

# Design Development of Arabic-Rumi Transliteration Module with Virtual Reality Concept to Improve Primary School Students' Arabic Reading Skills: Design and Development

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## Abstract

This paper presents the design and development of an Arabic-Rumi Transliteration Module integrated with a Virtual Reality (VR) concept aimed at improving Arabic reading skills among primary school students. The background of the study highlights the challenges faced by students in mastering Arabic script due to the differences in script and phonetics compared to their native language. The primary objective of this research is to create an engaging and interactive learning module that bridges this gap and enhances the learning experience. The development process involves a meticulous design phase, where educational theories and VR technology are integrated to create a user-friendly module. The transliteration module is designed to assist students in recognizing Arabic letters and their corresponding sounds through an immersive VR environment, providing a multi-sensory learning experience. A mixed-method approach is employed to evaluate the effectiveness of the module. Quantitative data is collected through pre- and post-tests to measure improvements in reading skills, while qualitative data is gathered from student feedback and observations to understand their learning experiences. The results demonstrate significant improvement in students' ability to read Arabic text accurately and confidently. The VR environment proved to be highly engaging, keeping students motivated and enhancing their retention of the material. This study concludes that the integration of VR in language learning modules can be a powerful tool in overcoming language barriers and improving reading skills among primary school students.

## 1. Introduction

The acquisition of Arabic reading skills presents significant challenges for primary school students, primarily due to the substantial differences between Arabic script and the students' native languages. These differences in script and phonetics often hinder students' ability to read Arabic accurately and fluently. Traditional teaching methods have struggled to bridge this gap effectively, leading to a need for innovative approaches in language education.

This study addresses this issue by introducing an Arabic-Rumi Transliteration Module integrated with Virtual Reality (VR) technology. The primary objective is to develop an engaging and interactive learning module that can enhance students' Arabic reading skills by providing a multi-sensory learning experience. By immersing students in a VR environment, the module aims to make the learning process more engaging and effective, thereby improving students' recognition of Arabic letters and their corresponding sounds.

The development of this module involves a meticulous design phase that integrates educational theories with VR technology to create a user-friendly and effective learning tool. The module's effectiveness is evaluated using a mixed-method approach, combining quantitative data from pre- and post-tests to measure improvements in reading skills, with qualitative data from student feedback and observations to gain insights into their learning experiences.

The results of this study demonstrate the potential of VR technology to transform language learning by overcoming traditional barriers and significantly improving students' reading abilities. This research highlights the value of integrating VR in educational modules to create a more engaging and effective learning environment for primary school students.

## 2. Problem Statement

Primary school students often encounter significant challenges when learning to read Arabic due to the substantial differences between the Arabic script and their native languages. These challenges are multifaceted, encompassing the complexity of the Arabic script, which is characterized by unique letters and diacritical marks, and the distinct phonetic system, which includes sounds that may not exist in the students' native languages. These difficulties can lead to a lack of confidence and proficiency in reading Arabic, which in turn affects their overall academic performance and motivation to learn the language.

Traditional teaching methods, which often rely on rote memorization and repetitive practice, have not been sufficiently effective in addressing these challenges. These methods can be monotonous and fail to engage students, leading to limited improvement in their reading skills. Moreover, the lack of interactive and immersive learning experiences can hinder students' ability to retain and apply what they have learned, further widening the gap in their reading proficiency.

To address these issues, there is a pressing need for innovative educational approaches that can make the learning process more engaging, interactive, and effective. This research aims to develop an Arabic-Rumi Transliteration Module integrated with Virtual Reality (VR) technology as a solution to these challenges. The transliteration module is designed to assist students in recognizing Arabic letters and their corresponding sounds through an immersive VR environment, providing a multi-sensory learning experience that can enhance their understanding and retention of the material.

The VR component of the module offers an engaging and interactive platform that can simulate real-life scenarios and provide immediate feedback, thereby improving students' motivation and confidence in reading Arabic. By leveraging the immersive nature of VR, the module aims to create a more dynamic and effective learning environment that can address the limitations of traditional teaching methods.

The primary objective of this research is to evaluate the effectiveness of the integrated VR transliteration module in improving Arabic reading skills among primary school students. This involves assessing the module's impact on students' ability to recognize and read Arabic letters accurately and confidently, as well as understanding their overall learning experience and engagement with the module.

Through a mixed-method approach, combining quantitative data from pre- and post-tests with qualitative data from student feedback and observations, the study seeks to provide comprehensive insights into the module's effectiveness and potential as a powerful tool for overcoming language barriers and enhancing reading skills. The ultimate goal is to contribute to the development of more effective and engaging educational tools that can support primary school students in mastering Arabic reading skills, thereby improving their academic outcomes and fostering a lifelong interest in language learning.

### 3. Research Objective and Question

#### 3.1 Research Objectives

- Develop an engaging and interactive VR-based Arabic-Rumi transliteration module.
- Enhance students' recognition and reading of Arabic letters and sounds.
- Evaluate the effectiveness of the VR module using a mixed-method approach.
- Increase student motivation and engagement in learning Arabic.

#### 3.2 Research Question

##### 3.2.1 Effectiveness of the VR Module:

- How effective is the VR module in improving students' Arabic reading skills?
- What is its impact on students' accuracy, confidence, and proficiency in reading Arabic?

##### 3.2.2 Student Experiences and Perceptions:

- What are students' perceptions of the usability and interactivity of the VR module?
- What feedback do students provide about the immersive learning experience?

##### 3.2.3 Impact on Motivation and Engagement:

- Does the VR environment increase student motivation to learn Arabic?
- How does VR affect students' engagement and retention of the material?

This research aims to demonstrate the potential of VR technology to improve Arabic reading skills and enhance the overall learning experience for primary school students.

### 4. Literature Review

#### 4.1 Challenges in Learning Arabic Script

Learning Arabic script presents unique challenges for non-native speakers, especially primary school students. The Arabic script, with its distinctive characters and diacritical marks, differs significantly from the Latin alphabet used in many students' native languages. These differences can cause difficulties in letter recognition and phonetic pronunciation, leading to low reading proficiency and confidence among students. Previous studies have highlighted the need for effective teaching methods to bridge this gap and improve students' Arabic reading skills [1].

#### 4.2 Traditional Teaching Methods

Traditional teaching methods for Arabic reading often involve rote memorization and repetitive practice, which can be monotonous and disengaging for young learners [2]. These methods lack the interactive and immersive elements that can enhance students' learning experiences and retention of material. Research has shown that incorporating interactive and engaging tools in language education can significantly improve learning outcomes [3].

#### 4.3 Educational Theories in Language Learning

Educational theories such as Constructivism and Multisensory Learning emphasize the importance of engaging learners in active, hands-on experiences that stimulate multiple senses [4]. Constructivism suggests that learners build knowledge through experiences and reflections, while Multisensory Learning involves using visual, auditory, and kinesthetic activities to reinforce learning. These theories support the development of innovative educational tools that provide a more holistic learning experience.

## 4.4 Virtual Reality in Education

Virtual Reality (VR) technology has emerged as a powerful tool in education, offering immersive and interactive learning environments that can enhance student engagement and motivation [5]. VR can simulate real-life scenarios and provide immediate feedback, making it an effective medium for language learning. Studies have shown that VR can improve language acquisition by providing contextualized and immersive experiences that traditional methods cannot [6].

## 4.5 Integrating VR with Language Learning

The integration of VR with language learning modules, such as an Arabic-Rumi Transliteration Module, can address the limitations of traditional teaching methods and provide a more engaging and effective learning experience. VR can create a multisensory environment where students can interact with Arabic script in a meaningful way, improving their letter recognition and reading skills [7]. Research indicates that such immersive learning environments can lead to significant improvements in students' language proficiency and retention of material [8].

## 4.6 Previous Studies on VR and Language Learning

Several studies have explored the use of VR in language learning, demonstrating its potential to enhance student engagement and learning outcomes. For example, a study on VR-assisted language learning showed that students who used VR-based modules exhibited higher levels of motivation and better retention of vocabulary compared to those using traditional methods [9]. Another study found that VR environments helped students overcome language barriers and improve their reading skills by providing contextualized and interactive experiences [10].

## 5. Methodology Research

The research employed a mixed-method approach to evaluate the effectiveness of the Arabic-Rumi Transliteration Module integrated with Virtual Reality (VR). The study included both quantitative and qualitative methods for data collection and analysis.

### 5.1 Participants:

- The sample size consisted of 60 primary school students (aged 9-11) from various schools.
- The participants were divided into two groups: an experimental group (30 students) using the VR-based transliteration module, and a control group (30 students) using traditional methods.

### 5.2 Development Process:

- The module was designed by integrating educational theories (Constructivism, Multisensory Learning) with VR technology. It included interactive exercises that engaged students in recognizing and reading Arabic letters in a VR environment, providing visual, auditory, and kinesthetic stimuli.

### 5.3 Procedure:

Pre-Test: Both groups underwent pre-tests to evaluate their initial Arabic reading skills.

Intervention:

- The experimental group used the VR module for 30 minutes daily over 4 weeks.
- The control group used traditional rote memorization methods.

Post-Test: After the intervention, both groups took the same test to measure improvement.

## 5.4 Data Analysis:

- Quantitative: Pre- and post-test scores were analyzed using paired t-tests and independent t-tests. The effect size was calculated to evaluate practical significance.
- Qualitative: Semi-structured interviews with students from the experimental group provided feedback on their learning experiences.

## 6. Findings

### 6.1 Results

#### 6.1.1 Quantitative Findings:

- Pre-Test and Post-Test Scores:

**Table 1** Pre-Test and Post-Test Scores

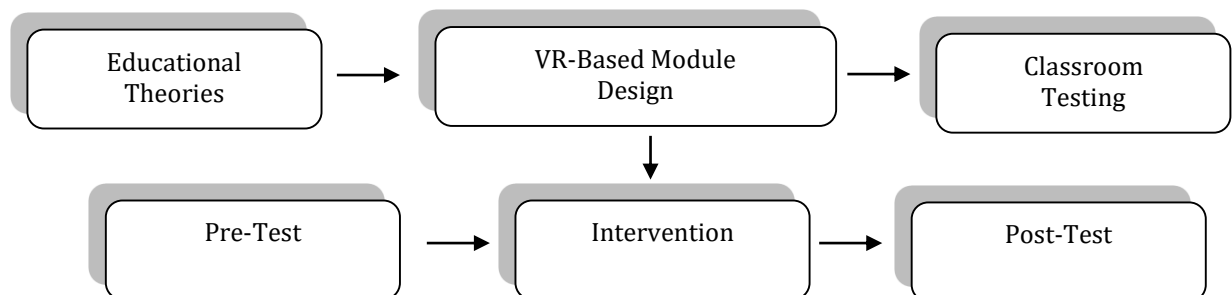
Group	Pre-Test (%)	Post-Test (%)	Improvement (%)
Experimental Group	45%	75%	+30%
Control Group	47%	55%	+8%

The experimental group showed a statistically significant improvement in their reading skills, with a 30% increase from pre- to post-test compared to an 8% increase in the control group. The p-value for the experimental group's progress was  $p < 0.01$ .

#### 6.1.2 Qualitative Findings:

- Students in the experimental group found the VR module engaging, citing the immersive environment and interactive exercises as key factors in their learning.
- The module helped improve motivation and confidence, as students expressed more interest in Arabic learning compared to traditional methods. The following diagram illustrates the design, testing, and implementation stages of the transliteration module:

Fig. 1 illustrates the design, testing, and implementation stages of the transliteration module:



**Fig. 1** Module Design and Implementation Process

It represents the structured approach to the design, testing, and implementation of the transliteration module within an educational setting. The process can be broken down into two major phases: module development and testing/implementation.

- **Educational Theories:** The process begins with the foundation of relevant educational theories. These theories inform the framework and principles guiding the development of the module, ensuring it aligns with pedagogical best practices and addresses the needs of learners.
- **VR-Based Module Design:** Based on the insights from educational theories, the module is developed using Virtual Reality (VR) technology. This stage focuses on creating an immersive and interactive learning environment designed to enhance students' engagement and comprehension of the subject matter [11].
- **Classroom Testing:** The developed VR module is then deployed in a real classroom environment. This stage involves observing its practicality, usability, and the overall experience it offers to students. Classroom testing helps to refine and validate the effectiveness of the module.

Pre-Test, Intervention, Post-Test: In parallel with classroom testing, the implementation process involves a three-step testing sequence:

- **Pre-Test:** Students' initial knowledge and skills are assessed before exposure to the module.
- **Intervention:** The VR module is introduced as the primary learning tool during this phase. Students actively engage with the content to develop their understanding.
- **Post-Test:** After the intervention, a post-test is conducted to measure the improvement in students' knowledge and skills, offering insights into the module's effectiveness.

This holistic approach ensures the module is designed with theoretical rigor and tested comprehensively to achieve optimal learning outcomes. The iterative design also allows adjustments to enhance the module's impact on student learning and engagement.

## 7. Contribution

### 7.1 Educational Contributions

- **Innovative Teaching Tool:** The development of the Arabic-Rumi Transliteration Module integrated with Virtual Reality (VR) provides an innovative educational tool that addresses the challenges of learning Arabic script. By combining transliteration with VR, this module offers a unique and interactive learning experience that enhances students' engagement and proficiency.
- **Enhanced Learning Outcomes:** This study demonstrates that integrating VR technology into language learning significantly improves Arabic reading skills among primary school students. The findings contribute to the growing body of evidence supporting the effectiveness of immersive and interactive educational tools in enhancing learning outcomes.
- **Multisensory Learning Experience:** The VR module provides a multisensory learning experience, engaging students through visual, auditory, and kinesthetic elements. This approach aligns with educational theories such as Constructivism and Multisensory Learning, offering a practical application of these theories in a real-world educational setting.

## 7.2 Technological Contributions

- **Integration of VR in Language Learning:** This research highlights the potential of VR technology to transform language education. By integrating VR with a transliteration module, the study showcases how advanced technologies can be utilized to create more effective and engaging learning environments.
- **User-Friendly Educational Software:** The development process involved creating a user-friendly interface that can be easily navigated by young learners. This contribution is significant for educational software design, emphasizing the importance of usability and interactivity in educational technology [12].
- **Framework for Future Development:** The methodology and findings of this study provide a framework for future development of VR-based educational tools. Researchers and developers can build on this framework to create similar modules for other languages or subjects, further expanding the application of VR in education.

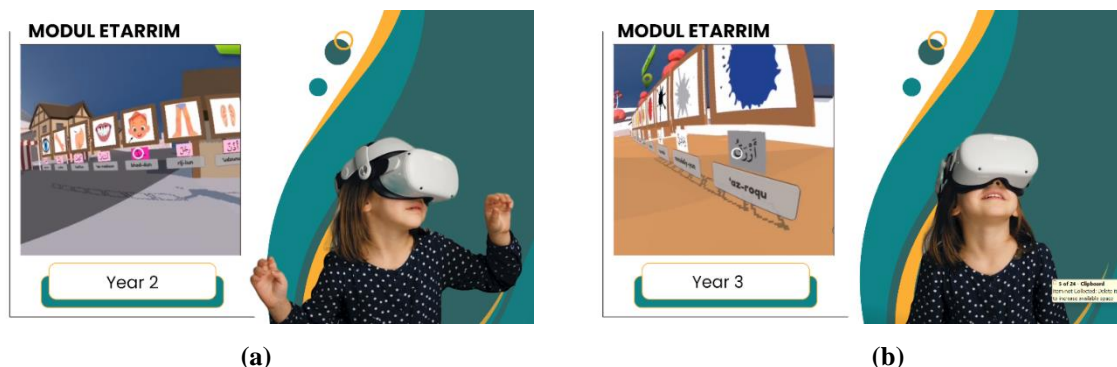
## 7.3 Pedagogical Contributions

- **Alternative Teaching Methods:** The study offers an alternative to traditional rote memorization and repetitive practice methods. By incorporating interactive and immersive elements, the VR module presents a new pedagogical approach that can be adopted by educators to enhance language learning.
- **Increased Student Motivation and Engagement:** The findings reveal that the VR module significantly increases student motivation and engagement. This contribution is crucial for educators seeking to create more dynamic and motivating learning environments, particularly for subjects that students find challenging.
- **Support for Diverse Learning Needs:** The VR module's ability to provide personalized feedback and allow self-paced learning addresses diverse learning needs. This contribution is valuable for inclusive education, offering a tool that can support students with varying abilities and learning styles. The findings support initiatives that promote innovative teaching methods and improve language education.

## 8. Conclusion

This study demonstrates that the integration of a Virtual Reality (VR) Arabic-Rumi Transliteration Module significantly enhances Arabic reading skills among primary school students. The findings reveal substantial improvements in reading accuracy, confidence, and overall engagement when compared to traditional teaching methods. The immersive and interactive nature of VR provides a multisensory learning experience that not only addresses the challenges of learning Arabic script but also increases student motivation and enjoyment. This innovative approach highlights the potential of VR technology to transform language education, offering a powerful tool for educators to improve learning outcomes and student experiences. Future research should explore the long-term benefits and broader applicability of VR-based learning modules in various educational contexts.

## 9. Module Prototype



**Fig. 2** Example Display of the eTARRiM Module for Year 2 (a) and Year 3 Students (b)

The eTARRiM module provides an innovative and engaging platform for Year 2 and Year 3 students to learn Arabic as in Fig. 2. Structured into four topics per year, the module covers practical and relatable themes such as colors and body parts. Through its interactive virtual environment, students can explore the Year 3 classroom and navigate to specific topics of interest, fostering curiosity and active engagement. Within each topic, students can click on Arabic script sections to hear correct pronunciations, enhancing their phonetic skills. Additionally, the module supports spelling activities for both Arabic words and their Roman transliterations, catering to diverse learning levels and bridging the gap for beginners transitioning to full Arabic script proficiency.

To further enrich the learning experience, each word or concept is supported by interactive 3D visuals that vividly represent its meaning. For instance, students learning about colors might interact with vibrant objects, while lessons on body parts are complemented with detailed anatomical visuals. These features make abstract concepts tangible, aiding understanding and memory retention. By combining audio, visual, and interactive elements, the module creates a multi-sensory learning experience that appeals to different learning styles. Moreover, its gamified exploration approach encourages self-directed learning, making the process both enjoyable and educational. Overall, the eTARRiM module transforms Arabic language learning into an immersive, visually rich, and interactive experience, building students' confidence and fostering a deeper connection with the language.

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### Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

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