

e-MATHJR EDUCATION FOR KINDERGARTEN: A FRAMEWORK

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ABSTRACT

E-learning can be viewed as a natural development of remote learning, which has always benefited from the newest tools to appear in the environment of technologies for conducting education. Various subjects can be applied to e-learning which allow students to engage with educational materials in a playful and dynamic way. One of it is the mathematics subject. The area of mathematical development starting from early childhood is important to a child's progress in primary and post-primary education. Kindergarteners will practice basic concepts of math, reading, writing, shapes, and so on. To replace the traditional learning methods in Mathematics, e-MathJr Education for Kindergarten was being developed. ADDIE Model is used in the system development. This mobile application will provide kindergarteners with an interesting and more engaging learning application through instant and personalized feedback.

Keywords: *e-learning, kindergarten, mathematics, application*

Introduction

Game-based learning is not just creating games for students to play, it is designing learning activities that can incrementally introduce concepts, and guide users towards an end goal (Pho & Dinscore, 2015). A mobile application, most referred to as an app, is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer. Mobile applications frequently serve to provide users with similar services to those accessed on PCs (Rouse, 2020).

Kindergarteners are children age 4-6 years old, who attend kindergarten, which is typically the first year of formal education in many countries. Kindergarteners will learn and practice many lessons and learning mathematics is crucial so that they can learn and understand basic concepts before they go to primary school.

Most kindergarten use a manual learning method in the classroom, which involves books. Some students may also become disengaged in such environments due to the lack of individual attention and engagement that does not meet their learning needs. This traditional method may also have some other difficulties as students require more assistance from the teacher, unable to receive immediate feedback

since traditional teaching or learning approaches do not provide each child with appropriate observations and difficult for parents to monitor their child's performance so they are not aware of their child's learning progress and are unable to assist them in getting better at the topic.

Thus, to overcome this problem, a learning mobile application was being developed to make learning more interesting and create a more engaging learning application. The benefit of developing an e-MathJr application for kindergarteners is to solve math problems faced from the current practice. The project's goal is to improve kindergarten students' cognitive development because by doing visual math exercises, it can have an impact on their ability to reason, investigate, and solve problems. It also promotes critical thinking, logical reasoning, and problem topics to actual circumstances, giving them greater significance and relevance to a child's everyday existence.

Project Scope

The upcoming e-MathJr application aims to address the syllabus content related to addition and subtraction designed for six-year-old kindergarten students. The scope of the user for this application involves the kindergarten students and parents.

Kindergarteners

To make learning more enjoyable, children can access the system and play a variety of activities provided, such as puzzles with dynamic background music and eye-catching graphics. Scores can be reviewed to evaluate their performance on the activities done.

Parents

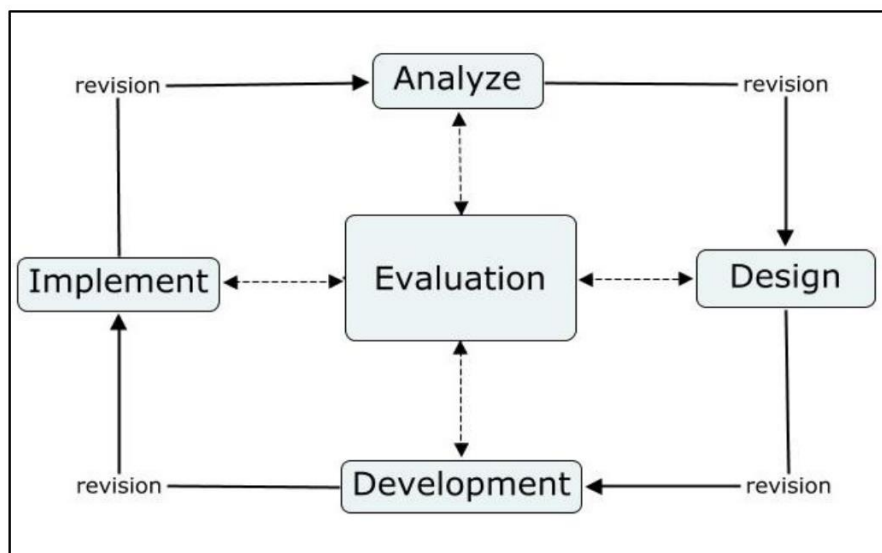
In order to provide children with additional help on the parts that they are unable to understand, parents can assess their child exercise scores. Parents may also monitor how frequently the system is being used by the children to learn the subject matter and complete exercises.

Methodology

In producing a good instructional design, there are various theories and models presented by instructional design researchers such as the ADDIE model and Jean Piaget's Cognitive Development Theory.

ADDIE Model

The stages in the ADDIE Model involves preliminary study, analysis, design, development, implementation, evaluation, and report. Figure 1 shows stages of ADDIE model.



(Source: Kurt, 2019)

Figure 1: Phase in ADDIE Model

The project framework of e-MathJr application will be using the ADDIE Model which consists of seven stages. The method will be applied to define progress that will be needed to complete the project by modifying the process. Table 1.1 shows the phase that will be needed to complete the project.

Table 1: Project Development Methodology of e-MathJr

Phase	Activity	Outcome
Preliminary Study	<ul style="list-style-type: none"> ◆ To choose a suitable project title for the design and development of the application. ◆ To choose an application name for the project. ◆ Conduct the interview session. ◆ Identify the current problem in math subject for kindergarten 	<ul style="list-style-type: none"> ◆ The title of the project “Exploring Mathematical through E-Learning for Kids” identified. ◆ The application name of the project “e- MathJr”. ◆ The interview session with a former kindergarten teacher
Analysis	<ul style="list-style-type: none"> ◆ Collecting data requirement. ◆ Find suitable material for kindergarten mathematics syllabus. 	<ul style="list-style-type: none"> ◆ Information regarding kindergarteners’ mathematics subject. ◆ The content requirement of the e-MathJr application will be decided.

Design	♦ The e-learning application will be delivered to CD-ROM or play-store.	♦ The application will be written to the CD- ROM or will be launched on the play- store.
Implementation	♦ To test the functionality of the application.	♦ Functionality of the application will be tested.
Evaluation	♦ Writing the project report	♦ Full project report will be done.

Jean Piaget's Cognitive Development Theory

The constructivist learning theory of Jean Piaget will be employed in the development of the Mathematics for Kindergarten (e-MathJr) application, facilitating the interpretation of information in an interactive manner. The guidelines from Jean Piaget's constructivist learning theory will inform the blueprint of the mathematics application throughout the developmental process. The design will be structured and the process will be iterative, ensuring ease of comprehension for designers, developers, parents, and kindergarteners in understanding

Each child goes through the stages in the same order (but not all at the same rate), and child development is determined by biological maturation and interaction with the environment. At each stage of development, the child's thinking is qualitatively different from the other stages, that is, each stage involves a different type of intelligence (McLeod, 2023). To get the best results in the educational process, all of the components in education should be involved, especially educators who always had to adapt to students' development. There are phases in children's development according to Jean Piaget's.

Sensorimotor stage

The sensorimotor stage is the period of development from birth through age two. During this initial phase of development, children utilize skills and abilities they were born with (such as looking, sucking, grasping, and listening) to learn more about the environment. In other words, infants and young children experience the world and gain knowledge through their senses and motor movements. Through trial and error, children discover more about the world around them (Cherry, 2023).

Operational stage

This stage includes the emergence of motor skills and language. At the age of two, children enter the operational stage, where their ability to use mental representations, rather than the physical 17

appearance of objects or people, improves greatly. In this stage, children also learn more about categorization.

Concrete operations stage

Children think logically about concrete events. The concrete operation stage is expressed by the development of a system of thought based on events that are directly experienced. During this stage, children begin to understand the concept of conservation; understanding that, although things may change in appearance, certain properties remain the same (McLeod, 2023).

Formal operating stage

The formal operational stage begins between around 11-12. Children are usually in grade school around this time. In the formal operational stage, children tend to reason more abstractly, systematically, and reflectively. They are more likely to use logic to reason out the possible consequences of each action before carrying it out (McLeod, 2023).

Conclusion

Learning mathematics in traditional methods is common in most kindergarten. Thus, to enhance the learning method, e-Math Junior mobile application for kindergarteners was being developed. This system can help kindergarteners to develop early numeracy skills like comparing quantities and 5 perceiving numbers as patterns. Besides, these abilities also serve as a building blocks for higher-level math. Furthermore, the system that will be developed will help parents to able to track their child's learning progress easily, anywhere. This can help parents to understand more about their child and be able to guide their child with extra exercises to sharpen their child's knowledge for the subject. The application follows the ADDIE model, considering stages like analysis, design, development, implementation, and project evaluation throughout its creation. The project is based on the constructivist learning theory, emphasizing Jean Piaget's cognitive development theory. This method ensures that the Mathematics for Kindergarten e-MathJr program is of the highest quality, conceptual, architectural, development, and deployment phases.

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