

Bridging the Gap Between Experts in Designing Multimedia-Based Instructional Media for Learning

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ABSTRACT

The research identified and explored the cognitive knowledge among the instructional multimedia design and development experts comprising of multimedia 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 was categorized into three groups of multimedia design principles encompasses of basic principles, authoring principles and design principles. The research methodology involved quantitative and qualitative methods. Initial phase began with the modified Delphi technique which involved a selection of experts and the list of principles in multimedia design. Next phase, the interview session involved four selected experts to verify the list of principles and obtain detailed information. Predominantly, the research presented the Shared Knowledge Multimedia Design Model (SKMD). The research outcomes significantly benefit the Ministry of Education, teachers, students, instructors, designers and the field of instructional design instructional design. Hence, quality multimedia learning products can be produced.

Keywords: *shared knowledge, expertise study, multimedia design*

INTRODUCTION

The field of expertise studies came about as a convergence of events and trends in computer science and psychology (Feltovich et al, 2006). Furthermore, studies on expertise venture into a number of domains, with the goal of advancing cognitive theory and contributing to instructional design. The study of expertise has tacitly been regarded as having value, because it touches on basic questions related to cognition, perception and decision making and applications involving skills training and the preservation of knowledge (Hoffman & Militello, 2008).

The driving hypothesis is that experts' domain-specific knowledge is highly complex, highly organized and highly coherent or cohesive, that is, concepts are interrelated in meaningful ways organized according to categories and dimensions that are important and necessary and functional for their domain functions (Bordage, Connell, Chang, Gecht, & Sinacore, 1997; Bordage & Zack, 1984; Glaser, 1987; Lemieux & Bordage, 1992; Mandler, 1967). Experts categories or schemas are "richer" (Chi et al, 1981; Lesgold 1988; Voss & Post; 1988).

Expertise can be defined in terms of the development of proficient skill or performance. Experts are able to use their vast knowledge effectively and efficiently (Norman & Brooks, 1997; Schmidt & Boshuizen, 2002; Verhoeijen et al, 2004). Moreover, they rely on conceptual categories that are principled and experts know that conceptually different problem types may nonetheless manifest the same surface features (Murphy & Wright; 1984). The finding is consistent across studies of diverse domains of expertise (Chen & Popovich, 2003).

Experienced programmers are better able to identify bugs especially those that can be found only after achieving a conceptual understanding of overall program function. Hypothetically this is because their memory organization falls at a more conceptual level (Sonntag, 2006). Experts among medical diagnosticians tend to remember the underlying gist or meaning including their own inferences (Patel & Groen, 1991).

The skills and knowledge enable experts to distinguish relevant and irrelevant information and to make order out of chaos by simplifying what appears to be the novice to be staggering complexity (Krogstad et al, 1984). Thus, the research is hoped to distinguish the relevant and irrelevant principles in multimedia design based on the experts' study.

Shared Mental Model

A team Cognitive Task Analysis is a description of the cognitive skills needed to perform a task proficiently. It is helpful as it can describe the way the team is thinking as opposed to the steps it is following. Cognitive processes for teams consist of control of attention, shared situation awareness, shared mental models, application of strategies and heuristics to make decisions, solve problems and plan and metacognition (Cook et al, 2001).

Shared mental models imply that team members have the same understanding for the dynamics of key processes. These processes can include the roles and functions of each team members in accomplishing the task, the nature of the task, the use of equipment and so forth. In most settings a critical factor is the degree to which the team members have a shared mental model of their own roles and functions (Schraagen, Chipman&Shalin, 2000).

The research is focusing on soliciting knowledge of agreement on strategies. The process requires asking each team member to analyze the situation and justify strategies taken. Besides that, the purpose is also to analyze team agreement (Schraagen, Chipman&Shalin, 2000). This is further discussed in the methodology section on the application of Delphi technique to analyze team agreement.

One common source of difficulty for teams is when the members are confused about who is supposed to do what. Confusion about roles and functions leads to wasted effort or a failure to carry out essential subtasks. Effective teams understand the functions, including the common routines. Hence shared mental models refer to the configuration of the team and the way it is supposed to perform routines (Hoffman & Militello, 2008).

Research aimed at addressing this issue is clearly needed. Despite the gaps in research, a number of knowledge elicitation methods are available from research since such data are required so that team selection, training, task design and management systems can be optimized. Thus, this research highlights the flow of information among team members, models of shared knowledge or analyses of knowledge overlap among the design and development of multimedia courseware team members. These include understanding of what each team member needs to know to function effectively, as well as an understanding of what information must be dynamically shared among members.

Background of the Research

With the current development of multimedia design activity in every level of education, research in multimedia design is increasingly in demand. Predominantly, multimedia design which is based on theory, model and design guideline successfully produced multimedia materials which conveniently suit human learning. Thus, multimedia design principles should be clear and applicable (Baharuddin et al, 2007). Rio Sumarni (2007) further advocates that the emphasis on Instructional Design theories, models and learning theories in designing instructional materials is as important as it gives meaningful learning to the students. Thus, educators and instructors should take into consideration the pedagogical and technological aspects when designing instructional materials to practice effective instruction and enhance learning.

However, Samaras et al, (2006) argues that the earlier generation of multimedia design and learning research deficiency has caused the failure in technology application which is due to the focus of instructional design concentrating on incorporating technologies into instruction. Technology-centered approach with a 100-year history of failure has shifted the multimedia design paradigm to a learner centered approach (Mayer, 2005). Learning from the earlier generation, the emergent generation focuses on current issues and future trends of multimedia research and encourages new emergent models. Studies are now aimed at a deeper understanding of the impact of multiple forms of representation on learning by taking into account content characteristics. In addition, factors that differentiate learners (prior knowledge, cognitive/learning style, motivation and others) and also the support required by different learners are taken into account as well (Samaras et al, 2006).

In the earlier generation of multimedia design and learning research, most instructional designers created learning materials according to the instructor's perspective (Jonassen, 1988; Landauer 1995; Mayer, 2005; Rio, 2007; Samaras et al, 2006). Many inexperienced academicians design, create guidelines and devise authoring tools used to implement multimedia learning packages solely based on their own experiences and ideas (Sidhu and Ramesh, 2006).

Hence, this research explores the shared knowledge among experts and simultaneously gains better perspectives on the principles in designing and developing multimedia. This is advocated by several studies which agree that experts are able to use their vast knowledge effectively and efficiently (Brooks, 1997; Norman & Verkoijen et al, 2004; Schmidt & Boshuizen, 2002).

Multimedia Design and Development Experts

Bergman and Moore (1991) describe development experts as comprising several specialists who perform the design, development, production and authoring work. They are divided into primary roles and supporting roles. The former consist of Application Designer, Managing Producer, Art Director and Video Director. Meanwhile the latter consist of Writers, Graphic Artists, Developers, Audio and Video Production Personnel, Authors, Programmers, Subject Matter Experts and Administrators. Bergman and Moore (1991) add that some individuals may have multiple skills, thus the team does not necessarily comprise of every specialization. Careful selection of members with the right skills is essential as it is not realistic to expect any one member to possess all the sophisticated skills required.

Lee and Owens (2000) argue that organizations that assume a couple of people with the right skill sets can design and produce multimedia are misinformed about the number and complexity of skill sets needed for even a minimal multimedia design and development project. Assigning roles to the project group depends on the size of the project, timeline, skills and resources needed. They describe the roles into eighteen, which is more than advocated by Bergman and Moore (1991), encompassing Audio Producer or Technician, Author (Publisher, Materials Developer), Creative Director, Editor, Evaluation Specialist, Graphic Artist, Graphic Designer, Implementation Representative, Instructional Designer (Interactive Designer), Performance Analyst, Project Manager (Project Leader), Quality Review (Evaluator), Sponsor, Subject-Matter Expert (SME), Systems Designer, Systems Engineer (Application Developer), Video Editor (Technician) and Video Producer.

Despite emphasizing on the number of roles, Alessi and Trollip (2001) highlight the importance of brainstorming and collaboration among the experts as an excellent way of bringing together the different people and skills that can contribute productively to project design. Compared to the earlier researchers, Alessi and Trollip (2001) divide the team into a group that creates a design of the program for the most effective learning by the target audience and another group that produces or oversees the production of a set of documents for effective communication with the rest of the team. The former include the Instructional Designer, Clients, Project Manager, Content Experts, Trainers or Teachers and learners. Alessi and Trollip (2001) describe the latter as the production staff comprising technical writers, programmers, graphic artists, photographers, videographers, audiographers, special effects artists and actors.

On the other hand, Malaysian researchers in multimedia have their own perspective with regard to the role of the multimedia development team. Jamalludin et al, (2003) categorized the team according to three major groups, namely: management, design and technical. The management group comprises of project manager, creative director, art director, technical director and test director. The design group includes subject matter expert, instructional designer and script writer. The technical group encompasses the editor, graphic computer artist, audio specialist, video specialist, 2D animator, 3D animator and programmer. Collaboration between the three groups determines the flow of the project and thus ensures multimedia product quality.

Norazlin et al, (2007) agree to the notion of grouping the team into three different groups according to their area specialization. They add that the role depends on the needs of the particular project, since such needs differs between one project and another. Thus, some of the roles may not be applicable to another multimedia project. Apart from defining the roles, they also emphasize the working culture and leadership quality in the multimedia development team in determining the flow of the project for producing quality multimedia products.

For the purpose of the research, the team of multimedia development is categorized generally into four main groups which are instructional designer, subject matter expert, graphic designer and software developer. The four main categories are depicted based on the roles in the multimedia development team described by the aforementioned researchers. Hence this research categorizes the roles according to the general needs of a multimedia development team. Based on the description of the abovementioned research, the shared knowledge among the different roles in the team has not been ventured. Thus, this research focuses on the shared knowledge among the four groups in the team which will be the basis for the principles of designing multimedia products.

METHODOLOGY

The research methodology involves two types of methods; quantitative and qualitative. The research begins with the quantitative and is followed by the qualitative method. The methodology is known as mixed method (Creswell, 2007). Brewer and Hunter (1989) further define a mixed method research design as a procedure for collecting, analyzing and mixing both quantitative and qualitative data in a single study to understand a research problem.

Initial phase begins with preparing for modified Delphi technique which involves selection of experts and the list of principles in multimedia design. The list of principles is used in the Delphi technique whereby the experts are making selection of the principles applicable to their performed task in multimedia design. The list of principles is given to the experts during the two rounds of the Delphi technique. Next phase is the interview session with four

selected experts to verify the list of principles and obtain detailed information. Significantly, the interview with experts is also intended to validate the findings based on the quantitative analysis.

Mixed method is grouped into four major types namely the convergent parallel design, the explanatory sequential, the exploratory sequential design and embedded design (Creswell & Plano Clark, 2007). Hence, this research is applying the second type of mixed method research design, the explanatory sequential mixed method design. Quantitative data collection is the initial phase followed by the qualitative data collection (Creswell and Plano Clark, 2007). The research involves Modified Delphi Technique at the initial phase and interview at the following phase.

RESEARCH FINDINGS

The result is based on the analysis of the mixed (education and non-education) group only. Hence, the finding is based on involvement of both organizations. This is because the researcher wants to present the clashes of ideas and perceptions between experts from education and non-education groups. Experts from both education and non-education background agree that in education background experts in multimedia design involved in multi tasking. In contrast, experts from the non-education background specialized in their tasks. Thus, the research is exploring the overlapping principles applied in designing multimedia among experts from both backgrounds.

Due to the difference of opinions between the two organizations, certain principles are not applied by some group of experts in designing multimedia. This is to show the segregation of tasks among the experts.

Shared Knowledge Multimedia Design Model (SKMD) is a model of shared knowledge among instructional designers, graphic designers and subject matter expert is suggested based on the research finding. The model highlights four parts A, B, C and D as shown in Figure 1. Part A describes the area which instructional designers, graphic designers and subject matter expert share the application of principles in designing multimedia. Part B describes the overlapping of ideas between multimedia designers, graphic designers and subject matter expert. Part C illustrates the overlapping of ideas between instructional designers, graphic designers and multimedia designers. As for part D shows the overlapping of ideas between instructional designers, multimedia designers and subject matter expert.

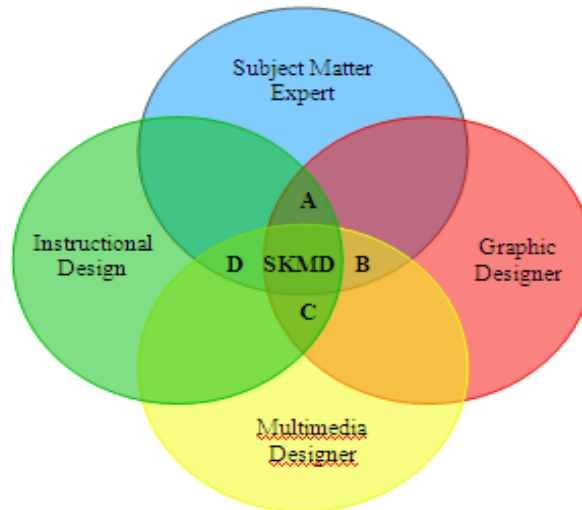


Figure 1: Shared Knowledge Multimedia Design Model (SKMD)

For part A, instructional designers and subject matter experts and graphic designers share the same point of view with regard to principles under content design, authoring tools instructional design process and screen design.

CODE	PRINCIPLES	GD		ID		SME	
		Med	IQR	Med	IQR	Med	IQR
cod1	Multimedia principle	5	3.00	5	3.00	4	3.00
cod 8	Signaling principle	4	0.75	5	0.00	5	0.00
cod16	Navigation principle	5	0.75	5	1.00	4	1.00
cod22	Interactivity principle	5	1.00	5	0.75	4	0.75
cod23	Self-critique principles	5	0.75	5	0.00	5	0.00
cod24	Conceptual principles	5	0.75	5	0.00	5	0.00
cod25	Marketability principles	5	0.75	5	0.00	4	0.00
cod26	Consistency principles	5	0.00	5	0.00	5	0.00

Table 1 :Consensus among subject matter expert, graphic designer and instructional designer for principles under content design

The description in Table 1 shows that all the three groups of experts obtain consensus for the principles such as self-critique principles, conceptual principles, marketability principles, consistency principles, navigation principle, interactivity principle and signaling principle which are under content design. They obtain consensus with high median score between 4 to 5 and interquartile range between 0.00 to 1.00. All the three groups of experts similarly obtained no consensus for principles such as multimedia with high median score between 4 to 5 and interquartile range 3.00. As for the multimedia principle, all three of them share the same viewpoint that the tasks requires technical skills which does not involve job specifications of subject matter experts, instructional designer and graphic designers.

Table 2 shows that subject matter expert, graphic designer and instructional designer similarly obtain no consensus for principles under authoring tools. They obtain high median score between 4 to 5 and interquartile range between 2.00 to 3.50. This indicates that all the three groups of experts do not apply principles under authoring tools in designing multimedia. The principles under authoring tools requires technical skills which does not involve job specifications of subject matter experts and graphic designers.

CODE	PRINCIPLES	GD		ID		SME	
		Med	IQR	Med	IQR	Med	IQR
atl1	Hypercard and Linkway	5	2.75	4	2.25	4	2.25
atl2	Powerpoint	5	3.00	4	2.25	4	2.25
atl3	video as real-time communication	4	2.00	5	3.50	4	2.00
atl4	video to depict problem	4	2.00	4	2.25	4	2.25
atl5	weblog	4	2.00	4.5	3.00	5	3.50
atl6	Wikis	5	3.00	4	2.50	4	2.50
atl7	podcast	4	2.25	5	3.00	5	3.25
atl8	e-portfolios	4	3.00	5	2.00	5	2.00
atl9	video sharing communities	4	2.25	5	2.25	4	2.75
atl10	social networking sites	4	2.25	5	3.00	5	3.00
atl11	Quicktime Virtual Reality	4	3.50	5	3.25	5	2.00
atl12	Geographic Information Systems	5	2.25	4	2.00	4	2.00
atl13	3-D models	5	3.00	4	2.00	4	2.00
atl14	virtual reality environment	5	2.50	5	3.25	5	3.00
atl15	full immersion system	4	3.00	4	3.00	5	2.25
atl16	Facebook	4	3.00	4	3.50	5	3.00

Table 2 : Consensus among subject matter expert, graphic designer and instructional designer in authoring tools

CODE	PRINCIPLES	GD		ID		SME	
		Med	IQR	Med	IQR	Med	IQR
aut1	integrate media elements	4	2.00	5	3.00	4	3.50
aut2	end users' perspectives	5	2.00	5	3.25	4	3.50
aut3	refine the presentations	5	2.00	5	3.25	4	3.50
val1	measurement instrument	5	3.00	4	2.25	4	2.25
val2	interview audience and	5	3.25	5	3.25	5	3.25
val3	record	5	3.25	5	3.00	5	3.00
enh	analyze validation findings	4	0.00	5	0.75	5	0.75
mat	beautify modify	4	0.00	4.5	0.75	5	0.75

Table 3 : Consensus of subject matter expert, graphic designer and instructional designer in of instructional design process

Based on table 3, the experts similarly obtain no consensus with regard to all the principles involving authoring and validation phases in instructional design process. All the three groups of experts obtain high consensus with high median score between 4 to 5 and high interquartile range between 2.00 to 3.50. This indicates that subject matter expert, instructional designer and graphic designers do not involve in both phases. In contrast, for enhancement phase, all the three groups of experts obtain high consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75. Besides that, all the three groups of experts obtain high consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75 with regard to maintenance phase.

CODE	PRINCIPLES	GD		ID		SME	
		Med	IQR	Med	IQR	Med	IQR
scd1	prepare for learning	4	0.75	5	0.00	4.5	0.00
scd2	develop and maintain	5	0.00	5	0.75	4	0.75
scd8	interest	5	1.00	4	1.00	4.5	0.00
scd9	understood familiar	5	1.00	4	1.00	4.5	0.00

Table 4: Consensus among subject matter expert, graphic designer and instructional designer in screen design

Based on the description in Table 4 graphic designers, subject matter experts and instructional designers obtain high consensus for principles such as prepare for learning, develop and maintain interest, understood and familiar with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

For part B, the result shows that subject matter expert, graphic designer and multimedia designer share the same opinion on principles under content design, instructional design process and screen design.

CODE	PRINCIPLES	GD		ID		SME	
		Med	IQR	Med	IQR	Med	IQR
cod 8	Signaling principle	4	0.75	5	1.00	5	0.00
cod16	Navigation principle	5	0.75	5	0.00	4	1.00
cod23	Self-critique principles	5	0.75	5	0.00	5	0.00
cod24	Conceptual principles	5	0.75	5	0.00	5	0.00
cod25	Marketability principles	5	0.75	5	0.00	4	0.00
cod26	Consistency principles	5	0.00	5	0.00	5	0.00

Table 5 : Consensus among subject matter expert, graphic designer and multimedia designer for principles under content design

The experts present the same perception with regard to principles such as signaling principle, navigation principle, self-critique principles, conceptual principles, marketability principles and consistency principles. They obtain

consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 1.00.

CODE	PRINCIPLES	GD		MD		SME	
		Med	IQR	Med	IQR	Med	IQR
des1	evaluate team capability	4	3.50	4.5	2.75	5	2.00
des2	review objectives	5	3.00	4.5	3.00	5	2.00
des3	plan high level design process	4	3.25	4.5	2.75	5	2.00
des4	prepare design strategies	5	3.00	4.5	3.00	5	2.00
val1	measurement instrument	5	3.00	4	2.25	4	2.25
val2	interview audience and record	4.5	3.25	5	3.25	5	3.25
val3	analyze validation findings	5	3.50	5	3.00	5	3.00
enh	beautify	4	0.00	4	0.75	5	0.75
mat	modify	4	0.00	4.5	0.75	5	0.75

Table 6: Consensus among subject matter expert, graphic designer and multimedia designer in instructional design process.

All the three groups of experts, do not involve in the application of the principles under design and validate phase in designing multimedia. They obtain high median score between 4 to 5 and high interquartile range between 2.00 to 3.50. Enhancement and maintenance principles are suggested during the first round and added during the second round. All the three groups of experts obtain high consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

CODE	PRINCIPLES	GD		MD		SME	
		Med	IQR	Med	IQR	Med	IQR
scd1	prepare for learning	4	0.75	5	0.00	4.5	0.00
scd2	develop and maintain	5	0.00	5	0.75	4	0.75
scd8	interest	5	1.00	4	1.00	4.5	0.00
scd9	understood familiar	5	1.00	4	1.00	4.5	0.00

Table 7: Consensus among subject matter expert, graphic designer and multimedia designer in screen design

Based on the description in Table 7 graphic designers, subject matter experts and multimedia designers obtain high consensus for principles such as prepare for learning, develop and maintain interest, understood and familiar with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

Part C represents the application of principles agreed by multimedia designers, graphic designers and instructional designers. The principles under content design, screen design and instructional design process are generally important for multimedia designers, graphic designers and instructional designers when designing multimedia.

CODE	PRINCIPLES	GD		MD		ID	
		Med	IQR	Med	IQR	Med	IQR
cod 8	Signaling principle	4	0.75	5	0.00	5	1.00
cod16	Navigation principle	5	0.75	5	1.00	5	0.00
cod23	Self-critique principles	5	0.75	5	0.00	5	0.00
cod24	Conceptual principles	5	0.75	5	0.00	5	0.00
cod25	Marketability principles	5	0.75	5	0.00	5	0.00
cod26	Consistency principles	5	0.75	5	0.00	5	0.00

Table 8 : Consensus among multimedia designer, graphic designer and instructional designer for principles under content design

All the three groups of experts share similar view with regard to principles such as signaling principle, navigation principle, self-critique principles, conceptual principles, marketability principles, consistency principles (illustrated in table 8) . They obtain consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 1.00.

CODE	PRINCIPLES	GD		MD		ID	
		Med	IQR	Med	IQR	Med	IQR

val1	measurement instrument	5	3.00	4	2.25	4	2.25
val2	interview audience and	4.5	3.25	5	3.25	5	3.25
val3	record	5	3.50	5	3.00	5	3.00
enh	analyze validation findings	4	0.00	4	0.75	5	0.75
mat	beautify modify	4	0.00	4.5	0.00	4	0.75

Table 9: Consensus among multimedia designers, graphic designers and instructional designers for principles under instructional design process.

Multimedia designers, graphic designers and instructional designers obviously do not involve at validate phase of instructional design process. Table 9 shows that the three groups similarly obtain no consensus with median score between 4 to 5 and interquartile range between 2.25 to 3.50. Enhancement and maintenance principles are suggested during the first round and added during the second round. All the three groups of experts obtain high consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

CODE	PRINCIPLES	GD		MD		ID	
		Med	IQR	Med	IQR	Med	IQR
scd1	prepare for learning	4	0.75	5	0.00	5	0.00
scd2	develop and maintain	5	0.00	5	0.75	5	0.75
scd8	interest	5	1.00	4	1.00	4	1.00
scd9	understood familiar	5	1.00	4	1.00	4	1.00

Table 10 : Consensus among instructional designer, graphic designer and multimedia designer in screen design

Based on the description in Table 10 graphic designers, multimedia designers and instructional designers obtain high consensus for principles such as prepare for learning, develop and maintain interest, understood and familiar with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

Part D represents the overlapping of ideas between instructional designers, multimedia designers and subject matter experts for principles under screen design, content design and instructional design process.

The three groups of experts share similar view with regard to principles under content design such as signaling principle, navigation principle, self-critique principles, conceptual principles, marketability principles, consistency principles. They obtain consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 1.00.

CODE	PRINCIPLES	ID		MD		SME	
		Med	IQR	Med	IQR	Med	IQR
cod 8	Signaling principle	5	1.00	5	0.00	5	1.00
cod16	Navigation principle	5	0.00	5	1.00	5	0.00
cod23	Self-critique principles	5	0.00	5	0.00	5	0.00
cod24	Conceptual principles	5	0.00	5	0.00	5	0.00
cod25	Marketability principles	5	0.00	5	0.00	5	0.00
cod26	Consistency principles	5	0.00	5	0.00	5	0.00

Table 11 : Consensus among subject matter expert, graphic designer and instructional designer for principles under content design

CODE	PRINCIPLES	ID		MD		SME	
		Med	IQR	Med	IQR	Med	IQR
scd1	prepare for learning	5	0.00	5	0.00	5	0.00
scd2	develop and maintain	5	0.75	5	0.75	5	0.75
scd8	interest	4	1.00	4	1.00	4	1.00
scd9	understood familiar	4	1.00	4	1.00	4	1.00

Table 12: Consensus among subject matter expert, instructional designer and multimedia designer in instructional design process.

The result indicates that all the three groups of experts agree with the application of the principles under screen

design in designing multimedia except for certain principles for multimedia designers. Based on the description in Table 12 graphic designers, multimedia designers and instructional designers obtain high consensus for principles such as prepare for learning, develop and maintain interest, understood and familiar with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75.

CODE	PRINCIPLES	ID		MD		SME	
		Med	IQR	Med	IQR	Med	IQR
dev1	develop storyboard	5	3.00	5	3.00	4	3.00
dev2	develop scripts	5	3.00	5	3.00	4	3.00
dev3	write for narrators	5	3.00	5	3.00	4	2.25
dev4	computer screens and video	5	3.00	5	3.00	4	3.00
dev5	graphics plan budget	5	3.00	5	3.00	4	3.00
val1	measurement instrument	4	2.25	4	2.25	4	2.25
val2	interview audience and record	5	3.25	5	3.25	5	3.25
val3	analyze validation findings	5	3.00	5	3.00	5	3.00
enh	beautify	5	0.75	4	0.75	5	0.75
mat	modify	4	0.75	4.5	0.75	5	0.75

Table13 : Consensus among subject matter expert, instructional designer and multimedia designer in instructional design process.

The three groups of experts similarly do not involve in the develop and validate phases. Table 13 shows that the three groups similarly obtain no consensus with median score between 4 to 5 and interquartile range between 2.25 to 3.50. However, the three groups of experts obtain high consensus with high median score between 4 to 5 and low interquartile range between 0.00 to 0.75 for enhancement and maintenance phases.

Shared Knowledge Multimedia Design Model (SKMD) highlights the shared knowledge among instructional designers, graphic designers, multimedia designers and subject matter expert. Based on the findings, the shared knowledge among the experts comprises of principles under content design, screen design and instructional design process. The principles such as enhancement and maintenance under instructional design process were suggested during the first round and added during the second round. Even though the principles are new, all the three experts similarly obtain high consensus. This indicates the importance of the principles in designing multimedia. The quantitative analysis is supported by expert 01:

enhancement is to beautify or to make it more lively and meaningful..after validate there's a part where we feel that we can improve some elements of the product so that's what I mean by enhancement..after receiving user feedback ...comment..make movement but we enhance the movement ..maybe add some vibration to it..sometimes others give ideas then we enhance the product to make it better.. put it before maintenance coz after we've enhanced then we maintain..

CONCLUSION

In designing and developing multimedia-based instructional media, the team members have the same understanding for the dynamics of key processes. These processes can include the roles and functions of each team member in accomplishing the task, the nature of the task, the use of equipment and so forth. In most settings a critical factor is the degree to which the team members have a shared mental model of their own roles and functions (Schraagen et al, 2000).

Based on the findings, all the three groups of experts similarly agree on the principles under content design such as self-critique principles, conceptual principles, marketability principles, consistency principles, navigation principle and signaling principle. Apart from that all of them do not involve in validate phase. Lee and Owens (2000) explain that validation phase involves Quality Review (Evaluator). Even though enhancement and maintenance phases are newly added phases in the instructional design process, all the three groups of experts agree that those two phases are important. The additional two phases are similar to the Three-Phase Development (3PD) Model. Sims and Jones (2003) elaborate that the phases elicit learning content through process of enhancing and maintaining materials, rather than the more traditional systems approach of analyze, design, develop, implement, evaluate.

Previous research (Keppell, 2000) addresses the gap in the field of instructional design and outlines a number of key principles to consider in interacting with subject matter experts. Without effective principles for interacting with

the subject matter expert, valuable time will be lost understanding and organizing the content. However, this research focuses on the shared knowledge among the experts in multimedia design and development. The team cognition emerges from the interplay of the individual cognition of each team member and 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 (Hall & Regian, 1996; Klinger et al, 1993; Salas et al, 1995).

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