

Didi the Explorer: Educational Mobile Game to Foster Teaching and Learning Arabic Number for Non-Native Speaker

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ABSTRACT

Having realised that many young children, in particular non-native speakers, are struggling with memorizing Arabic numbers, there is a huge potential for the creation of a mobile app that could attract children to enjoy learning Arabic Numbers. However, only a few apps that cater to the need of teaching Arabic numbers to non-native speakers are created. Thus, the objective of this study is to develop an educational mobile game that fosters the teaching and learning of the Arabic numbers in an attractive manner to non-native speakers in schools. Didi the Explorer is a mobile educational application created for children to learn numbers in Arabic. Emphasis is placed on pronunciation and recognizing Arabic numerals, which is a common obstacle for non-native learners due to the lack of similarity between the phonemes in many of the world's languages with the phonemes that exist in the Arabic language. Additionally, the importance of learning Arabic weighs significantly in religious studies seeing that the Holy Quran is written in Arabic. The challenges in recognising and pronouncing Arabic words can be addressed by using an educational app that engages students effectively with an attractive and interactive content. Adapting this application for usage in schools and at home can potentially instill a greater interest in exploring the Arabic language in-depth. The product was developed based on the ADDIE model whereby the scope of the project involves Analysis, Design, and Development of the prototype. However, the Implementation and Evaluation phases are not included in this research at this moment. According to Mayer's cognitive theory of multimedia learning, students learn better via multiple channels when processing information in the forms of text, images, audio and video, which must adhere to certain design and organizational principles. As such, the development of the mobile app emphasises the use of multimedia elements to enhance the teaching and learning processes in an interactive, fun, and effective way.

Key Words: Mobile Game, Application, e-Learning, Arabic, Primary School

1. INTRODUCTION

With the exponential growth and continuous evolution in technological advances, mobile applications have become ubiquitous in our daily lives. According to a Jacqueline Howard (2017) report kids under 8 years spend about two hours daily to access content through a screen media. Furthermore, the percentage of kids who use screen media is growing. From another study by Ofcom UK, it is revealed that the time spent by kids with screen media has increased up to 35% in 2018 compared to only 4% in 2011. In fact, 53% of the children who use tablets and smartphones to access online content are only between three to four years old (2018). Hence, due to the increased use of screen media among children, this study has proposed the development of an interactive application that attracts kids to memorize Arabic numbers in a fun way.

1.1 Problem Statement

Many young children, in particular non-native speakers, struggle with learning the Arabic language due to disabilities in recognising the Roman numerals and Arabic numerals (Maysa, 2020). The Arabic numerals are normally learned in schools during a formal structured class, but in order to practise their skills, students need to be exposed to Arabic numerals during out of school hours. A screen media like mobile app can be used for this purpose. Unfortunately, very few educational applications that emphasize on the Arabic numerals are available. According to Norfaezah, (2019) the challenges faced in teaching Arabic Language include the limited availability of teaching mediums.

1.2 Objectives

The aim of this study is to help students learn Arabic Numbers in an interactive and fun way in order to introduce Arabic numerals to non-native speakers who are at the primary school level. Hence, a mobile game was developed as a learning tool to enhance the learning experience of non-native Arabic speakers.

2. LITERATURE REVIEW

Educational mobile games can be defined as a digital game that has included the required educational components like contents that map to specific learning outcomes. The immersive platform of mobile games creates a ubiquitous environment which promotes motivation and learning opportunities (Liu, X., & Li, Q., 2015).

As the Covid19 pandemic spread globally, many schools started to adapt their teaching methods to the online mode. The use of video conference meetings for classes suddenly became an inevitable solution. While some of the schools are conducting synchronous classes, other classes choose to deploy asynchronous methods by using e-learning tools. According to Shamsudin, H., Hashim, H., & Yunus, M. Md. (2019), young learners nowadays have easily acquired digital literacy skills unlike the other learners since the past 15 years ago. Thus, the development of mobile games as learning tools could be an alternative way to foster kids interest in mathematics through mobile games. The lesson would be more compelling, engaging and interactive (Liu & Li, 2015; Minsang Kim, Yoon C. Cho 2018) with the emergence of mobile games either through synchronous or asynchronous learning methods. Moreover, another research found that most of the learners felt that using digital tools in lessons have positively impacted their learning experiences (Hashim, Yunus & Embi, 2018).

Elaish, M., Ghani, N., Shuib, L., & Al-Haiqi, A. (2019) discovered that mobile games have significantly increased the motivation of students to learn English and from the results of post-questionnaire, it is discovered that students fully support the use of mobile games as learning tools. The study showed that students also enjoyed using mobile games in class for formal lessons, and not just for playing games at home. Hence, mobile game applications could be one of the tools to foster the teaching and learning of Arabic numbers at the primary school level in an enjoyable and interactive way.

3. METHODOLOGY

This application was developed according to the first three phases of the ADDIE Model which involve the Analysis, Design, and Development phases as shown in Figure 1 below. However, the Implementation and Evaluation phases have not been conducted yet.

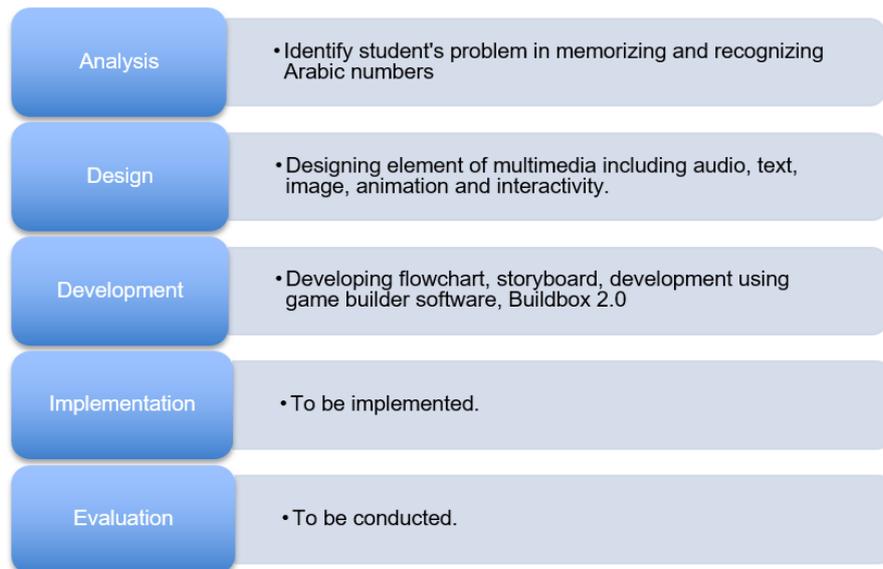


Figure 1. Design Framework

3.1 Key Theoretical Framework

Mayer's Cognitive Theory of Multimedia Learning explains that students learn better through multiple sources of information such as text, images, video and audio. From his studies, Mayer has suggested a framework to guide educators in creating multimedia learning materials that nurture students' ability to process information effectively. Hence, the mobile game explained in this study has been developed as a learning application according to Mayer's Cognitive Theory of Multimedia Learning focusing on five of multimedia principles which are:

Multiple Represent Principle: Explanation through words and image is better than in words alone.

Contiguity principle: Multimedia elements like text and image should be placed close together.

Split Attention Principle: Using audio is more effective than using text in explaining information.

Individual Different Principle: Each student will perceive information differently. This design principle effect is stronger for individuals without prior knowledge.

Coherence Principle: The information should be conveyed in a simple and short form with highlights of the relevant elements.

The principles applied through this application are expected to help students learn Arabic numbers better since the mobile game has integrated and combined images and audio files to enhance students' understanding of Arabic numbers.

Table 1 below shows the multimedia elements that have been used to develop the learning materials in this project.

Table 1: Multimedia element in Arabic Educational application

Application	Image	Sounds	Text	Videos	Animation	Interactivity
Mobile Game	Yes	Yes	Yes	No	Yes	Yes

3.2. Content Outline

The application covers the topic of number recognition in Arabic that includes the numbers from 1 to 10. The Didi, the Explorer, mobile game application is aimed towards improving lower primary school level students' competency in recognising Arabic numbers and reciting these numbers with proper pronunciation. However, the game would also be appropriate for younger children as an exposure to the content. This application could be another edutainment product that engages students with the content through a game.

3.3 Design & Development Phases

To develop this application, software applications were employed such as Adobe Photoshop for editing images, Adobe Illustrator for creating illustrations, a video editing and recording software for producing voice overs, and Buildbox for creating the mobile game. The first step in the ADDIE model is the Analysis phase which seeks to identify issues that need to be solved by educators. The issues that have been identified in this study are the challenges faced by non-native speakers of the Arabic Language in recognizing, memorizing and saying the number characters using the correct pronunciation and the limited availability of mobile learning applications in the market that focus on Arabic Numbers. A precedence study was conducted during this phase to look for the content available in the market.

The next step was the Design phase. At this stage, the developer created the learning activities in the mobile game according to Mayer’s five multimedia learning principles to address the learning or performance gap of learners as identified in the first phase of the ADDIE model. Based on these learning activities, the developer then sketched and created the storyboards for the mobile game’s content. An example is illustrated in Figure 2.

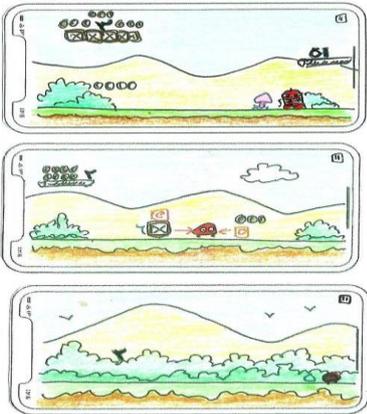
NAME : Juniza Zamvi ID : 1141401355 TITLE : DIDI THE EXPLORER NOTES : GAME SCREEN (PLATFORM)	PAGE: Game Screen 3	
	Graphic / A/V	Authoring / Interactivity
	Graphic: Graphic as visual includes: 1) Platform 2) Assets 3) Sprite Animation: 1) Coins spinning 2) mushroom change color 3) tile move from left-right 4) enemy moving. Video: no video. Text: Arabic numerals were designed in Ai. Audio: 1) Background music 2) coin sfx 3) Arabic numerals sfx	- All game scenes displayed in the game screen play (world). - The PAUSED linked to the Pause Page. - Collect coins and Arabic numbers to get points. - Avoid monster to avoid game over. - Exit the game by clicking mouse and choose to go back to menu to exit current game.

Figure 2: Sketches and storyboard were created in the design phase.

Finally, the storyboards served as a guide to develop the mobile game as an interactive multimedia application which is presented in Figure 3.



Figure 3: Screenshots of the finalised version of the mobile game.

4. RESULT & DISCUSSION

Arabic numbers are part of the Arabic language. The characters are widely used especially in the holy Quran. The inability of students to recognize and pronounce the Arabic numbers correctly could be improved by using a learning application that engages students with the content through multimedia elements. Implementing this application in school and at home could encourage the students to explore further the language in-depth. Mayer (2009) had created a framework for effective multimedia learning based on 12 principles and to ensure the effective learning and understanding of the Arabic numbers, five multimedia learning principles were applied in the mobile game. Table 1 demonstrates the application of these principles.

Table 1: Mayer Learning Principle adopted in Didi The Explorer mobile game.

Screenshot	Multimedia Learning Principle
	<p>Coherence Principle</p> <p>The first screen was designed with this principle to convey the idea of the whole application briefly through relevant words (title) and graphics (game characters, enemies and game assets).</p> <p>This introduction page would gain the user's attention to click the start button and explore the application.</p>
	<p>Pre-Training Principle</p> <p>This principle was adapted in this application by means of a quick guide for users. This guide will be helpful for users to gain relevant information on how to play the game.</p> <p>Pre-training elements are designed in the game to help users understand the overall picture about the whole content and application.</p>
	<p>Multimedia Principle</p> <p>When users go through the game play, they will experience the sound and visual elements together with animations that offer exciting and motivational content that encourage students to finish the game while they gain a new learning experience.</p> <p>Audio of voice overs that pronounce Arabic numbers accurately will appear each time the character hits the Arabic number.</p> <p>The colour combinations used in this application needed to attract students' attention in order to increase their engagement with the application.</p>
	<p>Segmenting Principle</p> <p>The Didi the Explorer mobile game application is divided into 3 segments. In Level 1, the user will explore the whole journey to collect coins and Arabic numbers before finishing the mission to arrive at the tree house. Upon arriving, the Numeric basket will be linked to the Do You Know (Learning) page to learn Arabic numbers 1-10 and the mission continues up to Level 2 which includes a game quiz in the gameplay.</p>
	<p>Voice Principle</p> <p>Human voice overs are as used in this application to provide a more positive learning mood and environment to users. The voice overs will be played each time the specific characters are tapped on the screen.</p> <p>Another principle that was applied in this application is the Spatial Contiguity Principle where related texts and pictures are placed close together.</p>

The combination of multimedia learning principles could help students learn effectively through the appropriate processes as explained by Mayer's theory that are incorporated with Cognitive Learning Theories, like the Cognitive Load Theory, Working Memory Theory and Dual-Processing Theory. These theories are applied during the development of this project through the application of Multimedia Learning Principles. The **Spatial Contiguity, Pre-Training, Multimedia, and Voice principles**, for example, are among the multimedia principles that have been applied in the project.

5. CONCLUSION AND RECOMMENDATION

The development of this mobile game requires the developer to understand the overall content of the topic before proceeding with the design. Developers are recommended to apply the ADDIE model to design their application. The ADDIE model would ensure the products are developed according to the

standards expected of learning applications from the ANALYSIS phase to identify the context of the learning experience - the targeted students, the topics that students need to understand, and what the students already know and what they should know after learning the content until the EVALUATION phase during which the developers would ascertain whether the issues identified in the ANALYSIS phase have been solved through the application and the desired learning outcomes are achieved. However, for this paper, only three phases of ADDIE model have been explained which are the ANALYSIS, DESIGN and DEVELOPMENT phases.

In relation to the development of the mobile game, another issue to be considered is The challenges of developing a mobile game include investing in the software licences needed to develop the game itself. Even though there are many software in the market that can be used to develop games, the Buildbox application, as explained in *The Beginners Guide to BuildBox - Drag n Drop Development* (2020) is recommended for all levels of developers or instructors to create their own learning content that is suitable for their students' use. Additionally, there are other software that are available for developers to try such as unity 3D, game maker, salad game and so on.

In conclusion, since mobile games are rapidly gaining popularity, this study is essential to explore the deployment of mobile games as an instructional tool to be adapted for teaching and learning, especially at the primary school level, in order to make the lesson more interesting and engaging to students.

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