

Mobile development: learn du'a for early childhood learners

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ABSTRACT

This project stands by acknowledging the use of mobile technology is progressively popular among early childhood learners in recent years. But, an extensive systematic literature search on educational mobile technology and touchscreen indicated that most of the applications are not suitable for early childhood learners as it lacks several multimedia features. Therefore, this project designates the development procedure of an educational mobile application for early childhood learners, who are very receptive to new knowledge and information. As a proof of concept, the development of this application utilizes the learning of the Islamic du'a recitation. This application was designed using the android studio and the flutter software combined with the java programming language. Upon the development of this application, several testings were done and analyzed. The result shows that users were satisfied with the applications as most of the testing scores were highly rated. Based on these results, the usage of this newly mobile application can be suggested to be adopted by early childhood learners.

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1. INTRODUCTION

The concept of early childhood learning has been suggested to be the foundation aids of learning for children [1]. Furthermore, it is here during the early formative years, a child has great opportunity and prospect to learn and use their five senses so that their brains will fully develop according to their best potential. It is also during these formative years, the quality of the early childhood learning is vital as to educate children as early as possible, thus children grow up to develop stronger intellectual, emotional, and spiritual thinking skills [2], [3]. Studies have suggested that quality of an early childhood learning needs to be addressed as an effort to stimulate and guide a child's thinking ability and skills [4]. Furthermore, it is said that the standards of an early childhood learning can be enhanced using modern technology [5], [6]. The usage of technology in an early childhood learning process may result in creating an explosive thirst for knowledge [7], and increase a child's focus on understanding concepts [8], [9]. Among the advances in technological development, the touchscreen technology has gained vast popularity in the early childhood learning research domain [10], [11].

The touchscreen technology helps promotes an reciprocal experience that closely resembles a child's natural constructivist learning [12]. Furthermore, the use of mobile devices (e.g., touchscreens) in early

childhood learning has been accepted as an innovative approach to support the traditional learning and teaching practices [13]. Thus, by combining traditional teaching methods and the use of technology helps create a more fun and interactive learning experience for a child, thus fostering a child's creativity and imagination, and problem-solving skills [14].

2. LITERATURE REVIEW

With the rise of digital technology in the field of education, the use of mobile application (i.e., touch screen) has gained positive feedback especially in the early childhood stage. Among the positive feedback using the mobile application in early childhood has are: i) improving the child's memorization, ii) simplifying the child's learning process, and iii) improving child's speech skills [15], [16]. Furthermore, the mix of certain multimedia interactive features in the mobile application, especially in early childhood learning process will result in attracting children: i) to obtain knowledge effectively, ii) by providing a conducive learning atmosphere, and iii) by providing visualized dynamic information [16]. A systematic literature review conducted revealed, early childhood learning using mobile application has seen a steady increase in the number of users [6], [17], [18]. These applications use unique multimedia features to better promote the knowledge delivery for children. However, a closer look at the development of these mobile application revealed several limitations between the adapting of technology and children's education, among which are: i) these mobile application merely conveys knowledge material, and does not facilitate children's to be independent learners, ii) the lack of sound and music to help promote better understanding among the children's, and iii) the lack of knowledge reinforcing interest thus making the children feel frustrated [19]-[21]. Previous studies also highlight, the success of adapting technology and education (especially in the kindergarten children) mainly depends on the quality of the educational content. If appropriate educational content is not well created, this then creates more negative benefits in a child's learning process [22], [23].

Based on the paragraphs, the adaptation of digital technology in the education field (especially in early childhood learning) seems to have both positive and negative impacts on children's learning process. However, one can notice that the adoption of technology has become popular in the early childhood education system [14]. The development in technology (i.e., multimedia) promises great potential in changing: i) the way children learn, ii) the means to obtain information, and iii) the customization of a child's information [24]. Furthermore, the use of multimedia technology also provides various opportunities for teachers to apply various teaching techniques combined with the use of multimedia teaching aids which can draw children attention and interest. Therefore, this research project intends to design and develop a mobile application that combines multimedia features with the hope of being able to provide a more profound learning experience in the early childhood education. The development of the mobile application in this project will focus on helping children in *du'a* recitation. The learning of *du'a* recitation was chosen as a proof of concept, in this mobile application combined with several multimedia features. There are three main objectives for this project: i) to develop a well practical mobile application focusing on early childhood learners (i.e., kindergarten kids), ii) to provide a robust point of reference for kindergarten kids towards a better and more comprehensive early childhood learning activity, and iii) to provide appropriate feedbacks for the early childhood educators using this mobile application.

3. METHOD

The main goal of this research project is to develop a mobile application for early childhood learners. Based on the literature, the analyze, design, develop, implement, and evaluate (ADDIE) research design was adopted as it widely used in multimedia mobile application development. Each step of the ADDIE process is illustrated in Figure 1 as shown in. Each of the phases in the ADDIE research design will be explained in the following subsections.

3.1. Analysis phase

In this research project, the relevant multimedia features must be present for it to be appealing to the users (i.e., early childhood learners). Therefore, prior to developing the mobile application, a methodical and through literature review was conducted. The findings from this systematic review revealed several basic multimedia features and information which was very much needed which was then used during the development of this research project.

3.2. Design phase

During this phase, a flow chart which describes the specific flows in the mobile application is created. Next, a structural module design of this research project is also designed. The structural module is the system architecture of a mobile application. Following that, to further illustrate the flow chart, a basic

storyboard was also designed. A storyboarding is an essential part of any multimedia research project. The storyboard helps the developers to fully understand the flow of the application from one module to another. The flow chart, system architecture and storyboard in shown in Figures 2-4, respectively.

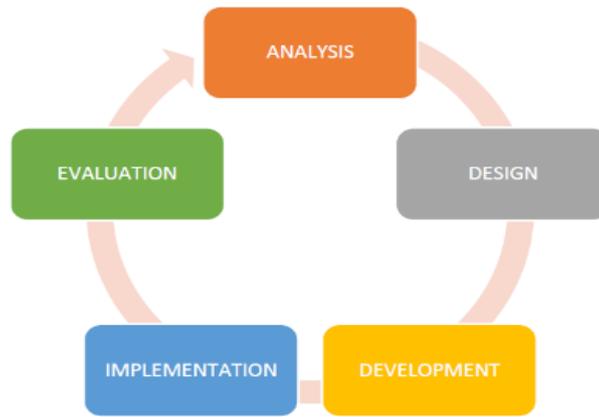


Figure 1. ADDIE research design

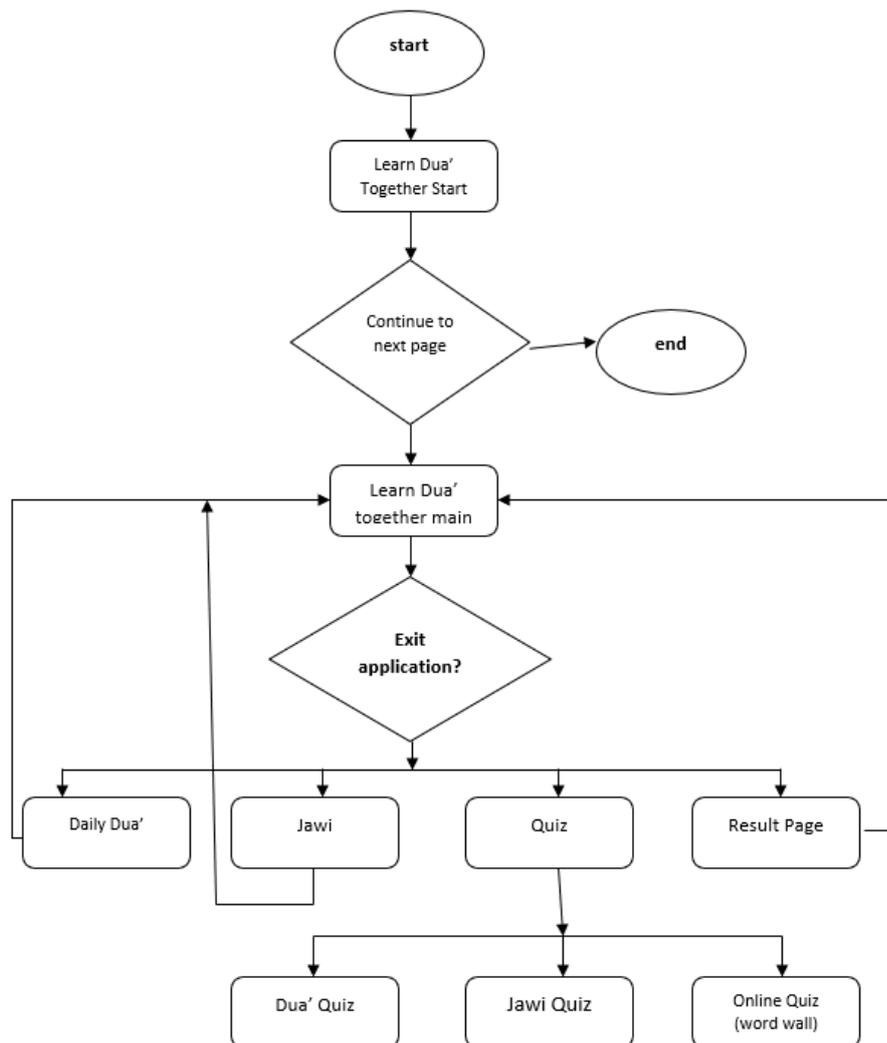


Figure 2. Flowchart

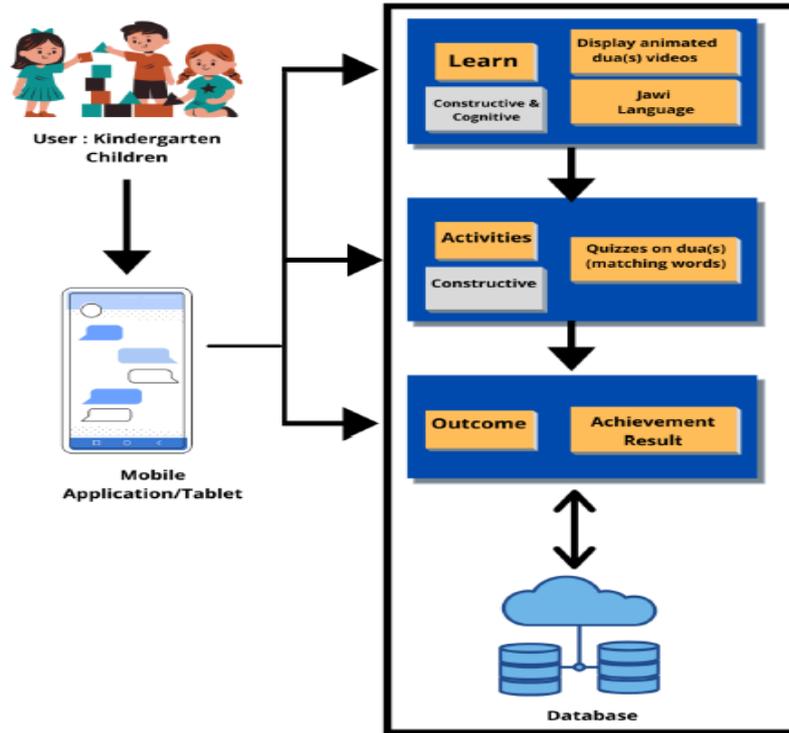


Figure 3. System architecture



Figure 4. Storyboard

3.3. Development phase

In this phase, the mobile application is developed. This mobile application is developed using the android studio and flutter combined with Java programming. The animated video in this mobile application is developed using the adobe animate character. In this mobile application, each multimedia feature is developed based the requirement functionality. Due to the nature of the mobile application development process, the mobile application was revised often and updated according to the functional element of this research project.

3.4. Implementation phase

In this phase, the mobile application goes through a strict project examination. This is to ensure that there are no errors in the application. If there are any errors, the mobile application will be fixed and retested until no more errors are detected. The project will be modified on a regular basis to attain maximum efficiency and a favorable outcome.

3.5. Evaluation phase

In this phase, the user's feedback was vital to determine if the mobile application had multimedia features that were appealing to users and how other features (if required) could be included based on improvements that users suggested. Further, for each feature in the mobile application, users were asked to rate the feature on a scale of one to nine and note their likes and dislikes. Additionally, users were also asked to rate the application as a whole and note down any further improvements required.

4. RESULTS AND ANALYSIS

In this section, the result of testing phase is presented in figures. The purpose of the testing phase is to evaluate how the program works in a real operational environment, and it was tested on a few android devices. Several respondents were selected to test the application and were required to provide feedback towards the application through the online questionnaire. The mobile application developed in this research project was subjected: i) functionality testing, ii) usability testing, and iii) efficiency testing. These testing was performed with the aim of validating the quality of the mobile application [18]. Each of these tests, is briefly elaborated and shown in the following sub sections.

4.1. Functionality testing

Functional testing is a software testing procedure that is used in application development to ensure that the application meets all criteria. It is a method of ensuring that application contains all the required functionality as defined in the functional requirements analysis [25]. Figures 5 and 6 shows the results of the functional testing survey completed by the respondents. The highest number (5) indicates that they strongly agree, while the lowest (1) indicates that they strongly disagree. Based on Figure 5, 80% of the respondents strongly agree that the application buttons and menus are functional to perform the tasks and produce the desired output while only 10% agrees and another 10% are neutral with their answer. Hereafter, in Figure 5, 80% of respondents strongly agrees that all mobile application screens (i.e., pages) are accessible, and users can complete the given task and receive the intended outcome.

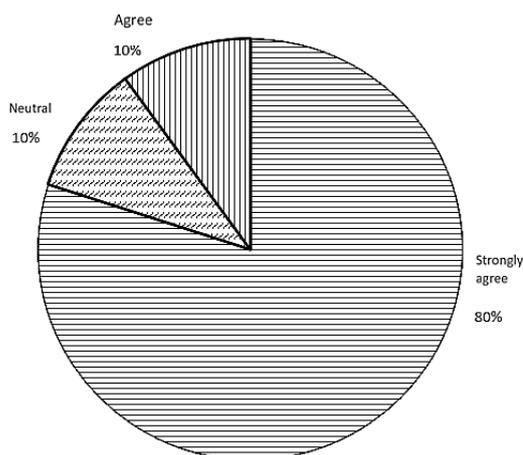


Figure 5. Functional testing result 1

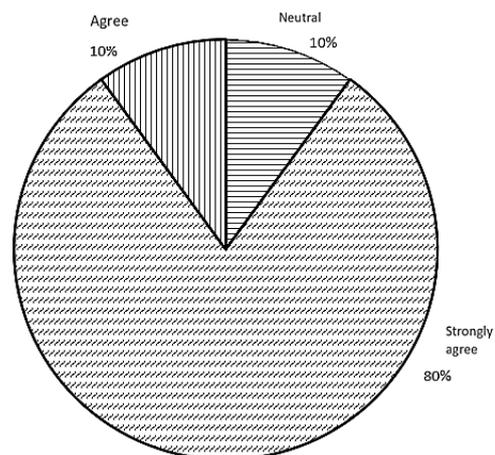


Figure 6. Functional testing result 2

4.2. Usability testing

The usability testing involves having users to engage with the application and analyzing their behaviors and reactions. A usability test is a vital step to ensure the intended mobile application design is an effective, efficient, and delightful experience for the users. Figure 7 shows that 80% of respondents strongly agree that they prefer to use the application because it aids their child's learning of *du'a*. 10% of the users

agree that the application helps their child learn *du'a* and the remaining 10% are neutral, meaning they do not agree or disagree. Figure 8 shows 70% of the respondents are extremely pleased with the application. 20% of the respondents agrees that they are indeed satisfied with this application while another 10% of the respondents are dissatisfied with the application.

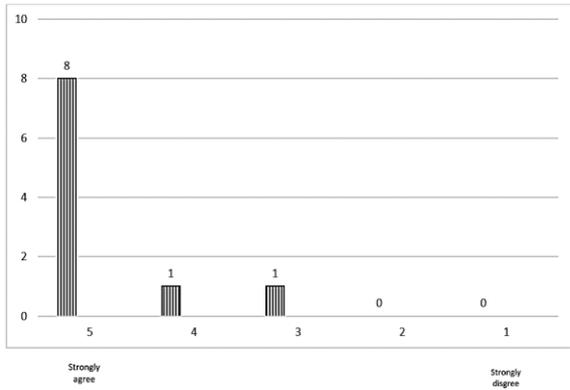


Figure 7. User acceptance result 1

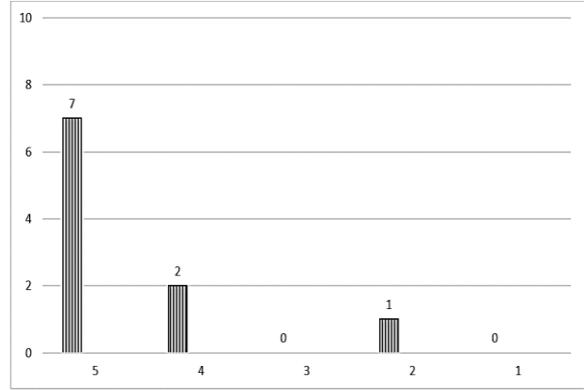


Figure 8. User acceptance result 2

4.2. Efficiency testing

Efficiency testing, commonly referred to as User Experience (UX) testing, is a testing method to determine how simple and user-friendly is a system or application. Based on the respondents results in Figures 9 and 10, it shows that this research project was designed well, and all the requirements were met. Figure 9 shows that 80% of the respondents strongly agree that the application makes it easier for children to learn *du'a* and attracts their attention, while 10% agrees and 10% are neutral about how the application makes it easier for their children to learn *du'a*. Figure 10 shows that 70% of respondents strongly agree that the application helps parents see their child's performance, 20% agree, and 10% disagree that the application helps them see their child's performance.

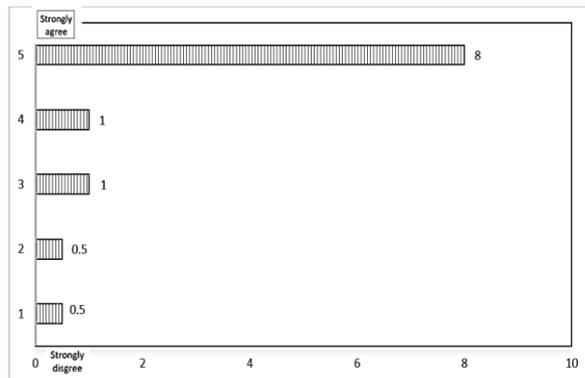


Figure 9. Efficiency testing result 1

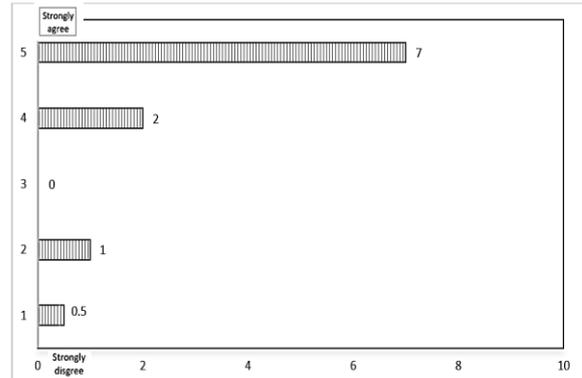


Figure 10. Efficiency testing result 1

5. CONCLUSION

The goal of this research project was to make learning enjoyable and simple for children. Since the first purpose was to design an interactive multimedia-based mobile application to learn *du'a* for kindergarten children, the mobile application was full of appealing images to lure children to explore more, and the *du'a*(s) were shown in an animation video with translation. Furthermore, this mobile application has a quiz module where users can choose whether to take an online quiz or use the application's built-in quizzes and the results will be saved in the result module, where parents can view their children's performance. Based on the results of the questionnaire, the participants were pleased and satisfied with the application. As a result, the project's objectives were met because it was well-designed and developed. There are many mobile

learning applications for *du'a* recitation, but none of them teach *du'a* utilizing animation videos, instead relying only on static images. In comparison to traditional methods of learning to recite *du'a* through books, this application, which combines technology and learning, is hoped to assist children in learning the correct way to recite the daily *du'a*(s). This combination has been shown to be effective because today's children are exposed to technology at such a young age that they are more interested in using technology to learn rather than traditional methods. Several recommendations are suggested from this research project, namely, i) although the targeted users for this mobile application is the early childhood children's group, further study needs to be conducted to other possible groups (such as primary and secondary) as it may attract a larger group of learners and ii) incorporating more gamification techniques in the mobile application. This can help engage more users in using this mobile application for their learning purposes. This research project also offers several contributions. Firstly, the development of this mobile application is ideal as an additional tool to support the learning activities for early childhood children's (i.e., in the kindergarten). This will therefore contribute towards making the learning experience for kindergarten children more enjoyable. Next, this research project also contributes to early education research by providing an empirical study of the technology adoption, which can serve as a guideline for other mobile application programs especially for early childhood. Finally, this research project has the potential to contribute to the technological education literature by providing informal learning experiences through the adoption of mobile technology.

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REFERENCES

- [1] N. Phonkhao and W. Ounjit, "Social structure and early childhood learning enhancement," *Procedia-Social and Behavioral Sciences*, vol. 65, pp. 225-231, Dec. 2012, doi: 10.1016/j.sbspro.2012.11.115.
- [2] S. Kaplan and N. B. Hertzog, "Pedagogy for early childhood gifted education," *Gifted child today*, vol. 39, no. 3, pp. 134-139, May 2016, doi: 10.1177/1076217516644637.
- [3] B. Y. Hu and J. Szente, "Exploring the quality of early childhood education in China: Implications for early childhood teacher education," *Journal of Early Childhood Teacher Education*, vol. 30, no. 3, pp. 247-262, Aug. 2009, doi: 10.1080/10901020903084330.
- [4] I. K. Sudarsana, "Quality Improvement Of Early Childhood Education Through The Utilization Of Multimedia," *Jurnal Penjaminan Mutu*, vol. 4, no. 2, pp. 174-183, 2018.
- [5] A. N. Atika, Khutobah, Misno, L. Ariefianto, and Syarifudin, "Early Childhood Learning Quality in Pandalungan Community," *Jurnal Pendidikan Usia Dini*, vol. 13, no. 2, pp. 296-309, 2019, doi: 10.21009/JPUD.132.07
- [6] D. H. Clements and J. Sarama, "Early Childhood Corner: The Role of Technology in Early Childhood Learning," *Teaching children mathematics*, vol. 8, no. 6, pp. 340-343, 2002.
- [7] N. Vernadakis, A. Avgerinos, E. Tsitskari, and E. Zachopoulou, "The use of computer assisted instruction in preschool education: Making teaching meaningful," *Early Childhood Education Journal*, vol. 33, no. 2, pp. 99-104, 2005, doi: 10.1007/s10643-005-0026-2.
- [8] A. Dafoe, "On technological determinism: A typology, scope conditions, and a mechanism," *Science, Technology, & Human Values*, vol. 40, no. 6, pp. 1047-1076, Apr. 2015, doi: 10.1177/0162243915579283.
- [9] S. Edwards, "Digital play in the early years: A contextual response to the problem of integrating technologies and play-based pedagogies in the early childhood curriculum," *European early childhood education research journal*, vol. 21, no. 2, pp. 199-212, 2013, doi: 10.1080/1350293X.2013.789190.
- [10] C. Ahearn, S. Dilworth, R. Rollings, V. Livingstone, and D. Murray, "Touch-screen technology usage in toddlers," *Archives of disease in childhood*, vol. 101, no. 2, pp. 181-183, 2016, doi: 10.1136/archdischild-2015-309278.
- [11] D. J. Holloway, L. Green, and K. J. Stevenson, "Digitods: Toddlers, touch screens and Australian family life," 2015.
- [12] V. Orfanakis and S. Papadakis, "A new programming environment for teaching programming. A first acquaintance with Enchanting," *Proceedings of the 2nd international virtual Scientific Conference Scieconf*, 2014, pp. 268-273.
- [13] C. B. Hodges and A. H. Prater, "Technologies on the horizon: Teachers respond to the horizon report," *TechTrends*, vol. 58, no. 3, pp. 71-77, Apr. 2014, doi: 10.1007/s11528-014-0754-5.
- [14] S. Papadakis and M. Kalogiannakis, *Mobile learning applications in early childhood education*. IGI Global, 2019.
- [15] K. Chachil, A. Engkamat, A. Sarkawi, and A. R. A. Shuib, "Interactive multimedia-based mobile application for learning Iban language (I-MMAPS for learning Iban language)," *Procedia-Social and Behavioral Sciences*, vol. 167, pp. 267-273, Jan. 2015, doi: 10.1016/j.sbspro.2014.12.673.
- [16] N. S. Yahaya and S. N. A. Salam, "Mobile learning application for children: Belajar bersama Dino," *Procedia-Social and Behavioral Sciences*, vol. 155, pp. 398-404, Nov. 2014, doi: 10.1016/j.sbspro.2014.10.312.
- [17] Z. Pan, M. López, C. Li, and M. Liu, "Introducing augmented reality in early childhood literacy learning," *Research in Learning Technology*, vol. 29, 2021, doi: 10.25304/rlt.v29.2539.
- [18] P. L. Hutinger and J. Johanson, "Implementing and maintaining an effective early childhood comprehensive technology system," *Topics in Early Childhood Special Education*, vol. 20, no. 3, pp. 159-173, 2000, doi: 10.1177/027112140002000305.
- [19] K. Kaur, K. S. Kalid, and S. K. Sugathan, "A User Experience Model for Designing Educational Mobile Application," in *International Visual Informatics Conference*, Nov. 2021, pp. 139-150, doi: 10.1007/978-3-030-90235-3_12.
- [20] T. Lumor, M. Pulkkinen, and A. Hirvonen, "The actual adoption and use of mobile apps: The case of a higher education context," *Americas Conference on Information Systems*, 2020.

- [21] S. Pringsewu, "Learning application of Lampung language based on multimedia software," *International Journal of Engineering and Technology*, vol. 7, no. 2.27, pp. 175-181, 2018.
- [22] J. Radich, "Technology and interactive media as tools in early childhood programs serving children from birth through age 8," *Every Child*, vol. 19, no. 4, pp. 18-19, 2013.
- [23] E. Oliemat, F. Ihmeideh, and M. Alkhaldeh, "The use of touch-screen tablets in early childhood: Children's knowledge, skills, and attitudes towards tablet technology," *Children and Youth Services Review*, vol. 88, pp. 591-597, May 2018, doi: 10.1016/j.childyouth.2018.03.028.
- [24] D. D. Prasetya and T. Hirashima, "Design of Multimedia-based Digital Storybooks for Preschool Education," *International Journal of Emerging Technologies in Learning*, vol. 13, no. 2, 2018.
- [25] C. R. Camacho, S. Marczak, and D. S. Cruzes, "Agile Team Members Perceptions on Non-functional Testing: Influencing Factors from an Empirical Study," *2016 11th International Conference on Availability, Reliability and Security (ARES)*, 2016, pp. 582-589, doi: 10.1109/ARES.2016.98.

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