

# Theoretical Framework for Edutainment – The Cognitive Engineering

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*Abstract:* - In this paper we present the theoretical framework for the cognitive development of children with focus on mathematical concepts in a creative environment called 'edutainment'. Within this framework, educators will acquire new roles that will allow them to be creative and innovative in incorporating the learning outcomes that are required in the curriculum. The potential advantages of this research will also be described. It is hoped that this research will serve as the basis for the game developers and educators around the world to create a more effective learning environment for the children.

*Key-Words:* - Edutainment, Theoretical framework, Mathematical concepts, Cognitive development of children, New roles of educators, Potential advantages.

## 1 Introduction

Edutainment can be defined as "a place where children could enjoy what they learn with a combination of many mediums (sound, animation, video, text and images) by simply using a computer mouse to point and click on a particular picture, word, or button; and stories as well as information that will come alive on a computer screen" [1]. It usually exists in the form of educational games. Computer games are undoubtedly motivating, thus the intrinsically motivating nature of it should be utilized by using this medium for educational purposes, as it is no secret that motivation is the key to education. Conventional techniques of design in computer games normally use programming as the ultimate task for developing computer games. In this framework, the development of edutainment for developing computer games for kids will spearhead towards educators. The development of this environment will lead the users to build an application towards a distributed resource available to a group of children. The aim of this software is to be used as a tool for non-programming-background

users especially educators for preschool children to develop computer games or widely known as electronic educational games. Furthermore, it will identify the needs for the use of diverse media elements and accommodating different skill levels in interface controls.

This framework is suitable for non-programming-background users by using the concept of WYSIWYG (What You See Is What You Get). The development of edutainment environment is intended to implement technological innovations in education [3]. The goal and design principles of this environment emphasize on creating applications that provide common and transparent technology to learners.

## 2 Problem Formulation

From the empirical study that has been conducted [2], it has been found that all of the computer games selected in the study, whether the local products or foreign ones, lack some of the parameters used for

evaluation especially the 'ready-made' content that is cognitively inappropriate for children ages 5-6 as the research subjects. Hence, the educators would be left with an option of reproducing them again in order to achieve the required learning outcomes which is almost impossible to be done and require much effort and technical knowledge, not to mention the amount of time to be spent in rebuilding it. Thus, the proposed framework [3] has the advantages of merging technologies between education and entertainment which is suitable for educators to use for the cognitive development of the children and easier handling whereby in 'one-page', they can manipulate the course as required by the educational environment. Educators should not spend an excessive amount of time learning to use the technology.

### 3 Problem Solution

The design framework is based on the design factors of motivating electronic educational games for children and evolved in the context of observations and reflections made in this study. There are four factors that reflect the design of the edutainment environment that are considered as the best practices for game design that can affect children's learning that must be viewed collectively and not considered in isolation:

**Storytelling:** It is found that situating a subject learning in a computer game environment brings greater relevance to the subject for children. In the interview with the educator, she was much concerned with the content or storytelling element of existing edutainment products. There is no single product that satisfies the educator's requirements as well as fully adapts to children's needs. For instance, although Junior Express Maths Year 1 (JEM) [6] covers all of the learning outcomes required in the curriculum, it was presented in a 'drill and practice' method which can have detrimental effects on children's creative abilities as it is the type of product that is considered as 'non-developmental software' [7]. The learning concept must be embedded thoroughly to provide an environment in which children find learning a subject especially mathematics to be meaningful and useful.

**Challenge:** During the interview, children showed that they liked the challenge in the games. The research showed that the degree of challenge children asked for corresponded to their individual abilities; they needed to face a challenge, but not

one that was beyond what they could handle. They particularly liked games that would progressively become more challenging. They often became quickly bored with activities within games, which were repetitive. As they mastered a certain level of difficulty that exists in Jump Ahead Maths Year 1 (JAM) [8], many children would want to immediately move on to a new challenge. Children need to be constantly challenged and seem to thrive on it. They enjoy learning mathematics in the context of a fun challenge. Most of the games provide children with a goal or a set of goals to achieve that can make the games challenging. For instance, in JAM, the ultimate goal is to return Frankie the dog to his normal size or in some of the parts in Mathematics 1 (MT) [9], the goal is to finish the game or, as children put it, to 'beat the game'. In addition, throughout all the games, there are also intermediate goals such as finishing a puzzle, advancing to a higher level in the game, and increasing one's score. It is noticed that such goals could create a sense of mission in children and often they would stay on until they could finish the games. Often the four children who played the games as well as the other children who have no opportunity to get their hands on the games begged us to allow them to play the games during recess periods so that games like JAM can be mastered or finished. In answering the question of attaining the goal, many children expressed that they enjoyed it because when there is a goal to accomplish, they would get excited after accomplishing it and that with a goal 'you have something to look forward to'. Accomplishing the goals of educational games can provide children with a sense of success. For example, the children playing MT keenly kept track of their score in each section and how far they had advanced through the game as measures of their success. A particularly interesting instance was when some children became very excited upon advancing through the farthest in the adventure of JAM or reaching a score point of 100 in MT. In this research, it is also found that children want and need to be successful in the social environment of their class. Therefore, we should place them in environments of learning that provide this sense of success. An important factor in feeling successful is how children perceive their mistakes. Since children could recover from their mistakes in the games through the mechanisms without forfeiting much, they would not feel threatened by making mistakes. Rather, mistakes became stepping stones for later success in the games allowing children to progress at their own pace towards the ultimate goal.

**Interactivity:** In the observations of children playing the games, interactivity is a factor which could make the game a cognitive artifact for them. Most of the children demonstrated the enjoyment that they could interact with the mathematics embedded in the games and the ease of using the input devices. For instance, when interviewed regarding this parameter, some of them said that they liked the interactivity because as compared to the text or workbook, 'it cannot talk to you'. This interactive learning process helps children develop a sense of the mathematics they are learning. Educational games like JAM and MT also provided the children with concrete, external reference points by which they could communicate their thoughts. Children need such cognitive artefact to motivate and allow them to express their thoughts about a subject, even if the expression is game-bound.

**Interface:** Many children liked playing the games because of colourful graphics, nice images, animations of their favourite characters together with elements of sound effects and background music. It can be seen that for children, such sensory stimuli add to the fun of playing the game and make the learning more enjoyable and memorable. Hence, having an attractive interface in educational games can create an environment in which children get excited about the embedded learning concept and, therefore, are willing to be immersed in it and spend time learning it. In the interviews with children, many of them made comments such as they are having fun with the games especially while playing JAM and MT. In order to stimulate children to intensely think about a learning concept, they need to be put in learning environments, which attract them and allow them to experience the joy of learning it.

Motivation plays a central role in any learning activity [10]. By playing educational games that are developmentally appropriate, children's psychological needs [11] can be fulfilled as these games can provide a 'fun' and 'play' experience, thus can be motivating for the children to learn the embedded learning content. Based on the study that has been performed, a framework for edutainment environment is refined. In this study, the framework has been made based on the difficulty in helping children to learn in two domains:

Motivation - to motivate them to want to spend time and engage in learning activities and  
 Psychological needs - to aid them cognitively to construct knowledge.

On the other hand, the best practices for game design also have the influence in assisting children in their learning. Although initially, from literature review alone, the researcher concluded that the best practices for game design are meaningful content or storytelling and use of interactivity as a cognitive artifact, attractive or nice interface and challenge driven mainly by a goal are also the best practices for game design drawn from this study. The advantages of information technologies such as multimedia applications that are used extensively in games development can be utilized to perform the edutainment environment. This environment can be designed in one screen that hides incredible programming behind a simple façade for educators to build their own educational games for children. It can also be used to spearhead the content development of the edutainment environment for developing educational game.

According to Prensky [12], tools can be included in games either as an integral part of the game play (to build own environment) or as supplements (design own characters or new levels). As such, game designers need not be concerned about the content but could focus on other best practices for game design namely interactivity, interface and challenge. By having the tool for this purpose, the users (educators) could put the content or storytelling element in whichever way they like without requiring them to have good programming background or technical knowledge. It is believed it could resolve the problems faced with existing edutainment products especially with regards to the incomplete or unsuitable content area. In this edutainment environment, educators will play these roles :

**Motivator** - The educator as a motivator is one of the main factors that can contribute towards a different style of learning. The environment can be used to focus the student's attention on what needs to be learned. Hence, the educator should have an idea or incentive to motivate the student to learn.

**Content Structurer:** - The best-organized material makes the information meaningful to the students. One method of organization includes relating new tasks to those that they've already known. Other ways to relay meaning is to determine whether the student understands the final outcome desired and instruct them to compare and contrast ideas. Educators should focus on the creation of the content structure so that they can tailor towards the goal, which should be realistic towards the student's readiness or progress towards goal.

**Debriefier** - Educators should help students reflect on what is being learned, which forms part of the learning process. In this part, the question of ‘how do you accomplish this?’, ‘what are the steps to get into the next level?’ and so on will have not be answered by them. They will act more of a facilitator than purveyor of knowledge.

**Tutor:** An educator should act as a tutor, to be able to customize and individualize learning to each student’s diverse learning style. In this new style of learning, it is one of the great opportunities offered through the combination of education and entertainment technology.

**Producer/Designer** – By having such tool for game creation, educators can be creative producers or designers. This is the most crucial role for an educator and an important aspect in preparing today’s educators. It is contended that they have the ability of being a motivator, content structure, debriefer and tutor but to be a producer or designer, they must be trained to use such tool whenever available.

As playing together is better than playing apart, collaborative play is much encouraged among the children as ‘end user’ of the final output. In the local context, with the setting up of the Multimedia Super Corridor

(MSC

[http://www.mampu.gov.my/EG/EG\\_MSCFlags.htm](http://www.mampu.gov.my/EG/EG_MSCFlags.htm)

), smart schools project has been identified as one of the seven flagship applications for implementation. The teaching-learning approach is changed with the use of multimedia technology to support the practice of self-accessed, self-paced and self-directed learning. The information technology supported activities introduced in smart schools comprise the educational games. Although primary and secondary schools are involved in the smart school project in Malaysia, the pre-school children are exposed to this new educational environment to prepare them ahead before entering smart schools later on especially in the subjects that are taught in English i.e. Mathematics and Science.

There are several potential advantages in the design framework for edutainment environment that has been refined in this research :

It addresses the difficulty for the children to learn a subject matter by fulfilling their psychological needs. Hence it can increase motivation that is known as the key towards successful education

The best practices for game design to be addressed by game designers include content or storytelling,

interactivity, interface and challenge. However, within this framework, they need to focus on creating a tool instead of the actual game and therefore need not be concerned of the learning content or storytelling element which they are not familiar with.

The educators can acquire the five new roles namely motivator, content structurer, debriefer, tutor and designer by implementing this framework. This will increase their skills and creativity in an effective edutainment environment

By implementing this framework, there will be no concern of having to purchase whichever edutainment products that might be suitable for the children’s learning capacities. It will be more cost effective as well as benefits to be gained by educational institution at large.

## 4 Conclusion

Merging technology in education for the cognitive development especially in subjects like Mathematics is not a simple task. The implementation of this framework requires a long-term study and takes time to accumulate results. The future works will involve pilot project with the prototype to be developed and tested on the targeted users.

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