

DEVELOPMENTAL OF TWO-DIMENSIONAL MOBILE ASSISTED AMERICAN SIGN LANGUAGE LEARNING

Symon Christopher A. Bolinas, Elirose A. Dalit, Alexa Mae O. Leynes, and Zerah-Jane M. Astoveza

Laguna State Polytechnic University, Siniloan Campus
Siniloan, Laguna, Philippines

Article Info:

Received: 10 Aug 2023; Revised: 10 Dec 2023; Accepted: 20 Dec 2023; Available Online: 31 Dec 2023

Abstract - MALL as "mobile-assisted language learning," which refers to a method of learning a language where individuals utilize mobile technology such as smartphones or tablets to aid and participate in language study or education specifically in sign Language. This research aims to showcase and educate both deaf and mute individuals interested in learning American Sign Language (ASL) through a contemporary approach utilizing 2D animated videos. Additionally, to gain the engagement of the users the system incorporated an assessment gameplay consisting of quizzes and conversational. The system was created following the GDSE framework, utilizing Adobe Illustrator and Adobe After Effects, with compatibility designed for Android devices.

Keywords – Deaf, Mute, American Sign Language, Mobile Assisted Language Learning, Assessment, 2D, Animation, GDSE

INTRODUCTION

Learning resources are usually a book, with all material delivered from the book, thus students rapidly become bored and find it difficult to absorb the material [1]. Laziness, playing with classmates, and eating in class as contributing factors to poor academic performance and behavior problems in students. [2] That's to prove innovative teaching strategies, technology-based learning, appropriate learning aids, and addressing communication barriers can improve the quality of education and address the social and academic challenges faced by individuals with hearing impairments [3]. The effective use of modern learning media has a significant impact on students' learning outcomes. [4] Thus, animation has been widely used as an educational resource to enhance learning for many years. [5] MALL as "mobile-assisted language learning" which refers to a method of learning a

language where individuals utilize mobile technology such as smartphones or tablets to aid and participate in language study or education [6], the main advantages of MALL that have been recorded in the literature can be summarized as follows: it enables students to create their own learning framework in terms of time, place and how they will use online information and learning material with consequence that their education is independent, self-directed and autonomous [7](Penelope & Panagiotis, 2021). The focus of the research is to develop a 2D mobile-assisted language learning system about American Sign Language for deaf and muted people. The researchers find a way to improve the quality of education in terms of sign language and the well-being of the Deaf community through communication. The study wants to address problems with the communication barriers of the deaf and mute

towards normal hearing people by assisting using mobile. It helps to benefit each one of them by teaching them sign language and by acknowledging the equality between the two groups.

This study focused on integrating animated video tutorials for learning American Sign Language (ASL) within a Mobile-Assisted Language Learning (MALL) system. The researchers successfully developed a comprehensive system that encompasses various aspects of ASL featuring numbers, alphabets, words, and sentences in 2D animations. This system was designed to provide a structured and accessible method for teaching deaf and mute individuals the fundamentals of communication using sign language. Additionally, the study comprised several key components, including the creation of an immersive learning environment using 2D graphics, and the implementation of an assessment-based gameplay feature.

OBJECTIVES OF THE STUDY

This study aims to develop mobile assistance for deaf and mute people about American Sign Language entitled “SignTopia: A Mobile Assisted American Sign Language Learning”

Specific Objectives

1. Develop a 2D mobile assisted application with the following features:
 - 1.1 ASL 2D animation of Number, Alphabet, Words and Phrases
 - 1.2 2D environment
 - 1.3 Assessment gameplay
2. To create an animated tutorial of American Sign Language for deaf and mute.
3. Create a sign language assessment featuring game exercises for deaf and mute.

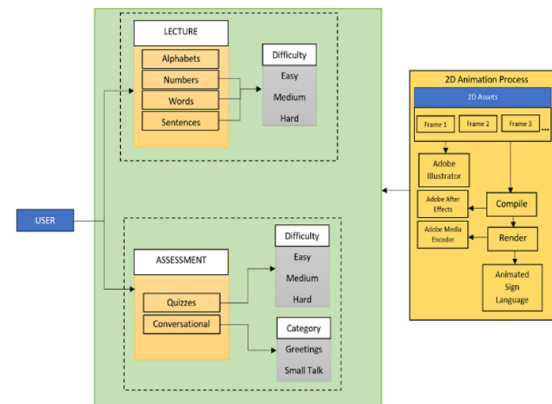


Fig. 1. Conceptual framework

This framework has been created with the intention of aiding individuals who are mute or deaf in their journey to acquire proficiency in American Sign Language. Within the lesson module, American Sign Language is divided into four categories: Alphabets, comprising 26 letters; Numbers; Words; and Sentences, each of which is categorized into three levels of complexity. These categories of American Sign Language are presented through 2D animated videos. Furthermore, to evaluate the user’s learning progress, there is an Assessment module consisting of two types: First, Quizzes, which are divided into three levels of difficulty and involve gameplay similar to multiple-choice questions, requiring the user to guess the correct sign being demonstrated. Second, Conversational exercises, which allow users to apply what they’ve learned in the lesson feature by engaging in conversations with the system and selecting appropriate responses to system-generated messages.

MATERIALS AND METHOD

A. Research Design

The researchers used developmental research methods. Developmental method was used in developing the application using the proposed framework as a guide in designing the application [8]

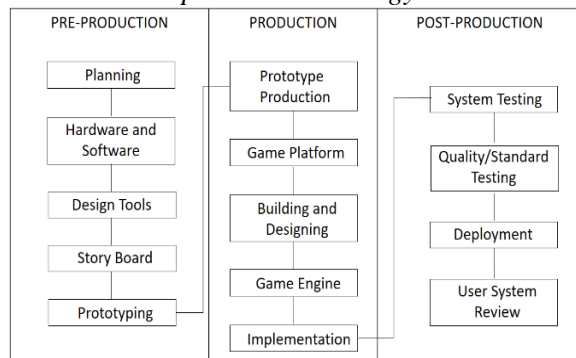
B. Data Collection Instrument

The researchers utilized various data gathering approaches to tackle the challenges associated

with learning American Sign Language. Initially, they performed an Online Search, consulting reputable sources to investigate potential gaps in prior literature, which informed the development of their research title. Next, they conducted Interviews and Surveys with schools that teach ASL to collect data for the system's content. Lastly, they employed Surveys and Actual System Usage, gathering feedback and insights from the selected respondents to obtain results and recommendations.

identify the procedure of it. This allows the researchers to more carefully evaluate the intricacies, efficacy, and design. So that they can improve the system's performance. The researchers utilized this technique to develop Application, a mobile-assisted language learning software that teaches American sign language for deaf and mute users.

C. Development Methodology



(Fig.2) Game development software engineering methodology.

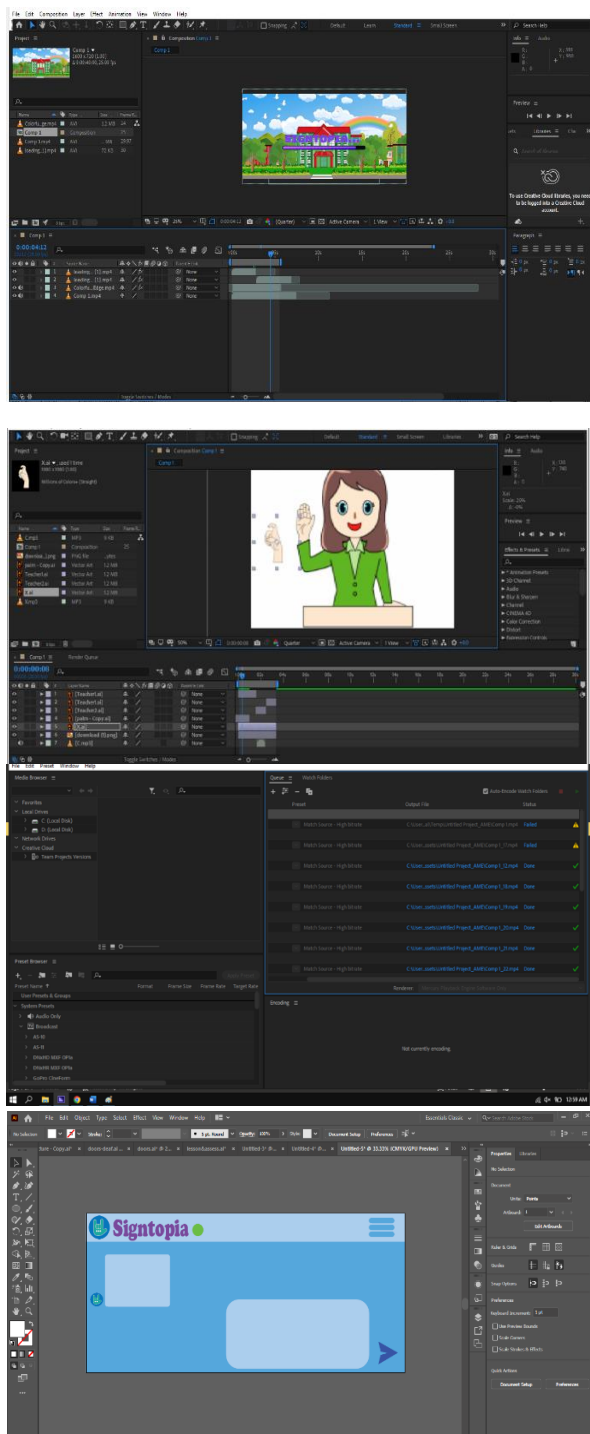
The researchers used a game-based software engineering model. It is a technology that the researchers use to engage the learning of the users. It combines learning with a game-based approach, which will aid the user in teaching and learning from the given instructions. Game-based learning enhances learning competencies through an assisted game. It is a way to create an education and learning tool to provide to those users who are deaf and mute. Game-based software engineering methods fit the system, to showcase the detailed structures of the game and the UI design for the system.

The GDSE is divided into three stages: pre-production, production, and post-production. During these phases, the researchers decide what to undertake initially in terms of developing the system. It contains production phases that operate as a guide in developing the system to



(Fig.3) Pre-production phase- initial prototype

In the pre-production phase, it is where the researchers made a crucial decision on what they will do, a plan for the content and design. Moreover, in this study the researchers first create a prototype of the plan for the system interface including the signs in American sign language that are being demonstrated in the system. The source of the assets is from the internet for the researchers to have references on their plan. They used a friendly 2D UI design as it found out that this method can attract users to learn, especially American sign language. On the other hand, animation is also included in the system as it is a powerful tool to teach complex ideas easily. And to engage users, the researchers added a gameplay that contains quizzes that has categories which include easy, medium, and hard, also a conversational type of assessment that allows the users to practice their gained skill in sign language.



(Fig.4) production phase

The next phase is production, which is the most important for the game-based development software engineer. This is the time when all the things that have been planned take

place. In this section, it will apply all of the assets, the conversion through an Android, and the making of each asset through software. The 2D interface including the environment, buttons and the 2D American sign language are made in Adobe Illustrator. Furthermore, to animate the 2D ASL the researchers used Adobe After Effects and Adobe Media Encoder, to generate it into an ASL animated video. Moreover, in this segment, the researchers applied all of the codes that are needed to run all planned functions for the system, including the buttons, especially the lesson and assessment feature as well as the quizzes, and conversational feature of the system. The researchers use Android Studio for the scripting and for the conversion of the game to be able to use it in Android devices. The last phase is post-production, where the system conducts tests, which are system testing, quality testing, and standard testing, to see if errors and problems occur while using the game. And lastly, the launch of the system to the prospective respondents to see how it affects them while instructing them on how the system works.

RESULTS AND DISCUSSION

A. Develop a 2D mobile assisted American sign language learning application with ASL 2D animation of Number, Alphabet, Words and Sentences, 2D environment and Assessment gameplay.

The study developed a Mobile Assisted-Learning Language system where the deaf and mute users can learn the American Sign Language in a 2D graphics environment. MALL is providing learners with a more customized and convenient learning environment. Language learners use MALL within this framework to access educational materials and interacting with learning platforms [9]. It enhances the motivation for learning through the use of technology familiar to students such as

smartphones and tablets, give more opportunities to students to develop all six communication skills: comprehension and production of written speech, comprehension and production of spoken language, aural interaction and aural and written mediation [7]. The 2D graphics environment benefits for better contextualization of learning, and more effective collaborative learning [10], [11] Visual aids play a crucial role in the education system. They are devices used in classrooms to enhance the learning process and make it more engaging and accessible. Visual aids are considered an effective tool for teaching, facilitating better understanding and knowledge dissemination. [12] Thus, it proved that 2D learning approaches are successful in enhancing students' self-confidence and understanding. And because students expressed disinterest towards traditional teaching styles that rely heavily on lectures and engaging activities. Animation found effective in teaching complex ideas and with 2D that can maintain interest and engagement therefore, the researcher used this strategy to teach ASL.



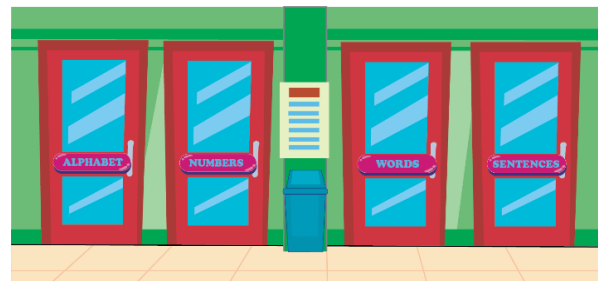
(Fig.5) Main page

Figure 5 shows the main page of the game; this will identify the user, which is the start button, the information, and the settings button. It also has a fingerspelling sign language to indicate to the user that this application is for American sign language. Because the system used ASL as it is most recognizable and widely-used sign language in the whole world. [13] The theme of the 2D graphics environment design of the system is school-type, so it's like learning at school.



(Fig.6) Main Menu

Figure 6 shows the main menu, which contains the categories for the user to choose from. The main menu has two categories, which are the lecture and the assessment. Moreover, lecture part is where the user could learn, using animated ASL videos. Lecture methods are used to acknowledge the user for the given material by instructing them. In the other hand the assessment means applying all the information that they have learned from the given lecture. In this field, the assessment part serves as the test where they can measure their capabilities in sign language.



(Fig.7) Categories

Figure 7 shows the categories. In this segment, the user can choose between different lessons, which are the alphabet, numbers, words, and sentences. The system acquire alphabet and number because it is the first sign language teach in learners in school. And the words and the sentences are about the common words and sentences used in daily communication. Furthermore, these lessons are the basics for the user to learn. Learning the basics can help the user be more creative and a broad thinker, which they can apply to themselves in real-life communication.

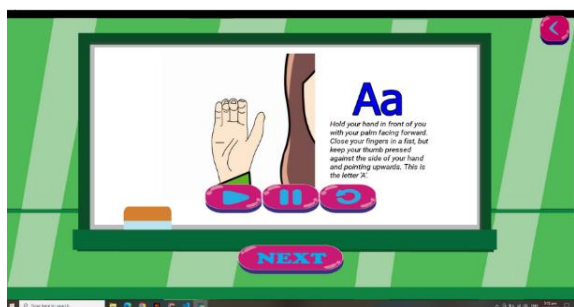


(Fig.8) Difficulties in lesson(numbers, words & sentences)

Figure 8 shows the difficulties of lesson specifically in numbers, sentences and words as alphabets has a fixed numbers of letters and can't further divide per difficulty. The difficulty is divided into three: easy, medium and hard, that is based on the complexity of the ASL.

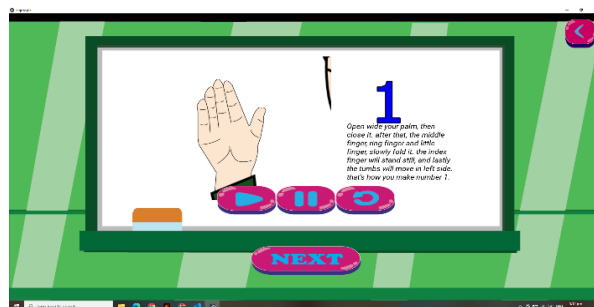
B. To create an animated tutorial of American Sign Language for deaf

This is the lesson feature of the system where it uses 2D graphics and a 2D animated video of the ASL. It used 2D and animation to demonstrate the sign language effectively [4], [14] and innovative as it alters the traditional teaching that uses plain text books and static illustration. [15], [4] that leads to boredom and disinterest of the learners [4].



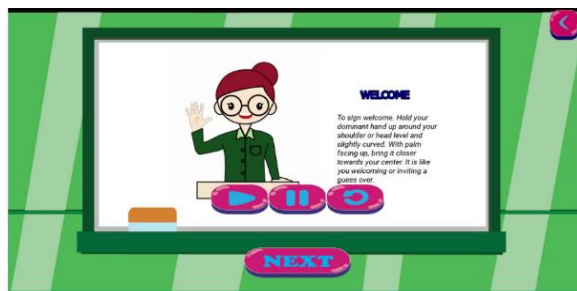
(Fig.9) Alphabet lesson

This is an animated tutorial for the alphabet, consisting of 26 letters from A to Z. It includes sound and text instructions on how each letter should be demonstrated. It features three buttons designed for users to customize their viewing experience. It has a pause, play, and replay button to help the user better understand what they are watching.



(Fig.10.) Numbers lesson

This is the lesson for numbers, similar to the alphabet lesson. It has an animated video of ASL, along with text and sound instructions on how to perform the shown sign language.



(Fig.11) Words lesson

This is the page of the words lesson that demonstrated selected words that can be used in daily communication of the deaf and mute.



(Fig.12) Sentences/phrases lesson

This is the animated lesson for the sentences that also consists of selected sentences/phrases that applicable in daily conversation.

The majority of learners have a preference for watching cartoons and animations. [16],[17] The engagement and effectiveness of animation in education have

been supported by research findings. For instance, the data from coverage demonstrate that participants were actively engaged with demonstration videos [18].

C. Create a sign language assessment game feature for deaf and mute

These features include quizzes, and the conversational assessment for them to learn and apply all of their knowledge from the given lessons. The researchers include these types of assessment because it has potential for evaluating implicit knowledge—knowledge that hard to measure using traditional assessments [19] such as stressful tests and exams [15]. Additionally, the incorporation of 2D animation in American Sign Language (ASL), is utilized to sustain user interest and engagement. [20] Furthermore, assessments serve the purpose of identifying areas where learners may face challenges, providing personalized feedback and support [21] and allowing users to analyze their own progress [22].

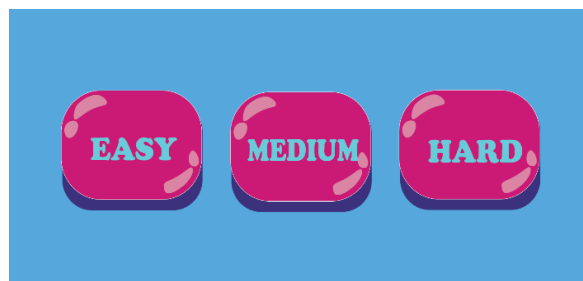


(Fig.13.) Types of assessment

These are the two types of assessments in the system. The first one is the quiz, which is like a multiple-choice test. The user is given a set of possible answers and must choose the correct one. In doing so, they will gain points corresponding to their performance in answering.

The second type is the conversational assessment, similar to a chatting app, but with the distinction of using an animated ASL video.

For better understanding, the system will prompt an animated ASL video, and the user will also be prompted with choices. They should then choose the correct and appropriate answer to the statement given by the system. This way, users can practice their communication skills through the system.



(Fig. 14.) Difficulties on the quiz

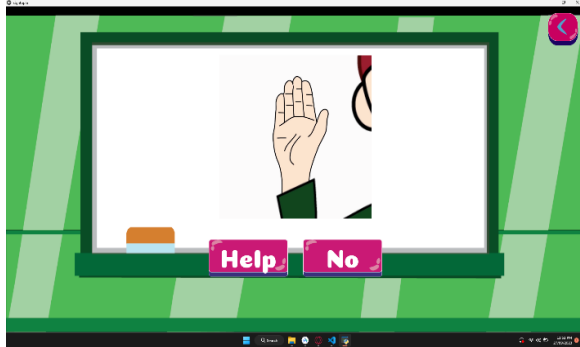
The system's quiz feature offers three difficulty levels: easy, medium, and hard. These are distinguished by the number of steps that has in the animated ASL video.



(Fig.15) Easy quiz

This is the quiz for easy level of the game, it includes alphabet and numbers of ASL

as those two categories has the fewest steps in demonstrations.



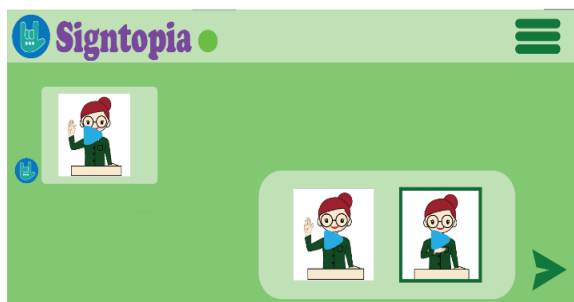
(Fig.16) Medium quiz

It includes words because it represents the midpoint between the fewest and the greatest number of steps within the specified categories.



(Fig.17) Categories in conversational assessment

There are two categories one is the Greetings in school which about signing greetings such as good morning and good afternoon in the school. The second one is small talk with Friends like “how are you?” “I’m fine” type of conversation.



(Fig.18) Conversational type

This is the interface of the conversational where the system provides a statement in animated ASL and the user will have a choice and then they will select the appropriate sign that they should correspond to the statement.

CONCLUSION AND RECOMMENDATION

The research successfully developed a Mobile Assisted Learning Language for American Sign Language (ASL) and integrated 2D animated videos into it. This development benefits both deaf and mute individuals interested in learning Sign Language, providing them with a free system to acquire Sign Language skills for better communication. The study of American Sign Language became enjoyable and encouraging as the researchers incorporated 2D objects and an assessment gameplay approach, increasing user enthusiasm for learning Sign Language.

Additionally, the system includes an assessment game feature that employs a Quizzes and Conversational type. This feature allows individuals to test their ASL learning by answering multiple-choice questions in Quizzes and guessing the appropriate answer to the system-generated message for the user to exercise their communication skills in conversational type of assessment.

Furthermore, the development of a 2D animated video showcasing sign language, categorized into four distinct segments encompassing Numbers, Alphabets, Words, and Phrases or Sentences, that has three levels of difficulty. It was accomplished through the systematic compilation of information obtained from various authoritative sources, including books and online resources.

REFERENCES

- [1] Puspitarini, Y. D., & Hanif, M.. (2019.). ERIC - ej1244451 - Using Learning Media to Increase Learning Motivation in Elementary School, *Anatolian Journal of Education*, 2019-Oct. ERIC - Ej1244451 - Using Learning Media to Increase Learning Motivation in Elementary School, *Anatolian Journal of Education*, 2019-Oct. <https://eric.ed.gov/?id=ej1244451>
- [2] Ramadhani Fajri, B. B., Fajri, B. R., & Kusumastuti, G. (2019, December 1). Perceptions of ‘Hearing’ People on Sign Language Learning | Atlantis Press. Perceptions of ‘Hearing’ People on Sign Language Learning | Atlantis Press. <https://doi.org/10.2991/icet-19.2019.91>
- [3] Kamnardsiri, T., Hongsit, L. O., Khuwuthyakorn, P., & Wongta, N. (2017, August 1). The Effectiveness of the Game-Based Learning System for the Improvement of American Sign Language using Kinect | Electronic Journal of e-Learning. The Effectiveness of the Game-Based Learning System for the Improvement of American Sign Language Using Kinect | Electronic Journal of e-Learning. <https://academic-publishing.org/index.php/ejel/article/view/1839>
- [4] Hanif, M. (2020, October 1). The Development and Effectiveness of Motion Graphic Animation Videos to Improve Primary School Students’ Sciences Learning Outcomes. *International Journal of Instruction*, 13(4), 247–266. <https://doi.org/10.29333/iji.2020.13416a>
- [5] Sarif, L., Syed-Abdullah, S. I. S., & Sufian Kang, E. K. M. (2022, July 27). Science Education Through Malaysian Animation Series. *International Research in Education*, 10(2), 28. <https://doi.org/10.5296/ire.v10i2.19682>
- [6] Loewen, S., Crowther, D., Isbell, D. R., Kim, K. M., Maloney, J., Miller, Z. F., & Rawal, H. (2019, May 28). Mobile-assisted language learning: A Duolingo case study. *ReCALL*, 31(3), 293–311. <https://doi.org/10.1017/s0958344019000065>
- [7] Penelope, K., Panagiotis, A., (June 2021) Mobile Assisted Language Learning (MALL): Trends from 2010 to 2020 Using Text Analysis Techniques, *European Journal of Education*. 4(1). <https://files.eric.ed.gov/fulltext/EJ1336725.pdf>
- [8] Bigueras, R. T. (2020, June 25). Design of Mobile Game-Based Learning Application for Children with Dyslexia. *International Journal of Advanced Trends in Computer Science and Engineering*, 9(1.3), 322–326. <https://doi.org/10.30534/ijatcse/2020/4991.32020>
- [9] Aliakbari, M., & Mardani, M. (2022, October 7). Mobile-Assisted Language Learning and Its Effects on Learners’ Speaking Development. *Education Research International*, 2022, 1–14. <https://doi.org/10.1155/2022/9043326>
- [10] Richards, D., & Taylor, M. (2015, August). A Comparison of learning gains when using a 2D simulation tool versus a 3D virtual world: An experiment to find the right representation involving the Marginal Value Theorem. *Computers & Education*, 86, 157–171. <https://doi.org/10.1016/j.compedu.2015.03.009>
- [11] Shabiralyani, Hasan, Hamad, & Iqbal. (2015). Impact of Visual Aids in Enhancing the Learning Process Case

- Research: District Dera Ghazi Khan. .
 Journal of Education and Practice,
 Vol.6.
<https://files.eric.ed.gov/fulltext/EJ1079541.pdf>
- [12] Azer, S. A., & Azer, S. (2016, December). 3D Anatomy Models and Impact on Learning: A Review of the Quality of the Literature. *Health Professions Education*, 2(2), 80–98. <https://doi.org/10.1016/j.hpe.2016.05.002>
- [13] Foggetti, F. (2023, February 16). The Benefits of Sign Language for Children with Hearing Loss. *Hand Talk - Learn ASL Today*. <https://www.handtalk.me/en/blog/the-benefits-of-sign-language-for-children-with-hearing-loss/>
- [14] Kwasu. (2015). Effectiveness of Animated Instructional Resource for Learning Facilitation among Secondary School Student in Bauchi Nigeria . *Journal of Education and Practice*, Vol.6,(No.21).
- [15] Sarrab, M., Alzahrani, A., Alwan, N. A., & Alfarraj, O. (2014). From traditional learning into mobile learning in education at the university level: undergraduate students perspective. *International Journal of Mobile Learning and Organisation*, 8(3/4), 167. <https://doi.org/10.1504/ijmlo.2014.067014>
- [16] Shinta, A., Hanif*, M., Gunarhadi, G., & Roemintoyo, R. (2019, October 15). Motion Graphic Animation Videos to Improve the Learning Outcomes of Elementary School Students. *European Journal of Educational Research*, 8(4), 1245–1255. <https://doi.org/10.12973/eujer.8.4.1245>
- [17] Wiana, W., Barliana, M. S., & Riyanto, A. A. (2018, February 27). The Effectiveness of Using Interactive Multimedia Based on Motion Graphic in Concept Mastering Enhancement and Fashion Designing Skill in Digital Format. *International Journal of Emerging Technologies in Learning (IJET)*, 13(02), 4. <https://doi.org/10.3991/ijet.v13i02.7830>
- [18] Van der Meij, H. (2017, November). Reviews in instructional video. *Computers & Education*, 114, 164–174. <https://doi.org/10.1016/j.compedu.2017.07.002>
- [19] Rowe, E., Asbell-Clarke, J., Baker, R. S., Eagle, M., Hicks, A. G., Barnes, T. M., Brown, R. A., & Edwards, T. (2017, November). Assessing implicit science learning in digital games. *Computers in Human Behavior*, 76, 617–630. <https://doi.org/10.1016/j.chb.2017.03.043>
- [20] Shahriarpour, N., & kafi, Z. (2014, May). On the Effect of Playing Digital Games on Iranian Intermediate EFL Learners' Motivation toward Learning English Vocabularies. *Procedia - Social and Behavioral Sciences*, 98, 1738–1743. <https://doi.org/10.1016/j.sbspro.2014.03.601>
- [21] Martin, F., Ritzhaupt, A., Kumar, S., & Budhrani, K. (2019, July). Award-winning faculty online teaching practices: Course design, assessment and evaluation, and facilitation. *The Internet and Higher Education*, 42, 34–43. <https://doi.org/10.1016/j.iheduc.2019.04.001>

- [22] Maki, P. L. (2023, June 22). Assessing for Learning.
<https://doi.org/10.4324/9781003443056>