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A Conceptualisation of Courseware Development Process in Malaysian Educational Context

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Abstract

Multimedia-based learning has been accepted as an effective learning tool and has broadly prevailed in various types of education around the world. The Malaysian Ministry of Education (MOE) has also adopted this information communication technology (ICT) as the means of an education reformation project called, 'Smart School' since 1998, aiming to improve all Malaysian primary and secondary students' learning ability, attitudes, achievement, and further enhance teachers' teaching performance. As a result, Malaysian Ministry of Education has distributed a number of interactive courseware of the key learning domains such as Mathematics, Science, Bahasa Melayu (Malay language), and English. According to recent reports by Malaysian Ministry of Education, however, the courseware has not been effectively used in schools, and many researchers point out there are vital issues concerning the interface and interaction design. Within this context, this paper presumes that one of the main reasons could derive from a structural aspect of the course development process that is devaluing or ignoring the importance of interface and interaction design. Therefore, it is imperative to conceptualise the courseware development process in terms of creating interactive and quality learning experiences through defining the stakeholders' needs in terms of better learning and teaching. Within this context, this paper reviews the current development process and proposes a new concept called the interactive communication component which enables courseware developers to embed interactive and quality learning experiences into their courseware development process. The key objective is to provide opportunities to discuss the courseware development process from the different stakeholders' perspectives of the educational courseware in a Malaysian context.

Abstrak

Pembelajaran berasaskan multimedia telah diterima sebagai alat pembelajaran yang berkesan dan telah digunakan dengan meluas dalam pelbagai jenis pendidikan di seluruh dunia. Kementerian Pelajaran Malaysia (KPM) telah menggunakan teknologi komunikasi dan informasi sebagai kaedah untuk melaksanakan reformasi pendidikan yang dipanggil 'Sekolah Bestari' semenjak 1998 yang bertujuan untuk memperbaiki kebolehan, sikap dan pencapaian semua pelajar sekolah rendah dan menengah di Malaysia di samping meningkatkan prestasi pengajaran oleh guru. Sehubungan dengan itu KPM telah mengedarkan beberapa *courseware* berinteraktif di dalam mata pelajaran utama seperti Matematik, Sains, Bahasa Melayu dan Inggeris. Menurut laporan oleh KPM *courseware* ini tidak digunakan dengan berkesan oleh sekolah-sekolah dan ramai penyelidik menunjukkan bahawa isu yang penting adalah berkaitan dengan reka bentuk antara muka dan interaksi. Dalam konteks ini, artikel ini menganggapkan bahawa satu alasan utama yang boleh diperoleh daripada aspek struktur proses pembangunan kursus ialah mengabaikan kepentingan reka bentuk antara muka dan interaksi. Oleh itu adalah penting untuk mengemukakan konsep proses pembangunan *courseware* dari segi mengwujudkan interaksi dan kualiti pengalaman pembelajaran menerusi pendefinisian keperluan pengguna dari segi pengajaran dan pembelajaran yang lebih baik. Dalam konteks ini, artikel ini membuat ulasan terhadap proses pembangunan *courseware* semasa dan mengemukakan satu konsep baru yang dipanggil komponen komunikasi interaktif yang membolehkan pembangun *courseware* untuk memasukkan interaktiviti dan kualiti pengalaman pembelajaran dalam proses pembangunan *courseware*. Objektif penting ialah untuk menyediakan peluang-peluang untuk berbincang berkaitan dengan proses pembangunan *courseware* daripada pengguna-pengguna dari perspektif yang berbeza dalam konteks *courseware* pendidikan di Malaysia.

Introduction

Throughout the past decade, advances in information and communication technology (ICT) have affected all areas of daily life and education. In particular, emerging technologies such as the world wide web and multimedia have been changes education learning environments. In fact,

in
the current education context, the rapid advancement of this technology was plays as one of the most important roles in classrooms as interactive courseware learning especially in primary education being aware of the impact of a learning experience. In particular, interactive educational software has been used in many different applications for presenting learning content and information. These new media are expected to motivate students to learn and encourage active participation.

Inspired by the understanding that multimedia based learning and computer technology can offers a lot of advantages and potential in effective pedagogical methods by making learning more fun and more interesting, the Malaysian government has facilitated the greater adoption of information and communication technology (ICT) in education sectors (MOE, 2004) since year 1998. The Smart School Project is one of the Malaysian government's initiatives to facilitate the greater adoption of information and communication technology (ICT) and change the culture and practices of Malaysia's primary and secondary schools. It began with introducing a pilot program in 1999 to 2002 rolled out to 89 schools across the country primarily aimed to improve all Malaysian primary and secondary students' learning ability, attitudes and achievement, and enhance teachers' teaching performance by the end of 2020. Due to this initiative, 1949 interactive courseware was developed, namely Science, Mathematics, Bahasa Melayu (Malay language*)* and English and implemented by the smart school students and teachers. In the following years, the Malaysia Education Ministry evaluated this implementation among the smart schools involved. Findings from this study defined that utilization levels by the Smart Schools on the courseware provided were low and it was under-utilised by teachers and students. It was also reported that a lot of interactive courseware failed to provide a quality experience for the learners (Multimedia Development Corporation, 2006).

One of the reasons for this is derived from the impoverishment of the interface design and interaction design to the extent that many educational courseware programs have been developed without deeply considering communication and interactions between students and courseware,

between students and teachers, and between students and students. In other words, the interface design of courseware is not properly accommodating students' and teachers' needs and their interactions with the functions and as the result, the students' engagement and motivation have been gradually decreased. Furthermore, the situation in Malaysia currently does not call for the need to equip teachers with skill and knowledge but includes issues pertaining to the quality of teaching and learning. Nevertheless, to date there is only one comprehensive study conducted by Kamariah (2006) based on a total sample of 1494 which concluded that most of the courseware are more suitable for individual learning and did not have elements requiring collaborative learning activities to improved students' motivation when they are helping each other or encouraging each other to finish the given task, especially in mathematics and science subjects.

Many studies done on comparing electronic education to traditional face-to-face instruction have focused on the effectiveness of ICT on teacher-student interactions, effectiveness of different media, and student achievement, but there has not been much research on the interface design and communication design perspectives in terms of the courseware development process in which learners, teachers and courseware are connected. Therefore, a critical understanding of the concept of interface and interaction design in the development of educational courseware is required. As humans interact with computers in many ways, so creating an effective interface between humans and the computers is crucial to facilitate interaction and achieve objectives. In other words, inappropriate usage of interface design in courseware development could raise pedagogical and usability issues.

The Importance of Interface Design in Educational Courseware

Human-computer interaction (HCI) is the study of interactions between people and computers and an interface refers to where the user can interact with the computer displays appearance (Mayes, 1992). The proposed of the interface design aims to enhance the active participation of the user and to create an environment that enhances the learners' experience with the materials. A type of interactive communication within a computer interface and user is determined as a vehicle of interaction between a

machine and a human, and the interface is a communication path to the machine that allows them to interact. The development of the interface therefore requires the understanding of at least three things: the user who interacts with it, the system (the computer technology and its usability), and the interaction between the user and the system (Galitz, 2002).

In HCI, interface design plays a major part and is the key to the success or failure of the learning experience. As a crucial part of a user's experience with any piece of software, the interface become important to facilitate user's interaction. When applied into computer software, interface design is also known as graphical user interface. Currently, the usability of any educational courseware initiative can be determined by the ease with which learners can learn their chosen subject without getting lost in their learning activity and this is determined by the user interface design of the courseware material. A user interface design which is badly designed adversely affects the usability of educational courseware.

Interface design also refers to the overall "look and feel" presentation of the program that allows learners to access and make sense of the information (Norman, 2002). In other words, it allows humans to communicate with a machine (or its functions provided or experience designed). According to Shneiderman (1998), the first impression a user gets about a product is from the look of the interface. If a user can interact easily, and perform their task successfully, they will surely be pleased with the product. Meaningful learning can be achieved if learning material consists of such visual and verbal information that can be connected and integrated together with prior knowledge (Mayer & Moreno, 2002).

The greatest challenge to educational courseware developers in designing interfaces is to understand what users require from a product and how to provide effective engagement (Helen, 2006). From an educational courseware development point of view, interface design means how to provide a learning environment that encourages and motivates learners to recognize the important concepts of meaningful learning. To do this, the interface designers are required to have a basic understanding of mental models and other psychological theories and their application to the courseware design (Brenda, 1990). The designers are also able to consider

the implications of how the interface courseware influences and anticipates the target learners' thinking process during their interactions with courseware. In other words, simply knowing basic interface design concepts will not be helpful for the creation of effective learning courseware and the facilitation of learning in this electronic environment (Galitz, 2002). The user experience, or how the user experiences the end product, is the key to acceptance (Helen, 2006) and that is where user interface design enters into the design process.

Key Educational Courseware Components

Although computers and technology play an important role in educational contexts, there are still usability limitations in terms of the interactions between humans and computers. For example, the literatures in the area of e-learning argues that the quality of educational software is significantly related to its interface quality (Buzhardt et al., 2005; Cantoni, Cellario, & Porta, 2004; Hinostroza & Mellar, 2001) and many computer users particularly have trouble in learning and remembering information offered on a computer screen (Meyer, 2002). As aforementioned, a lot of educational courseware fails to meet the quality experiences expected by the learner (Dalton, 2002). A broad range of factors (i.e. technology, course structure and interface design) that can influence the quality of the educational experience in educational courseware have been mentioned in the literature (Fresen, 2005; Meyer, 2002; Council for Higher Education Accreditation, 2002). Furthermore, different software characteristics may have different effects on student interaction patterns (Cavalier & Klein, 1998; Nastasi, Clements & Battista, 1990), so it is hard to generalise the courseware development process. In addition, the level of effectiveness of educational courseware is influenced by the level of students' access to the technology, the courseware interface design, and the teacher's role (Helen, 2006).

The main elements of the effective learning environment are based on communication and cooperative learning (Hartwick & Barki, 2001). In the context of the quality of the learner experience, interface design catering for learners' possible and expected interactions is an essential factor in developing educational courseware. The quality learning experience however stipulates that there are two key components working

collectively: (1) the effective interaction and (2) the quality of interface design (Yang & Cornelious, 2004). The basic components are illustrated in Figure 1, showing a transformation of effective user interaction and interface design affecting the quality learning experience. It implies that these components must be embedded and examined in the courseware development process in terms of an iterative cycle of design process for each stage.

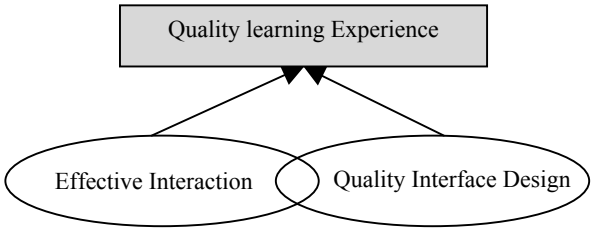

Figure 1 The basic components relationship for creating effective learning experience

Interface Design and Stakeholders

Interface design might also be considered to be the front-end of a product with which the user interacts, and which communicates with the user in some way or the other (Brenda, 1990) and becomes the most important part of any computer system because of the objects which people see on the screen (Galitz, 2002). Interface design would concern itself with the design of devices for operating a given product, and the language involved in this interaction. The aim is to make the interaction easy, simple, convenient, familiar and friendly.

Over the past few years, interface design has become one of the most important criteria for judging any software in terms of usability, functionality and user experience. Interface design take place in the context of a rich and complex process of a development software life cycle from conception to implementation and the user is the target of the information and the driver of the system (Mayes, 1992). In other words, the interface is the visible personality of the software, but it is likely to be

ignored by designers and developers. The user interface, therefore, becomes the primary factor in a user's decision to use the application in the long term. In other words, the user interface is the dimension of a solution that users see and feel; it is what ultimately satisfies or disappoints them (Galitz, 2002). Further the potential of the interface design will compete for the user's attention and provide an environment that is pleasant to work in and contributes to the user's understanding of the information presented. This means that the system and its software must reflect a person's capabilities and respond to the user's specific needs.

A generic guideline of interface design is easy to learn, easy to use, and aesthetically pleasing. A well-designed user interface is based on principles and a development process that centres on users and their tasks (Kristof & Satran, 1995). Developers however may have a different view of the product and a different skill set to the users. People who take part in e-learning can be categorised into four groups, students, teachers, developers and parents. Therefore, the positive effects of the technology depend upon the characteristics of the student population, the teacher's role, the design of the software and the level of access to technology. Characteristically, the student's and teacher's role is assumed to be a more important part of the innovations in the creation of effective learning environments. According to socio-cultural theory, in particular, the teacher is cited as a mediator of students' learning; and is involved in the continuous interaction between instruction and student conceptual change (Mason & Martin, 2000). In terms of the roles of students and teachers, there are three types of interaction within the multimedia based learning which are labelled as learner-content interaction, learner-instructor interaction, and learner-learner interaction (Park, 2008). The relevant research emphasised that the multimedia application for members' interaction should reflect the sharing effective ideas according to face-to-face communication. These interactions can be done through the interactivity of the application (Harry et al., 1993). Further, these three types of interactions play a key role in a multimedia based learning system.

Conceptualisation of Courseware Development Process

One pilot study was conducted by the researcher across Klang Valley with three different educational courseware developers who have developed some of the courseware for the *Smart School Project*. The purposed of this pilot study is to getting the overview about the general development process implemented by the courseware developer. From this pilot study, what it was defined are the development processes that implemented by them are most likely to fit into the following five design development stages (Figure 2). However, according to them, the courseware development commences with the process of definition and analysis of learning objectives and the systematic development of learning instruction. Further the storyboards proposed by courseware developers are sent to Curriculum Department desk officers for approval. Based on the storyboard approvals, the developers commence their actual courseware development and, over a period of time, the developers will be given observation reports from the desk officers for four to seven times without evaluating the quality of interface and interaction design. Then the final sign off from the Ministry of Education will be made based on their alpha version of prototypes.

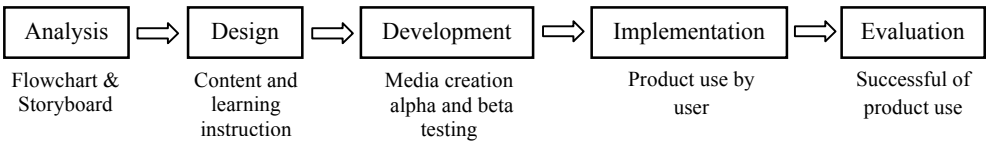

Figure 2 Generic Educational Courseware Development Process implemented by the developer

However, the process shown in Figure 2 does not reflect the iterative design cycle of prototyping, evaluating and redesigning at each stage that is recognised as important risk assessment in software development. In fact, most courseware developers are relying upon the storyboard throughout the development process which is developed based on the content provided by the Malaysian education ministry, including schools and subject matter experts. With this it can be conclude that is requires a constant endeavour to bridge gaps between analysing learners' needs and relevant design solutions. Furthermore, it also requires considering types

of learning materials, delivery formats and media and the interactive levels of target learners.

Therefore, Norhayati and Siew (2004) address that educational course development in Malaysian market is seldom related to education although the course development has grown rapidly in recent years and is mostly related to business or games-oriented applications. Furthermore, a majority of courseware focuses on teaching-learning courses, so there is a need for courseware development for students in terms of their engagement and participation (Norhayati & Siew, 2004). Halim et al. (2005) study educational courseware being utilised in the Malaysian Smart Schools in a taxonomic study related to the pedagogical, communication and media dimensions, and conclude that the 'courseware is predominately in the form of individual instruction rather than in the preferred collaborative learning format'. In other words, many courseware programs do not reflect or include the interactions of learners to learners and teachers to learners and it can be presumed that their courseware development process may restrict the possibilities of interactive learning experiences being embedded in the end-products.

As Figure 2 above shows, the development process has no room for embedding students' interactive learning experiences into courseware design. Each stage of the development process focuses on documentary outcomes rather than the end users' engagement and participation in terms of pedagogical solutions and interactive learning experiences. In particular, the courseware developers fail to prove that interaction and interface design based on interactive learning experiences have been applied throughout the development process. The current design of the courseware is predominantly information-based resulting in a directed form of instructional delivery. The cognitive processes are mostly information retrieval and memorising with little external learning resources made available. No online collaboration with peers and experts has been incorporated into the design and the interactivity is mostly of lower level interaction with the computer databases' (Halim et al., 2005).

According to Muda and Mohamed (2006), in particular, many Malaysian courseware programs failed or are not suitable in terms of pedagogical use because the development process does not integrate with the user's

interests and preferences. As a result, 'the instructional sessions at school continue to be based on textbooks, which are delivered by the teacher' (Muda & Mohamed, 2006). To overcome these issues, Muda and Mohamed (2006) suggest integrating user adaptively techniques in the multimedia courseware development process based on the diversity of the user interface approach. Muda and Mohamed (2006) explain the user adaptively techniques appropriately suggest users to system interactions depending on different users and different usage situations. However, the following model (Figure 3) created by Muda and Mohamed (2006) is not much different from the development process being used by courseware developers (Figure 2). Although the iterative design process is applied in the stage of development process, the structure of the course development is not likely to include interface and interaction design from the perspective of the end users needs.

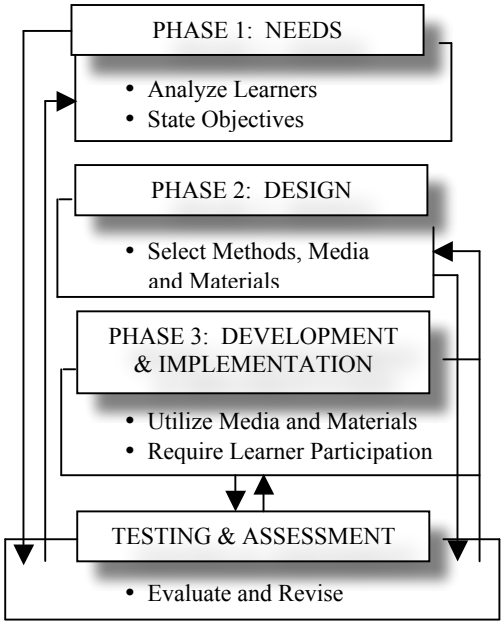

Figure 3 The courseware instructional design model (Muda & Mohamed, 2006)

Based on the courseware design model (Figure 3), Muda and Mohamed (2006) also develop an adaptive user interface courseware framework (Figure 4) that mainly consists of two components, a user model and task model. All the relevant user information will be stored in the user model whereas interactive design options will be in the task model. Muda and Mohamed (2006, p. 199) expect that the courseware framework could '...generate new perspectives in user interface design and promote a new era of multimedia courseware production...'. However, as those researchers state (p. 198), this adaptive user interface courseware framework is gone through based on the storyboard created earlier in the design phase of the instructional design model. This implicates that this adaptive user interface courseware framework may not functionally work in terms of creating quality and interactive learning experience as it is sitting in Phase 3: Development & Implementation (Figure 3) and is very much affected by the storyboard (Phase 2) created. In other words, the user model and task model based on the typical courseware development process may restrict development of interactive and quality learning experiences because of the inherent limitations of storyboard. The storyboard should be treated as an open-ended outcome in relation to each stage of the development process rather than as closed-ended product.

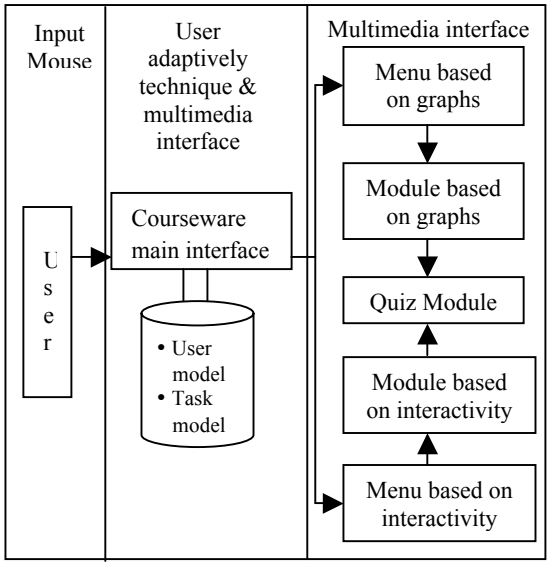

Figure 4 Adaptive User Interface Courseware Framework

(Muda & Mohamed, 2006)

With the failure and weaknesses in courseware developers accommodating the end users' needs in term of creating quality learning experiences via the courseware provided, the courseware development process can be conceptualised into two different perspectives: a developer and a learner's perspectives. Based on a review of the literature and pilot study, it is found that courseware developers, in common, develop the interface design of the courseware based on their understanding of interaction and measure the effectiveness of the courseware based on a generic courseware usability principle and methods (Figure 5). In other words, there is a possibility that quality learning experiences can be misinterpreted and which may be far from the learners' genuine expectations and satisfaction.

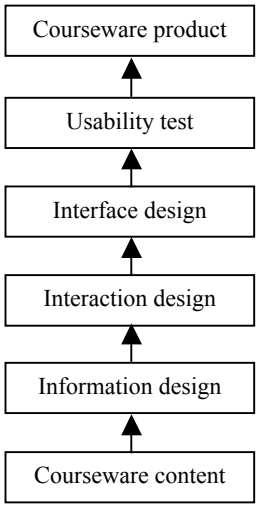

Figure 5 Courseware development process from the developer's perspective

From the learners' perspectives, meanwhile, the effectiveness of their interactive learning experience is relying upon the quality of interface design performance and it does contribute to the quality learning experience (Figure 6). Comparing Figure 5 and Figure 6, the implication are that the developers' perspectives are limited to address the interface in terms of achieving quality learning experiences of its linear process while,

from the learners' perspectives, those three design components in the development process are hardly compatible with or transferable to the concept of interactive communication design and its components.

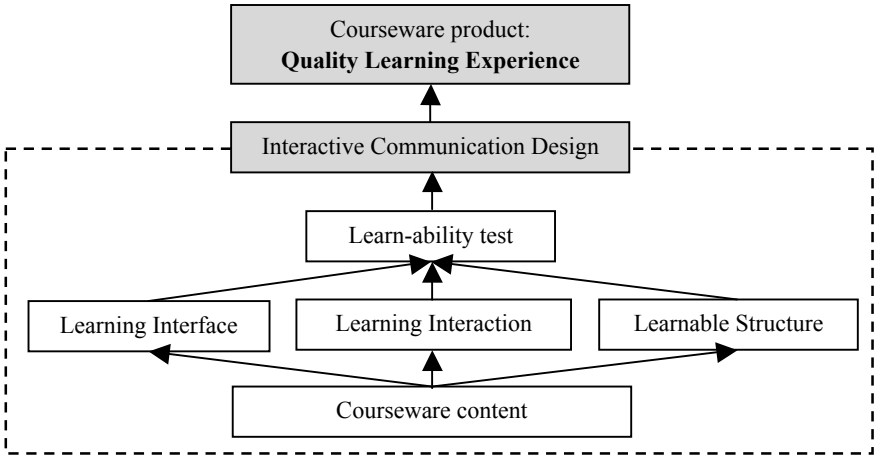

Figure 6 Courseware development process from the learner's perspective

The conceptual framework in Figure 6 shows how the design components can be placed in the development process in terms of creating a high quality of learning experience. *The concept of interactive communication design* in the courseware development process refers to an integration of the design components in terms of creating quality learning experiences, so that the courseware developer or learning designer is able to approach the design components with open-ended components rather than each closed-ended stage. In particular, the design components have to be appropriately embedded throughout the development process and all stages of the development process have to be integrated under a new concept. In doing this, the learn-ability test is required to be able to examine each communication components (learning interface, learning interaction and learnable structure) in terms of quality learning experience. Conversely, this conceptual framework requires being extended to be applicable to the real development process, and it provides the foundation for restructuring the current process of courseware development in Malaysia with the concept of interactive communication design.

It is expected that Figure 6 will enable the developers to reconceptualise and reshape the development process in terms of creating quality learning experiences. The concept of interactive communication design can lay the foundations for development of a practical guideline for courseware development. The outcomes of each stage can be examined through the concept of the learn ability test that allows the developers to evaluate courseware in terms of the learners' satisfaction and learning objectives. The learn ability test is formed through transferring the design components (interface design, interaction design and information architecture) to the interactive communication components (learning interface, learning interaction and learnable structure).

Conclusion

This paper proposes a different view of assessing the Malaysian educational courseware development process and suggests a new concept, *the interactive communication design*, which integrates various development components in terms of creating quality and interactive learning experiences. To realise quality learning experience in courseware development, it is imperative that the current courseware development process is examined, revised and integrated with all the stakeholders': learners, teachers, and the courseware developers. Furthermore, it requires developing a new method of learn-ability testing in terms of evaluating quality learning experiences in each stage and with each component in the development process rather than testing prototypes or end-products from functionality. It is expected, as a result, that conceptual frameworks and practical guidelines for educational courseware development to fit into the Malaysian educational context will be produced to realise interactive and quality of learning experiences in educational courseware.

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