Mobile educational apps for children: towards development of i-CARES framework (pre-print copy)

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Abstract

Mobile devices have becoming a new phenomenon not only among adults but also children of all ages. Children use these devices most frequently for entertainment purposes especially to playing games easily downloaded via online mobile app distribution stores such as Google Play and Apple’s App Store, more than for its educational purposes. Consequently parents and educators in general are concerned with the impact of this phenomenon – or mobile apps addiction – among their children. This is due to the inappropriateness of the apps content and graphics for their growing children. What is much needed is educational-appropriate mobile educational apps suitable for children. This paper discusses i-CARES, a five-phase framework detailing proposed sequential processes of selecting, categorizing, reviewing, evaluating and synthesizing variety of mobile educational apps for children. The framework was based on two theoretical models that is Howard Gardner’s (1993) and Jean Piaget’s (1928) theories of Multiple Intelligences and Stages of Development from birth to the age of 12. Each stage of the framework consists of specific processes and tangible outputs to inform the selection of the apps. The i-CARES framework is intended to act as practical guidelines for parents and educators alike to make informed decision in utilization of any mobile educational apps.

Introduction

Mobile computing devices such as iPad, tablet computers, netbooks and smartphones have become a social phenomenon in today’s society. It is not uncommon to see children of all ages as early as preschoolers to teenagers walking around with these gadgets in their hands. They use the gadgets not only to communicate with their friends and acquaintances, but also to organize their daily activities from planning on what movie to watch during the weekends to buying things online (Yusop & Sumari, 2013).
Because these mobile devices have become part of children’s everyday activity and lifestyle, it is quite impossible for parents to prevent them from using the technologies. Instead parents should take control over the type of mobile apps including games that their children are playing with. Mobile apps in this paper refers to various software applications designed for and downloadable to mobile devices such as smartphones, computer tablets, and iPads, among others.

Whilst there are thousands of apps available in the market today, choosing the most appropriate ones for children to use and play with is problematic. This is because some of the apps such as games-based apps are very entertainment-oriented and lack of its educational impact on child cognitive and attitude development. Moreover some apps are unsuitable for specific age of the children which may result in issue with content appropriateness or to some extent graphic appropriateness. Violent games for instance do not have much, if not any, educational values for children to learn from and are definitely unsuitable for younger children.

This paper proposes a design and development approach to help parents and educators in choosing suitable mobile educational apps for children from birth to 12 year old. This approach focuses on the five crucial steps parents and educators should apply based on two main theoretical constructs: Howard Gardner’s (1993) Multiple Intelligences theory and Jean Piaget’s (1928) Stages of Development theory. Both theories are discussed in the following section.

**Literature review**

We propose that selection of suitable apps needs to adhere to physical, emotional, cognitive and skill level of the individual child. In this paper, the review was based on Piaget’s (1928) four stages of child development theory and Howard Gardner’s (1999) Multiple Intelligences Theory.

The Multiple Intelligence web-based learning has the very positive effect on overall students. Grounded on this basis, this research discussed the application of the theories as well as its development and design, in the hope of achieving effective "individualized" learning. With this in mind, learning oriented web sites are to be brought into full play, instead of being limited to simply dazzling sound and visual effect or plain text (Zang & Kung, 2004).

Cabada et. al. (2008) created four different instances corresponding to four different student learning styles: Visual/Spatial, Logical/Mathematical, Verbal/Linguistic, and Musical/Rhythmic. They presented an author tool to facilitate the creation of adaptive learning material to be used in handheld devices. The adaptive material uses a pedagogical approach based on Multiple Intelligences and Fuzzy Logic Theory. The main contribution is a new author tool which allows instructors to systematically build tutoring systems for groups of mobile learners; everything under a graphic and visual environment. Another application of Multiple Intelligence Theory presented by Zuo et. al (2007), hope to realize human's full scale development on the basis of obtaining knowledge through game-learning.

Subsequently, the early roots of Constructivism are from the educational theories of John Dewey and Jean Piaget (Brown and Green, 2006). Dewey set the foundation for constructivism by finding inquiry
to be a key part of learning. Piaget’s theories also helped to shape constructivism with the key concepts of assimilation, accommodation and schema. Combined, these theories constitute the beginning of the constructivist learning process by focusing on how learning is processed and structured (Neo, 2007).

Cognitive developmental research has had a great impact on the constructivism movement in education and educational technology. Piaget’s cognitive theory and derive an inquiry-training model from it that support a constructivist approach to teaching and learning. The theory contributed to the design, process and development of constructive e-learning environments. Gillani (2010) presented the Web as an appropriate instructional delivery medium to apply Piaget’s cognitive theory to create e-learning environments.

**Development of i-CARES framework**

i-CARES is a linear systems design consisting of six developmental stages (Figure 1). It is the process of defining and developing systems of mobile educational app for children to satisfy specified requirements of parents in selecting the appropriate mobile educational app for their children. The Process Design of i-CARES concerned with how data moves through the system, and with how and where it is validated, secured and/or transformed as it flows into, through and out of the system. At the end of the systems design phase, documentation describing the six sub-tasks is produced.

![i-CARES system design](image)

**Figure 1 i-CARES system design**

The flow of i-CARES production process began with identifying the appropriate educational apps for the children ages 0 to 12 year old. A careful selection of the educational apps was based on three
important criteria in choosing educational apps for children. Educational traits and values are put forth as the initial criteria in selecting appropriate educational apps for children. Furthermore, the highlight was preparing children in becoming 21st century learners. Thus, producing effective instruction via integration of technology and media in education can aid educational process for 21st century learners.

Nonetheless, i-CARES considers Piaget’s four stages Child Development theory essentially useful in developing the educational mobile apps for children. The sensorimotor stage (birth to 2 years) allow children to explore the world around them with their sensors and motor skills. Preoperational stage (2 to 7 years) is the development of speech and symbolic activities, numerical activities, increased self-control and ability to delay gratification. Concrete operational stage (7 to 11 years) increased their abstract reasoning ability, can generalize from concrete experiences and able to perform conservation tasks. Formal operations stage (12 to 15 years), they form and test hypotheses, organize information and reason scientifically and able to show abstract thinking with symbolic materials. However, the identifying stage in i-CARES considers the formal operation stage merely at the age 12.

The language aspect is nevertheless, significant in developing educational mobile apps for children. English as an international and globally used language was chosen as the medium for communication throughout the process. Clear, concise and unbiased content of language use in the educational mobile apps is essential in maintaining the quality of the product. The output of the identifying stage is the checklist of appropriate educational mobile apps that cater for children between birth till 12 years old.

Next, is the categorizing stage in the development of i-CARES. This is the stage where the carefully selected and appropriate apps being clustered in the suitable category according to Multiple Intelligences Theory. Gardner categorizes eight different and relatively independent types of intelligences namely linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, intrapersonal, interpersonal and naturalist. The outcome of this stage is Multiple Intelligence checklist for educational mobile apps.

The third stage of the development of i-CARES is the review stage. Advantages and limitations of the educational mobile apps are presented at this stage. Predominantly, a transparent and clear description of the educational apps is portrayed for the convenience of targeted audience. The output of this stage is a review report with detailed description of advantages and limitations of educational mobile apps for children.

Subsequently, the developmental stage of i-CARES passed through evaluation stage. The quality of the educational mobile apps is evaluated based on three levels; low, medium and high in terms of quality. At the end of the process a report on the status of quality is produced. Finally, thei-CARES developmental process reach the synthesis part. This part produce recommendations on whether the educational mobile apps applicable or not applicable for use among children. The end product is the i-CARES Rubric. Table 1 summarizes of the developmental stages of i-CARES.

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<tr>
<th>Stages</th>
<th>Processes involved</th>
<th>Output</th>
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<tr>
<td>Identify</td>
<td>Choose apps</td>
<td>Checklist of appropriate apps</td>
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Criteria

- Have educational values
- Age-appropriate - Piaget’s developmental stages
- Language – English

Categorize
Cluster the apps based on the Multiple Intelligences

Review
Review the advantages and limitations of the apps

Evaluate
Evaluate the quality of the apps – high, medium, low quality

Synthesis
Recommend or not recommend for use

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<th>Criteria for children 0-12 year</th>
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<td>Multiple Intelligence checklist</td>
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<th>Criteria for children 0-12 year</th>
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<td>Review report</td>
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<td>Quality report</td>
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<td>i-CARES Rubric</td>
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Table 1 i-CARES stages, processes and output

Summary

The process of selecting mobile educational apps for children is a complex one as many theories could be applied as its base. In this paper we highlighted two main theories, that is, Howard Gardner’s (1993) Multiple Intelligences theory and Jean Piaget’s (1928) Stages of Development theory to aid our selection processes. The on-going i-CARES framework featured in this paper is hoped to become a useful guideline for parents and educators on choosing appropriate mobile educational apps based on their children development. It may also be used by mobile app designers and developers in thinking about their intended audiences in the process of creating such apps.

Acknowledgement

This study is funded by the University of Malaya Research Grant no. RP004E-13ICT.

References


