Towards Developing Cognitive Process Mobile Game-Based Training (mGBT) Model

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ABSTRACT

In this study, an improved cognitive process model will be proposed which customized to a mobile game-based training (mGBT) design model. Although many game design models have been introduced, studies show that customized phases and steps to develop games for training in mobile environment are substantially required. Therefore, the study will address this gap by proposing a cognitive-process mGBT (cog-mGBT) model based on the Bloom cognitive process. The model enables a game player to access three types of Bloom knowledge by allowing game player to experience related cognitive processes that can be replicated in the mGBT via the appropriate representation approaches. The proposed cog-mGBT model can provide instructors with recommendations to Bloom cognitive processes and achieve the desired learning performance. All the results should be exhibits useful development indicators for mGBT application and provide theoretical and practical contribution of the study.

Keywords: mobile game based training, mGBT, cognitive process.

I INTRODUCTION

Games are known as good platforms to motivate people to play, interact, communicate, and learn. Many studies have been conducted that show the potential use of game in learning and training environment. Game for training (GBT) can be successfully developed and implemented in learning environment by combining both game design and cognitive process model. Currently, mobile technologies are the most popular platform for both entertainment and learning purposes. mGBT is one of these technologies which utilizes mobile technologies such as mobile phone, PDA and handheld devices for playing and learning platform. There is a possibility of utilizing mobile contents for training purposes because of few aspects such as; huge potentials in mobile contents, high demands in mobile content markets, and supports from the government (Zaibon & Shiratuddin, 2010). Not to mention, there are a lot of advantages of using games for training. Numerous aspects and types of GBT have been investigated and put into practice in a variety of fields including business (Leger, 2006), education (Dickey, 2007; Dondi & Moretti, 2007; Jong, Shang, Lee, & Lee, 2008), medical education (Mooney & Bligh, 1998), and the military (Beal, 2007, 2009; Lampton, Riley, Kaber, Sheik-Nainar, & Endsley, 2006; Northrop Grumman Technical Services, 2008).

With such huge potential, there is considerable interest from educators and technical developers in exploiting the unique capabilities of mobile technologies to enable new and engaging forms of training. mGBT is one types of m-learning and basically, m-learning combines practices, strategies, tools, applications and resources with proven advances in technologies to support anywhere and anytime learning (Wagner, 2005). The most prominent promises by mobile technologies are students can learn without restrictions to places; in classrooms or outside, with or without teachers' guidance, and during or anytime class period. Therefore three mobile criteria are considered in the proposed model namely; anytime, anywhere, and platform.

In order to take advantage of the positive aspects of mGBT, the design model of mGBT as any form of training material must be carefully and intelligently designed. Therefore, there is a clear need for a design model which not only clearly defines how to design an effective GBT, but also focuses on providing the necessary support for implementation in mobile technologies.

II PROBLEM STATEMENT

Various game design models and development methodologies have been proposed by a number of researchers and are made available in different genres of games, with each having specific requirements (Kiili, 2005; Quinn, 1994; Amory & Seagram, 2003). However, the research literatures contain very few studies on methodologies of how to develop games for learning and training (Fletcher & Tobias, 2006; Moser, 2002). To date, there is lack of comprehensive development methodologies

to create mGBT. In addition, IGDA (2005) states that embedding training content into mobile games can be complicated, because mobile games particularly training games differ from the application software (Prensky, 2003; Ciavarro, 2006). Another concerning aspect is the restrictions of the mobile platform. The aspects that are considerably important when designing in mobile environment are screen design, interaction, and software or hardware dependent (Lee, 2005; IGDA, 2005). The guidelines on how to align with these restrictions should be clearly specified in the design model, so that the game developers, especially the inexperienced ones, will put into consideration these aspects when they produce any mGBT.

In relation to certification programme, achieving information technology (IT) certification is becoming an ongoing goal for all IT-related professionals (Yang & Wang, 2009). More than 100 IT-related certifications as in 2004 (Zeng, 2004) and the number is increasing. The certification is difficult to obtain especially to young trainees as it is a comprehensive subject matter. Few projects have attempted to integrate IT certification training into various training platforms to increase the certification pass rates. For example, in Universiti Utara Malaysia the integration of IT accreditation courses with the formal curriculum is formulated. However, the learning effectiveness of such integration remains limited. Through this approach, learners do not actually comprehend the learning content. Therefore, a new learning platform is thus needed to give more attractive to trainees and that invokes motivation for learning and certification training.

Prensky (2003) stated that game for training provides learners with a more concrete experience and arouses their attention and motivation, which is particularly important for trainees. GBT can provide users with a simulation arena that improves the certification training environment because computer games are a kind of an experience-based medium. Therefore, in this research, a cog-mGBT model will be developed based on the mGBL engineering model (Zaibon, 2011).

III RESEARCH QUESTIONS AND OBJECTIVES

mGBT definitely appears to be an appropriate platform for constructing the cognitive process via the experience of a particular episode in a game scenario. Therefore, in mGBT content design, both digital content, cognitive process representation, and mobile criteria should be addressed. In this research, a reference model for mGBT content design is proposed. This framework can provide both the instructor and the game developer with design recommendations and accelerate the mGBT content implementation. This research attempts to answer the following questions:

i) What are the key issues in developing mobile game for training?

ii) Would the learning performance increase by using mGBT approach?

iii) Would the learning performance vary for different knowledge types?

Therefore, the main aim of this study is to propose a cognitive-based game design model, which may be used in the creation of mobile game-based training environments. In achieving the main aim, the following specific objectives are formulated:

i) to identify the key issues in developing mobile game for training.

ii) to formulate the distinctive components from cognitive perspective of training which are specifically for mobile game-based learning environments.

iii) to develop a cognitive mobile game-based training (cog-mGBT) model.

IV RESEARCH PHASES

In accomplishing the objectives of the study research four phases are followed; (i) awareness of problem, (ii) suggestion, (iii) model development, and (iv) evaluation. The overall process is mainly focused on developing the proposed model.

A. Phase 1: Awareness of Problem: Indentify the scope

Research problem and scope are identified by conducting a preliminary study of mobile training preferences. Besides, theories and concepts are also analyzed in the areas of game-based training models, cognitive process, mobile game development methodologies, play theories, and learning theories.

B. Phase 2: Suggestion: Formulate the model components

In the suggestion phase, the theories and concepts will be used as the basis in determining the characteristics of mGBT, indentifying components of cog-mGBT model, and specifying the mGBT learning model. Expert consultations will be conducted to identify the flow and cycle, phases and activities, and components of cog-mGBT model.

C. Phase 3: Model Development: Construct the model based on gathered components

In the development phase, the model will be developed by combining all the related components as previously found in previous phases. Model pre-review process will be conducted to some experts.

D. Phase 4: Evaluation

The model is then will be evaluated in a combination of three stages: expert review, prototyping, and group treatment experimental study; which focuses on the certification training module. Finally, results from the evaluation phase will be analyzed, concluded, and reported in publications.

V GAME DESIGN MODEL

In building and proposing the cognitive process design model for mGBT, a number of game and multimedia design model have been reviewed. The models include: Input-Process-Outcome Game Model (Garris et al., 2002), Experiential Gaming Model (Kiili, 2005), Integrated Model for Educational Game Design (Paras & Bizzocchi, 2005), The Fuzzified Instructional Design Development of Game-like Environments (FIDGE) Model (Akilli & Cagiltay, 2006), Four Dimensional Framework (de Freitas & Oliver, 2006), Adaptive Digital GBL Framework (Tan et al., 2007), Games for Activating Thematic Engagement (GATE) (Watson, 2007), and The Digital Game Involvement Model (Calleja, 2007). The above listed models are all game design models which cater to the specifications, concepts, requirements, or components needed to be included when designing GBL. Although this is the case, all of them do not suggest any process of GBT development. Besides, the models also never specify on how to develop GBT on mobile platforms. In addition to that, there are methodologies for the mobile game development methodologies such as; Best Practice for Mobile Game Development (Dholkawala, 2005), Scrum Methodology (McGuire, 2006), Game Development Methodology (Dynamic Ventures, 2007), Game Life Cycle (Janousek, 2007), and Design-Protect-Build-Test-Market-Sell (Edwards & Coulton, 2006). These methodologies suggest the phases and methodologies for developing mobile games but are not specified for GBT. The drawbacks of all of these methodologies are (i) phases are generic in nature, and (ii) are not suitable for mGBT as there is no cognitive process model or learning theories considered. Most of the methodologies are guidelines and general approaches for developing mobile games and not mGBT.

VI UNITS OF MGBT

When referring to a mobile game-based training, it is similar to mobile game-based learning. Therefore, mGBL engineering model proposed by (Zaibon, 2011) is referred. The mGBL engineering model comprises phases, components, activities and deliverables for the development of mGBL application. It is divided into two layers, where the first inner layer is called as general phases; pre-production, production and post-production. The second layer consists of components to be included for each respective phase. The engineering model includes components namely: (i) Requirement Analysis & Planning, (ii) Mobile Interaction & Technical Analysis, (iii) Learning Content Design, (iv) Game Features Design, (v) Learning Content Development, (vi) Game Assets Development, (vii) Coding & Core Mechanics Development, (viii) Game Features Integration, (ix) Game Porting & Deployment, (x) Playability, Usability & Mobility Testing, (xi) Educational Testing, and (xii) Distribution. These components are flexible and iterative, which can be customized based upon developer's preferences. These components are also mapped to the AI four stages: i.e. discover, dream, design, and delivery.

The model as seen in Figure 1 is enhanced by integrating with the cognitive processes through the mGBT content design. The integrated cognitive process are "remembering", "understanding", "applying", "analyzing", and "evaluating" dimensions. These dimensions should be considered in learning content design and development (Wang & Li, 2009). Here, the main tasks are specifying the subject domain, defining learning outcome and objectives, designing the learning content, and specifying the mGBT characteristics. The subject domain could be a certification training module as to be included in the game. When the subject domain has been chosen, the training outcomes, objectives, and contents should be specified and designed. Developing training content means writing the details of the content that will integrate in the mGBT. The learning content should align with the game play and game tasks. In game, it can be a wide variety of interactivity, challenges and exploration in mGBT environment. At this stage, all training contents are properly and clearly described to be associated with the play and flow of the game.

In addition to that, here are some useful considerations to develop the learning content (Reigeluth, 1999; Reigeluth, 2008) that can be applied for mGBT training content:

- Establishing objectives for the training content.
- Selecting the most appropriate training content based on game play.

- Creating usable and appropriate content to meet mGBT objectives.
- Getting content experts help to be referred to.
- Maintaining and continuously improving the training content.
- Integrating training content into game play.
- Creating the training contents that are balanced with game play and give variety of challenges.
- Considering that overall training content should not be in a formal and complex ways.
- Providing information that makes it easier for leaner to navigate in the game and understand the learning objectives.
- Using simple and direct content styles which suit for the mobile technology restrictions.

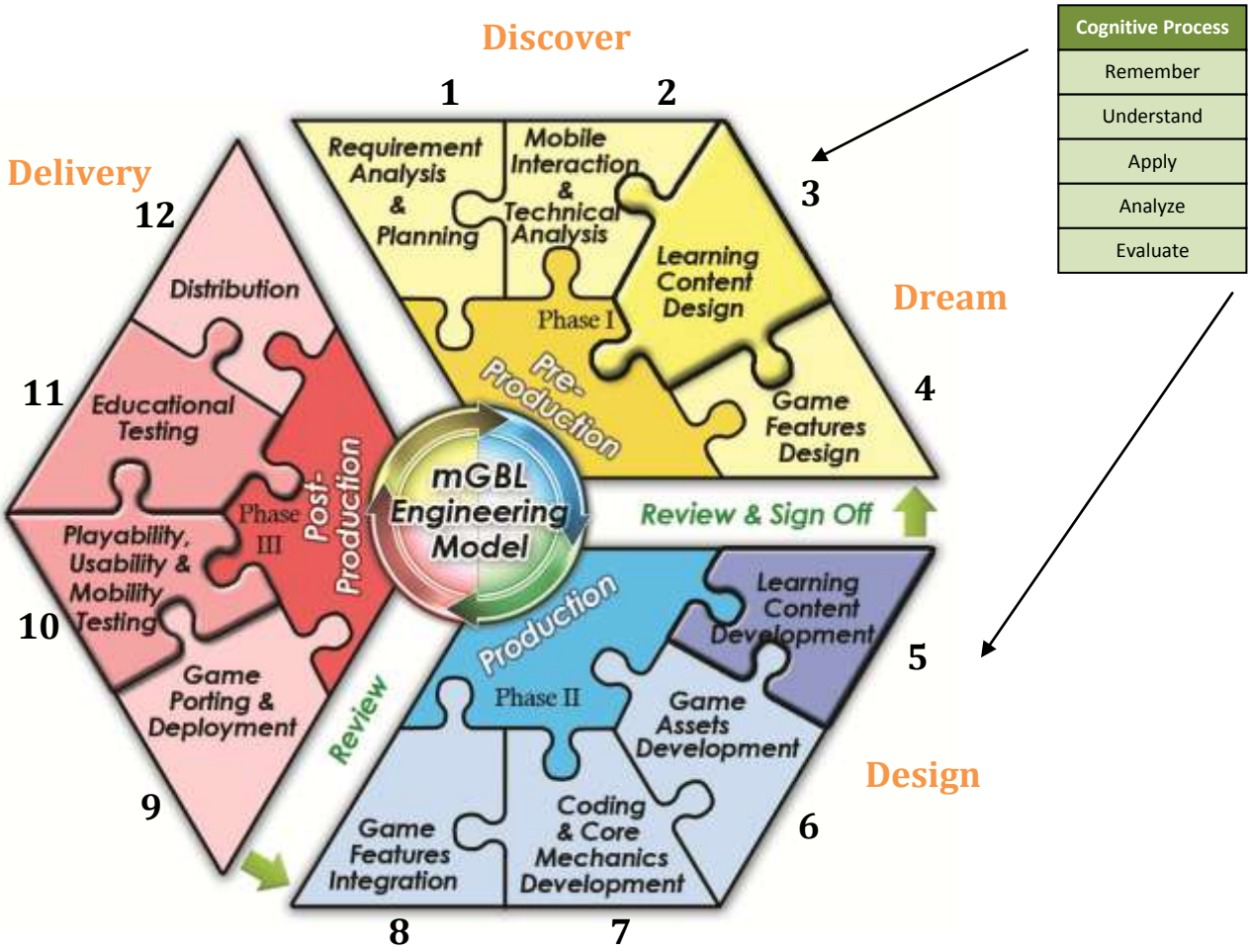

Figure 1: cog-mGBT model based on mGBL engineering model (Zaibon, 2011)

VII CONCLUSION

The aim of this study is to propose a cog-mGBT model which includes phases, components, and activities for developing mGBT application based on cognitive process in developing training content. The proposed model replicates the mGBL engineering model which has its unique characteristics as it provides specific guidelines on developing mGBT encompassing various theories and concepts, such as learning theories and approaches, play and game theories, and specific to certification training module. In addition, this study identifies key aspects for consideration in mGBT development such as cognitive process, learning models, and mobile technical specifications. The model with its related concept could be significantly utilized for future research by academics, training centres, future mGBT development by industries, and future instructional development by instructional practitioners.

Consequently, this study contributes generally to the body of knowledge which covers game design as well as instructional design area. In this way, the study closes the knowledge gap identified in the problem statement. This study is also significant because it explores mobile training through game that has the potential to improve and revolutionize training for the next generations of trainees and trainers. Studies have shown that the "Net Generation" of students are not interested in

conventional learning instructions. They require interactions with the contents frequently and quickly, and have exceptional visual literacy skills (Oblinger & Oblinger, 2005; Prensky, 2003). These needs are catered for in the model.The proposed cog-mGBT model can provide instructors with recommendations for cognitive processes and achieve the desired learning performance. All the results should be exhibits useful development indicators for mGBT application and provide theoretical and practical contribution of the study. In future, the model is planned to be evaluated in a combination of three stages: expert review, prototyping, and group treatment experimental study; which focuses on the certification training module. The specific certification programme will be utilized for the evaluation purpose.

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