beginning of a subsequent interview. With the aid of the knowledge map, John found this a powerful means of checking his understanding of the content against the expertise of the SME. John gathered the information in the interview, reflected on the content, constructed the map and then taught the material back to the SME at the beginning of each interview. This proved an effective adaptation of the CPP over what was originally conceived.

Conclusion

This study explored the development, trial, training and application of a process to elicit and conceptualize unfamiliar content. In particular the study examined the personal strategies used by the designer in handling unfamiliar content. A secondary purpose was to examine the effectiveness of the process to train designers in elicitation and conceptualization processes.

This study has examined the front-end investigation of eliciting and conceptualizing unfamiliar content by an instructional designer. The work is significant as it has carefully documented the interactions of a novice designer with SME's in a real context. The process appears promising in assisting the conceptualization of unfamiliar content and improving the designer–SME interaction. Further research needs to be undertaken with a variety of designers and SME's to determine the applicability of this process for the field of instructional design.

Epilogue—A Personal Note

Since conducting this study the researcher has employed the CPP to interact with over forty-six subject matter experts in the oil and gas industry in Canada from July 1993 to July 1994. Content areas included cementing, acidizing, fracturing, coil tubing, pipeline pigging, hydrostatic testing, vehicle inspections, nitrogen and CO_2. Comments by the SME's in relation to this process were very favourable. SME's were often puzzled by the accuracy of the information documented in the training manuals by an individual who was totally unfamiliar with the content. The operational procedures for twelve oil and gas operations relied exclusively on the input of SME's. The training materials were developed without actually observing the operations within the field setting. During 1994, I also worked with seven content experts in therapeutic massage. My role was to assist in the formulation of the curriculum. From August 1994 to February 1998 in Australia, I worked with over thirty subject matter experts in the development of multimedia training materials for industry and university-based clients. Some of these content areas included open cut coal mining, underground coal mining, automotive practices, alumina processing and engineering. This collaborative approach has proven to be successful in the completion of the technical projects. From February 1998 I have been working with medical subject matter experts at a medical school in Australia. I have utilised principles from the CPP to interact with over thirty medical experts in developing multimedia modules for use by medical students. Clients appear to "buy into" the process once they realize that their expertise drives the project. The role of the instructional designer is to filter and shape the content for the audience. My own experience in working with SME's has been favorable. In the project-driven environment in which I work, the identification and interaction with the SME is a major factor that determines the success or failure of the project. For me the CPP has continued to "work" and provide a valuable contribution to the design and development of multimedia modules.

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