

A Review of User Experience (UX) Frameworks for Educational Games

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Abstract. User Experience (UX) is a part of Human Computer Interaction (HCI) and have been a topic of discussion among the researchers in current age. UX research is vital to understand how users react or experience with a particular system both from users and systems perspectives. This study explore about the UX design of educational games (EG). Educational games have attracted many researches due to its popularity among the younger generation. However, its consumption among students and schools are still very much lacking. Thus it is important to understand the design issues that may contribute enhancement of user experience while using the applications. This initial study review and discuss several UX frameworks for the purpose of educational games UX design evaluation. Knowledge of UX design for EG will benefit the games designer for helping them design a better game.

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INTRODUCTION

Popularity of computer games usage has vastly grown among the people despite their age and gender [1]. In addition to that, rapidly growing technology worlds have given the user's unlimited access of games through smart phone, mobile phone, PDA or handheld devices and etc. anywhere anytime. A study shows that for the past 40 years, computer games have become a very favorable past time activity and lately there has also been attention in using serious games to aid in attitude, behavior change and skill acquisition as well as learning [2]. In line with this, now education researchers are in pursuit of exploring the pedagogical potential of computer games [3].

Educational games can be describe as games technology for learning and teaching purposes which includes the content of specific subject intended to meet desired learning results for students [4]. Besides that, educational games also have opened a new door of learning with fun and excitement. Studies of using games for learning have shown evidence that students are captivated with the idea and they believe that learning with

games can aid them better in learning especially with the fun factor. [5]. Computer games, being producers of rich and immersive HCI experiences, are able to prompt a complex patterns and mix feeling of emotions of the player [6] and the key focus of the User Experience (UX) movement is on the experience of interaction of the users with interactive products [7].

From early game development period, there have been user experience evaluation performed. [8]. Modelling users' experiences is especially important for predicting, understanding and identifying the processes of UX with values for software design. In addition to that, the game should be custom-made to individual players' affective response patterns, not certainly noticeable, yet the game version should be fast as well as with adjustable game elements, the affect-based contact should be rich in terms of game context and player input [7]. However, there are still issues pertaining to UX modelling remain to be fixed [9]. Therefore, there is a need to help game designer and researchers in identifying the proper user experience model so that they do not have to waste their energy and time in doing similar or repetitive research to identify the proper way to evaluate UX design.

The aim of this paper is to review the available user experience frameworks for the purpose of educational games UX design evaluation. This section includes the background of the present research, research approach and its aim. Section 2 highlights on User Experience definition followed by section 3 which focuses on the discussion of available user experience models. Nevertheless, not all the available frameworks will be covered as only few of the closely related to the topic will be selected for discussion. This section also briefly discuss on the process involves in the frameworks where several main factors are identified as well as some of their weaknesses and strengths. Last section is the conclusions and future work of this paper.

DEFINING USER EXPERIENCE

There have been various definition or explanation on defining user experience. The term 'user experience' is linked with a different range of meanings [10], ranging from traditional usability to hedonic, beauty, affecting or experiential features of technology use. Based on ISO 9241-110:2010 (clause 2.15)[11], user experience is explained by means of a person's responses and perceptions that result from the use and/or anticipated use of a system, product, or service (for briefness's sake, hereafter the word "product" refers to system, product,, and services)[12]. Table I summarizes some of these definition among the many different researchers.

Based from the Table 1, User Experience is described as a feedback, feelings or response of user(s) based on the interaction with a products or systems.

TABLE (1). Summary of User Experience Definitions.

NO	Source	Definition
1	[13]	User experience of a product is knowledge, implicating that a user's skills, personal, previous experiences of same products, and expectations of the user's perception of the new product.
2	[14]	UX is a sequence of events for a user's interaction with the software product.

3	[15]	The shift of emphasis in the field of HCI from usability engineering to a much richer possibility of user experience where users' emotions, motivations, affects and values are given as much, if not more, consideration than ease of use, ease of learning and simple subjective fulfillment.
4	[16]	Understanding tasks, users and the setting in which the product is used, are important issues of the achievement of the product design.
5	[17]	The quality of a user's interaction with the product is judged based on the usefulness, usability and the level of satisfaction, whilst interacting with the product.

Another study [18] present ten dimensions that can be used to characterize both positive and negative aspects of UX. Five aspects are related to the product itself (functional, usability, physical characteristics, informational and external characteristics), the other five aspects are related to its users (perceptual, cognitive, psychological, social and physical). User experience idea incorporate factors like effectiveness and efficiency with extra criteria like attractiveness, aesthetics or joy-of-use [19]. Based from the variety of user experience meanings, user experience goes beyond ordinary functionality and usability aspects of products by combining the users' emotions and feelings in the direction of these products during or before interaction [20].

RELATED WORK

Several studies have suggested user experience model in educational games, [21] developed a basic qualitative research design which is accepted as the research method. From their studies, they have highlighted five motivating factors in user experience modelling which are type of control, update, challenge, content and fun that provoke students to constantly engage with the digital games.

According to a study [22], the following phases are used to structure the overview on methods for evaluating user experience in games:

TABLE (2). Phases on Evaluating UX by [22]

Phases	Description
Concept	Primary game idea and first production of concept with documentation.
Preproduction	Development of production plans, description of game design, guides and technical design document.
Prototype	Initial working piece of software which exhibit game related to general UX.
Production	Development of programing period.
Localization	Game will be customized according to the tastes of market integrated with local regulatory authorities.
Alpha Phase	Evaluation on games will be applied in this phase.
Beta Phase	Bugs fixing phase and fine-tuning to improve overall user experience.
Gold	Game will be sent to be manufactured.
Postproduction	Productions of new versions of the game which includes updates and patches at the same time improve the user experience of the game.

One of the UX framework was introduced by [23] known as player experience (PX) framework which is a user experience in the specific context of digital games. The PX

frameworks is build around three layer aspects which are the technical game system experience (including the operational and perceptive effect of experience) and reaction of the player as well as the perspective of the game. This framework can be complicated over time as these three PX factors will change their interactions and independently model the connections among them and hence model the gameplay experience.

It is challenging to determine future experiences but it is possible to build upon prior experiences thus they have to handle the PX framework as a black box of consequences that track back the actions that applied at the current point of time (Figure 1).

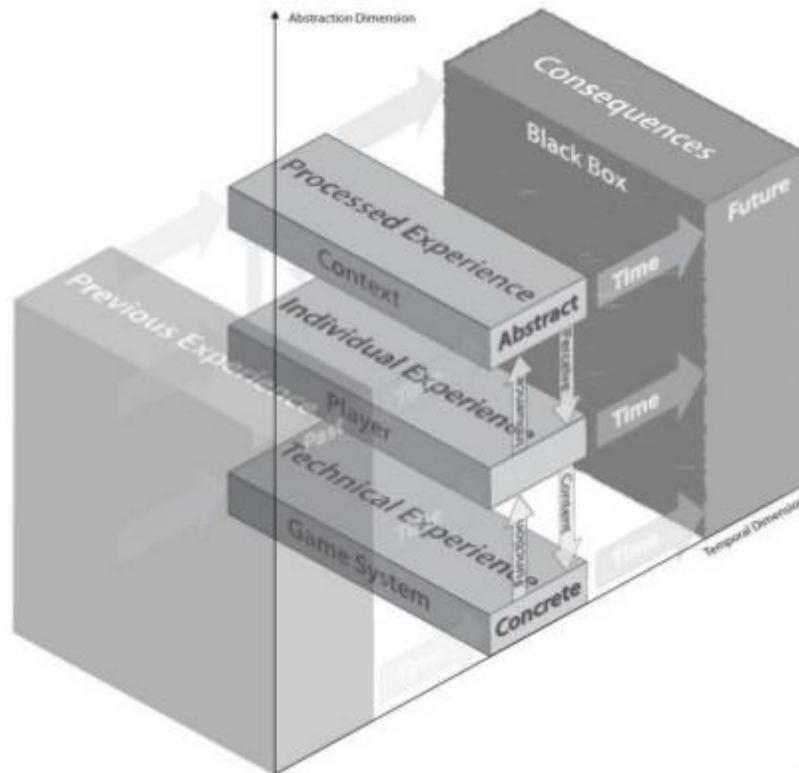


FIGURE 1. The PX framework overview [23].

Aside from that, [24] have developed mobile game based learning (mGBL) engineering modal which describe an organized method that contains methods and processes for the progress of mGBL (Figure 2). The development of the game was divided into three phases (Pre-Production, Production and Post-Production). The design phase which is the production phase included processes such as learning content development, game assets development, coding and core mechanic development and game feature interactions. In order to fulfil the needs of user experience evaluation, the authors have used a demographic approach as the game was developed with 1Malaysia concept with Malaysian cultural aspects. Heuristics evaluations are used to evaluate the application with 64 respondents completed the 5-point Likert scale questionnaires. The four main characteristics that was evaluated was Game Play (GP), Mobility ((MO), Game

Usability (GU) and Learning Content (LC) with 4.025 average score. Moreover, this framework was merely focus on mobile application rather than overall digital application.

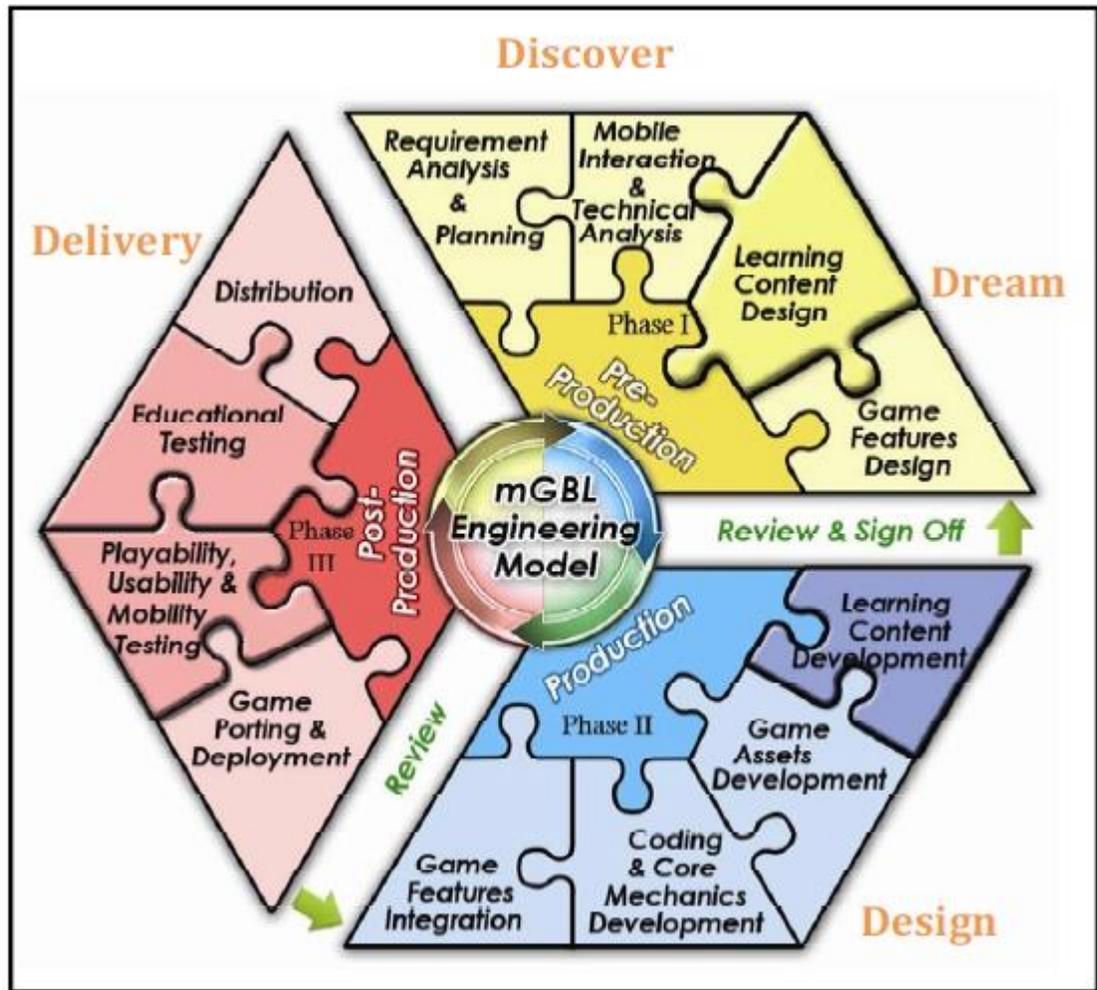


FIGURE 2. Mobile Game Based Learning Modal [24].

On the other hand, [25] introduced three layer framework of Game Experience (GX) for serious gaming which include learning game (Figure 3). Game experience is known as the player-game interaction and their focus was put on the technical metrics and physiological aspects of the game evaluation. Three methodological categories for experiences that frame digital games are identified: the quality of the product (game system experience), the quality of human-product interaction (individual player experience), and the quality of this interaction in a given social, spatial, temporal or other context. Game system experience is the overall functional level of the game system, in the meantime game engine and player experience methods focus on evaluating the emotional or cognitive effect that a game have on a player. Apart from that, this context experience methods are suitable for studying the interaction of player in a co-present or co-located game environment. This framework basically covers all aspects and suggested

all available testing to be conducted. Cost and testing equipment availability will be few of the concerned part whether this framework will be a favorable framework.

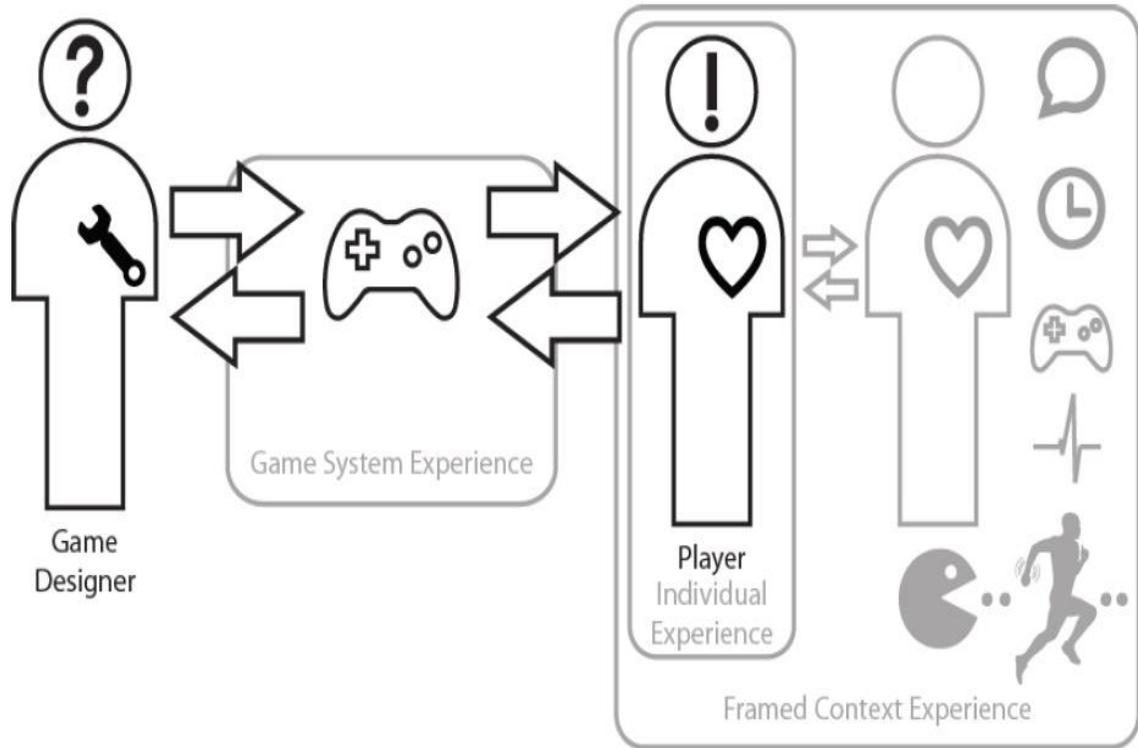


FIGURE 3. Three methodological frames of gameplay experience in the game development process [25].

A similar approach was made by [26] in proposing three layers of abstraction game experience modal with the game system's playability, the player experience emerging over the connection with the game system and the related gameplay experience formed by the interpretation of external and internal influences (Figure 4). This modal give enough room for future extensions by integrating with previous research. The authors believe that in future there is way to build a refined modal by using more mixed-method data on player experience in different situations. This was supported by [27] whereby they believe that a multi-measure approach allows a fuller description of game experience than any single inaccessible measure, hence preparing us to the rich scale of experiences allied with digital games.

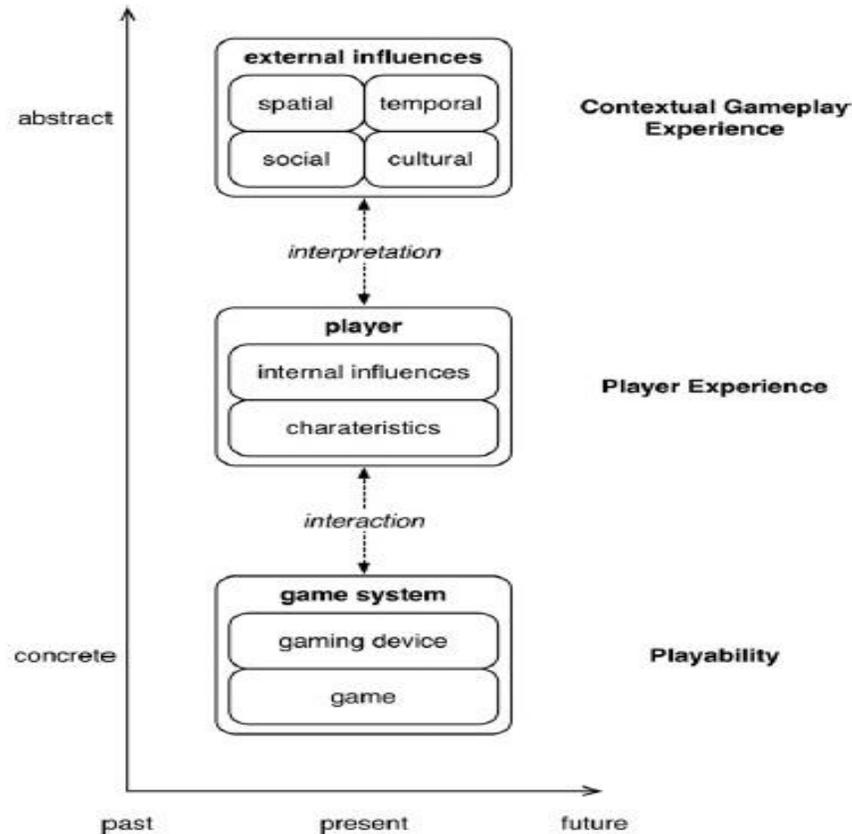


FIGURE 4. The gameplay experience model [26]

CONCLUSION AND FUTURE WORK

This study undertaken as it is relevant to the current as well as future needs of a good educational game industry. A suitable User Experience (UX) modal will ease the game designers work as well as contribute to an effective educational games. As mentioned in this study, user experience plays an important role to make products of the games more reliable and efficient. Thus through this paper, some reviews are done on previously defined User Experience (UX) modals to identify the most approachable way to evaluate UX design for educational games. Based from the reviews, it is clearly shown that a multi-measure approach is among the most advisable approach for educational games User Experience (UX) design evaluation. As for the future work, it is a need to design a proper single framework which incorporate all the important elements discussed in this paper for an ideal evaluation of educational games User Experience.

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