



SEMARAK ILMU
PUBLISHING
202103268166(003316878-P)

Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943



The Design and Development of a Multimedia Reading Application for Pre-schoolers as a Foundation in the Area of TVET

Suhaizal Hashim^{1,*}, Nur Zahira Mohamed Zahir¹, Nuraini Hanisah Maleki¹, Mohd Hasril Amiruddin¹, Mohd Erfy Ismail¹, Danakorn Nincarean²

¹ Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor, Malaysia

² Faculty of Computer Systems and Software Engineering, Universiti Malaysia Pahang Al-Sultan Abdullah, 26600 Pekan, Pahang, Malaysia

ARTICLE INFO

Article history:

Received 15 August 2023

Received in revised form 15 January 2024

Accepted 21 August 2024

Available online 18 September 2024

Keywords:

Technical and vocational education and training (TVET); preschool; multimedia application

ABSTRACT

The greatest time for this is during early childhood schooling, when children are just beginning to become aware of their job options and form an imagination about the careers, they are interested in. In order to prepare pre-schoolers for their future employment, Technical and Vocational Education and Training (TVET) aims to expand their knowledge and skill sets. Technology development also aids in these preschool students' knowledge and skill development in preparation for their future employment, particularly in TVET. At this preschool stage, their reading skills is essential for learning the TVET sector since it aids in their understanding of the subject that piques their interest. Yet, there are a number of reasons why they can struggle to read, including a lack of prior book experience, speech or hearing problems, and a lack of phonemic awareness. This design and development research (DDR) methodology was chosen to assist pre-schoolers in learning to read as a foundational skill in the field of TVET. The researcher focused on the development of multimedia applications for the teaching and learning process using a quantitative approach through ADDIE Model instructional design. The researcher used a random sampling technique to select three academic staff members with the required TVET educational credentials. This sample includes two academics with experience and skill in multimedia creation, as well as a preschool teacher from an appropriate educational institution, so the feedback gained is adequate to obtain precise comments and points of view. Data were acquired and assessed using frequency and percentage values based on a checklist form that was given. To facilitate data analysis, each item is categorised, and frequency information is quantified as a percentage. Professionals who believe that this multimedia application is useful as one of the self-learning mediums have responded favourably to the study's findings about how this multimedia application functions in terms of assisting pre-schoolers in learning to read from the aspects of content design, interaction, and interface. The study's conclusions can be used as a guide by anyone, especially when it comes to encouraging pre-schoolers' TVET growth.

* Corresponding author.

E-mail address: suhaizal@uthm.edu.my

<https://doi.org/10.37934/araset.51.2.111123>

1. Introduction

Early childhood education has been identified as the best period for this purpose as children start to develop career awareness and build imagination about the professions, they are interested in. Technical and Vocational Education (TVET) seeks to develop individuals' knowledge and skills for their future careers. Children at this age will accumulate career-related knowledge throughout their lifetimes. When the economy is doing well, parents who have a stable income and need high-quality childcare facilities will enrol their kids in preschool and early childhood education programmed. Children must research the nature of occupations as part of their career exploration. Youngsters learn about the job world from the experiences of others, develop their identities, and then connect themselves with the workplace to develop an aspirational employee identity [1]. Children also start looking for a variety of careers and learning about business trends. Following that, students will continue to choose their job pathways based on gender roles, societal values, and cultural practices that have a significant influence on their future choices in both schooling and employment [2].

Childhood has been deemed a crucial period for professional development [3], and the majority of studies have revealed a substantial correlation between young children's job development and their social-emotional growth. Any career exploration-related activity will promote positive social-emotional development. Hence, the advancement of technology significantly aids in the development of people's knowledge and abilities for their future vocations, particularly in the field of TVET. The idea of multimedia applications in digital technology is a global trend that is continuously evolving. Digital technology and digitalization have an impact on advances in the current changing environment, according to the research of Hartl and Hess [4]. This demand for digital modernization can also be seen from the industry's development in Malaysia, which is likewise considered as a driving force for the development of the nation [5]. The impact of having such a wide range of multimedia applications is seen in many other domains, such as business and education [6].

Reading comprehension is crucial for young kids as they begin to learn the TVET sector and strive to understand the area they are interested in. Several factors can contribute to reading difficulties in children, such as a lack of book experience, issues with speech and hearing, and poor phonemic awareness [7]. As a result, it is believed that this multimedia application will have a significant influence on the field of education. It has also changed the way that student's study, particularly when it comes to mastering reading abilities. The learning process was formerly solely centred on the teacher's instruction in the classroom, which represents the most significant change in this area of education. The learning process has, however, transcended the confines of the classroom thanks to modern multimedia technology. With the availability of mobile devices, students are no longer only dependent on face-to-face learning environments to use digital technologies [8]. Also, students will gain a new understanding of a topic through an initial overview thanks to the usage of multimedia-based digital technology, which can also provide a new learning experience that involves a number of senses like sight and sound [9].

The claim made by Joosten *et al.*, [10] in their study that a combination of innovations including media, audio, and visual has assisted students' aggressive disposition in following the learning process until successfully piqued their attention, focus, and curiosity supports this. Padlet, Zapper, Kahoot, Quizizz, and other programmed are examples of existing ones that have successfully aided students' growth in the field of education [11]. There is no denying that the production of instructional materials from a variety of perspectives to give more engaging training is greatly aided by the advancement of mobile and multimedia technology. The accessibility of this multimedia learning programmed also aids preschoolers who struggle with writing and reading skills. Because they have grown up in a technologically advanced world and are more interested in technology than

traditional ways, today's kids can be referred as "digital natives" [12]. Children's motivation is more positive and motivating when learning something different from what teachers routinely do in the classroom, according to Hiew *et al.*, [13]. This is because the traits of this learning are more enjoyable and support better mastery of the material.

According to Uralova [14], the usage of this multimedia application will also have distinct advantages, particularly in the development of fundamental abilities, enhancement of cognitive abilities, and fundamental abilities for preschoolers. According to the Malaysian Education Development Master Plan, all teachers must adopt the use of information and communications technology (ICT) in teaching and learning activities (PIPP 2013-2025). So, it can be observed that, as opposed to traditional learning, which only emphasizes teacher-centred learning, the usage of instructional materials in the form of multimedia apps is growing. Traditional textbooks can no longer handle the advancement and renewal of knowledge in education, claim Chan *et al.*, [15] throughout time. Also, because the learning style is uniform and uninteresting, this traditional sort of teaching methodology cannot assist pupils in giving the lesson their complete attention. This is further supported by the claim made by Szymkowiak *et al.*, [16], who claim that the current generation is better able to assimilate information and think more strategically.

Yet, there is still a lack of focus on the substance of the application created for preschool education, particularly in terms of enhancing their knowledge and abilities. The statement made by Haldorai, Murugan, and Ramu [17] that the development of multimedia applications typically faces two main problems—namely, that the applications developed are more likely to highlight the characteristics of graphics and animations than the educational materials that want to be delivered as well as educational materials that are too loaded and presentations—is further supported by their findings. The application's multimedia content is stereotypical, which makes the user feel bored.

For children aged 4-6 years, education in the preschool phase marks the start of formal learning. This education must be completed before moving on to the next phase, which is education at the primary school level. As preschoolers at this age have a natural curiosity for the world around them, it is imperative that their mastery of letter knowledge and reading begin at this age. Hence, the aspects linked to multimedia must be fully utilized in the planning and development phase of the programmed in order to create a multimedia application that can aid preschoolers' learning. These components are crucial for grabbing students' attention and demonstrating how different ways of presenting information might differ. A combination of materials engaging several senses can be used to assist preschool children understand concepts more effectively through the development of this multimedia application [18].

Choosing the appropriate content and design is crucial to the development of multimedia applications. One of the primary issues with aiding the knowledge development of preschool children, particularly in the area of TVET, is the production of weak and ineffective multimedia programmed. This occurs because the application's use of multimedia components and features does not support these kids' efforts to acquire knowledge. It is important to use multimedia-related components wisely while developing learning applications. This component is crucial for grabbing students' attention and may demonstrate the distinctions between text, visuals, and motion when it comes to presenting information. Preschoolers can be helped to understand concepts more clearly and avoid becoming perplexed by using this combination of objects that engage different senses. Thus, the purpose of this study was to:

- i. Designing a multimedia application to aid preschoolers in learning to read as a foundation for TVET.
- ii. Developing a multimedia application using ADDIE Model instructional design to aid preschoolers in learning to read as a foundation for TVET.
- iii. Evaluating the effectiveness of multimedia application from the perspectives of content, interaction, and interface design to aid preschoolers in learning to read as a foundation for TVET.

The development of multimedia programmed to aid preschoolers in their learning process is the main emphasis of this study. This study's main objective is to determine how well-received this built multimedia application is by industry professionals in terms of its interface, interactivity, and content design as an aid to preschoolers' learning. With their curiosity in using multimedia programmed and fostering their desire to learn, preschoolers' knowledge can also be indirectly strengthened by this process.

2. Methodology

This study adopts the methodology of product design and development research (DDR), where the researcher has concentrated on the creation of multimedia apps for the teaching and learning process using a quantitative approach through the use of a checklist form to get input from experts [19]. The researcher selected the ADDIE model as the primary reference for the design and development process of this teaching and learning application product since each phase in this model is easy to apply and suitable with the planning of this application. Analysis, design, development, implementation, and evaluation are the five phases of this model. Three primary phases must be taken into account in accordance with this DDR approach method, as shown in Table 1.

Table 1
Phases of the DDR Approach Method

Phase	Process
Phase 1: Needs Analysis	Literature Review
Phase 2: Design and Development	Application Development
Phase 3: Functionality	Quantitative Methods (Questionnaire)

2.1 Sampling

As the generalization process can only be used to the population that has been identified by the sample selection criteria and cannot be applied to other population groups, the researcher utilized a purposive random sampling method in this study. For the study, the researcher has chosen a total of three academic staff members with relevant TVET educational backgrounds. To ensure that the feedback gathered is sufficient to obtain clear comments and viewpoints, this academic staff is made up of two academics who are knowledgeable and skilled in the field of creative multimedia and an academic in the field of preschool education from a related educational institution. These academic staff members have a wealth of expertise and experience in each field, and they also instruct courses for TVET students.

2.2 Data Analysis

Using frequency and percentage values based on a distributed checklist form, data was gathered for this study and evaluated. Each item is categorized, and frequency information is recorded as a percentage to aid in data analysis. The percentage employed to obtain readings of the degree of agreement on this multimedia application was divided into several levels of determination using Microsoft Excel software. The percentage of expert agreement across all of the questions was then determined using descriptive statistical methods, as shown in Table 2.

Table 2
Determination Level Table

Assessment	Deterministic Level Indicators
High	80-100
Medium	40-79
Low	0-39

Two academics with experience and expertise in the field of creative multimedia and an academic with expertise in preschool education from a Malaysian educational institution were among the experts who received this checklist form. Section B of this checklist's form has 10 application interface design items, Section C contains 5 application content design items, and Section D contains 7 application interaction design items. Section A of the checklist contains expert demographic data. With score values ranging from 0% to 100%, the level of agreement is calculated using a percentage and two scale alternatives (Yes/No). This scale was chosen by the researcher because it makes data collection simpler and would provide an accurate evaluation in interpreting the responses of the respondents.

2.3 Product Design

To satisfy the goals of the study, the process must be planned and carried out methodically in order to produce high-quality research results. Any unforeseen errors will be reduced or eliminated at the planning stage. This application was created using the ADDIE model's instructional design as part of the product development process. The ADDIE model gives users a method for designing instructional materials that includes an iterative process and all of the necessary phases for creating a successful course or programmed. As indicated in Figure 1, the five primary stages of the ADDIE model technique are meant to serve as guides for application development.

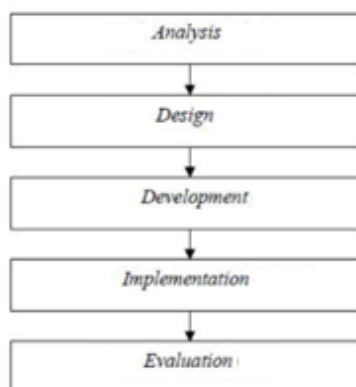


Fig. 1. ADDIE model [20]

2.1.1 Analysis phase

At this point, the researcher looks at the application's content as well as the three study's goals, which were to design and create a multimedia tool to aid preschoolers in learning to read and test the tool's usability for both teaching and learning. This ADDIE model's analysis phase is when the process of identifying the target audience, current issues, and stages for the problem-solving process are completed. The information gathered, acquired, and assessed during this phase also served to determine the study's objectives and scope. The five primary criteria that were examined during the analytical process before creating this multimedia application are shown in Table 3.

Table 3
Multimedia Application Analysis Phase Process

Criteria	Explanation
Functionality	Multimedia application design needs to have operational value where the developed design fits or meets the scope of the study.
Controllability	The user needs to manage the multimedia application guided by the manual provided so that the operation of this system can be demonstrated.
Design	The development of multimedia applications must be compatible with the functions and operating methods used for teaching and learning purposes.
Durability	The selection of materials for the development of multimedia applications must be considered because it also involves the durability and functionality of the application.
Economy	Cost, time, and energy for the development of multimedia applications should be considered. The price of this multimedia application is also affordable and functions as an effective tool for teaching and learning purposes.

2.1.2 Design phase

Researchers have identified three design categories: content, interaction, and interface design. Based on analysis and data collecting, the researcher went through the process of constructing a storyboard. A storyboard is a diagram that shows the organization of data, timing, and specifics for the presentation of a multimedia programmed. The researcher then claimed that three design kinds had been incorporated, including content topics, interaction types, and interface types for multimedia elements that had been positioned in accordance with the analysis stage. Microsoft Word is used as a storyboard drawing tool because it is simple to use, organized, and clear to read. The planning and preparation procedure for the primary design phase components is displayed in Table 4 below.

Table 4
 Multimedia Application Design Phase Process

No	Design	Display and Description
----	--------	-------------------------

1. Content Design



The goal of the content design process is to describe and arrange content in a way that will support the multimedia application's development objectives. This multimedia application's content includes reading, playing games, and learning.

2. Interface Design



Interface design serves as the primary conduit for displaying the page of this multimedia application to the user, improving each link's functionality and tying the connection to each piece of content.

3. Interaction Design








The navigation of this multimedia application's interface design gives users complete control over each link to the content and the nature of their user experience.

2.1.3 Development phase

This phase concerns the software that was utilised to create this multimedia application, which incorporates media and technical components as necessary. To aid in the creation of this multimedia application, researchers employed the Adobe Animate, Adobe Illustrator, Adobe Photoshop, Create Studio, and Wandershare Filmora software. At this phase, the researcher will use the preschool curricula as the model for how users will potentially learn to read. After the design phase is finished, the development phase is put into action. This level involves a variety of tasks, such as the creation of content material and the integration of multimedia components like text, graphics, audio, and video into the application. Applications with a lot of multimedia components enable users to follow an enjoyable learning process, particularly when comprehending the subject matter. Because interface design affects the user's first impression of this programme, it is crucial, and the

development process should be carefully managed to fit the subject and satisfy the learning objectives of the intended user. As shown in Table 5, this application's multimedia components comprise text, graphics, audio, and video. The usage of strong multimedia components can encourage students to concentrate on this subject.

Table 5
 Multimedia Application Design Phase Process

Content	Application Interface Design
Welcome Screen	
Loading Bar screen	
Main Menu Screen	
Notes Screen	
Video Display Screen	



2.1.4 Implementation phase

At this point, the offered instructional resources will be applied in actual circumstances. Real users will test this full multimedia application to find any bugs that were overlooked during the product development process. If an error happens, it will be rectified before the user receives the entire package. After the development phase has been completed, this phase will be put into action. In this step, the process of assessing how well-suited multimedia programmes is to teaching young children how to read from the perspectives of content design, interaction, and interface is involved.

2.1.5 Evaluation phase

This step involves evaluating the functioning and design of the multimedia application by specialists, including two academics with expertise and experience in the field of creative multimedia and an academic with expertise in preschool education from an educational institution. The final stage of this DDR-style study is the evaluation phase. At this point, the functioning of this multimedia application will be assessed using a checklist form to obtain input on how to make it more user-friendly and improve the application's interface, interactivity, and content design.

3. Analysis and Discussion

3.1 Expert Demographic Analysis

The researcher has chosen two academics who are skilled and have extensive experience in the field of creative multimedia and an academic in the field of preschool education from the institution related education so that the feedback obtained is sufficient to get clear comments and views. This is done in order to determine the functionality of multimedia applications in helping preschool children learn to read from the aspects of content design, interaction, and interface. The five interface design professionals' gathered demographics are shown in Table 6.

Table 6
 Expert Demographic Analysis

No.	Gender	Education Level	Field Specialization	Working Experience	Position	Sector
1.	Female	PhD	Multimedia Creative	10	Lecturer	Private
2.	Male	PhD	Multimedia Creative	10	Lecturer	Private
3.	Male	Bachelor's Degree	Pre School-Education	31	Teacher	Government

3.2 Expert Evaluation Analysis

Three specialists evaluated the content, interaction, and interface designs. Two senior lecturers from the Skills and Professional Department at one of the private institutions likewise in the Johor area as well as a preschool teacher are the specialists participating. The research results on the effectiveness of multimedia apps in assisting pre-schoolers in learning to read from the elements of content design, interaction, and interface are shown in Table 7.

Table 7
 Expert Evaluation Analysis of Content, Interaction, and Interface Design

No	Item	Yes	No	Acceptance Percentage (%)
Content Design				
1.	The contents of the topics in this application meet the learning objectives.	3		100
2.	The contents of the topics in this application correspond to the learning topics.	3		100
3.	The information in the video through this application coincides with the content of the learning topic.	3		100
4.	The information in the video through this application is compatible with the latest syllabus.	3		100
5.	The presentation of information in this application is clear and easy to understand.	3		100
Interaction Design				
1.	The use of text on each navigation button of this application helps users to explore other displays.	3		100
2.	The use of buttons in this application is consistent.	3		100
3.	The size of the buttons in this application is appropriate.	3		100
4.	The position of icons in this application is consistent.	3		100
5.	Every button in this app works well.	2	1	66.7
6.	The button to the next view in this application works well.	2	1	66.7
7.	The function of the navigation buttons used in this application can be easily identified.	2	1	66.7
Interface Design				
1.	The background colour of the application interface design used is appropriate.	3		100
2.	The type of writing used for each application content statement is appropriate.	3		100
3.	The use of text on application videos is appropriate.	3		100
4.	The use of the Colour of the buttons on the application is appropriate.	3		100
5.	The size of the video displayed on the application is appropriate.	3		100
6.	The description of the content in the video on the application is appropriate.	2	1	66.7
7.	The duration of the video on the application is appropriate.	2	1	66.7
8.	The video quality on the application is suitable.	2	1	66.7
9.	The use of audio in the application is clear and easy to understand.	1	2	33.3
10.	The background music selected in the video on the application is appropriate.	3		100

Based on the data collected, most experts concur that the material in the produced application is entertaining, relevant to the target user, and aligns with the learning objectives. According to their suggestions, this application needs to be enhanced in various areas. Researchers conducted scientific

reading and research to obtain data prior to developing this application in order to ensure the suitability of this learning issue using requirements analysis methodologies.

Throughout the research process, a number of issues including the use of insufficient content and the usage of less captivating multimedia resources in the application development process emerged. Researchers have been able to recognize these issues sooner because to the use of well-planned storyboards. A storyboard design is a conceptual representation of how a product will be used by an application [21]. In order to capture users' interest and attention throughout development, it is crucial to combine multimedia elements such as text, graphics, animation, and audio. According to Sofian, Hashim, and Sarlan [22], multimedia components are one way to improve learning compared to conventional techniques that focus on textbooks and writing, especially for kids with special needs.

Next, using movies to teach preschool pupils the fundamentals of a subject is highly recommended. This is so that information may be conveyed more readily and swiftly than with other forms of multimedia thanks to video. Makmuroh [23], who claims that interactive movies are particularly beneficial in helping users, especially preschool pupils, quickly absorb the material offered, supports this claim. As a nice video is compatible with the distribution strategy, it will increase children's attention and enthusiasm for the developed application.

The selection and determination of the product development model is the fundamental step in designing and developing an application. The ADDIE model has been used by researchers in the development of this application since it has a non-consecutive pattern and is more adaptable to work because modifications can be made quickly. In their study, Sriwahyuni & Saehana [24] argue that the process of planning, implementation, and assessment is a systematic effort with a defined goal in the process of creating and utilizing learning technology applications. This assertion is backed by their findings.

The primary tool used in the development of this application is Adobe Animate, with assistance from a number of additional programmed. Users of this Adobe Animate programmed can create interactive animations for usage in games, TV shows, and the internet. Moreover, users can enable the use of animations and advertisements, produce snippets and animated avatars, and add actions to infographics and eLearning materials. Users of this programmed can also publish applications on the platform in a variety of formats so that they can reach audiences on any screen. In their study, Setiawan, Alpindo, and Astuti [25] claimed that since Adobe Animate software is ideal for creating engaging learning materials, researchers can simply make animations with free movement and engage with media because it is interactive. But, the process of creating the interface, navigation, and content must be implemented first before this programmed reaches this stage of development.

This programmed was created specifically for preschoolers, for whom it is important to examine the choice of text formats given that they are still developing their letter knowledge. Also, the wording of the application should not be overly wordy and should employ simple language. Moving animation aids in the development of the storyline, and the text that appears beneath the animation helps to more effectively communicate the plot. The research should also focus the design of the navigation buttons since it is highly helpful for people surfing this application. The graphic elements utilized in this application were created using Adobe Illustrator Studio. This issue is consistent with the claim made by Harun *et al.*, [26], according to which applications with strong design should have a clear presentation that makes it simple for users to grasp.

Next, the process of assessing this multimedia application's functionality in terms of content design, interaction, and interface in aiding preschoolers in learning to read received favourable feedback from experts, who believe that this multimedia application is effective as one of the mediums for independent learning. Preschool pupils can master reading abilities with the aid of this application's content, interface design, and interactivity because they are so simple to understand. A

programmed called TVET is created to help students get ready for the workforce in accordance with the goals of the industrial revolution. The utilization of ICT methods in the classroom to complete the TVET programmed is becoming more and more crucial as the demand for skilled IT employees rises. As a result, it's critical that the next generation, namely youngsters, become accustomed to technology early on. According to Jemimah and Suziyani's [27] study, Malaysian preschool instructors have begun integrating ICT into the curriculum in order to meet the expectations of the fourth industrial revolution. In line with the primary goal of preschool education, which is to lay a solid foundation for children, which includes all areas of development such as cognitive, psychomotor, social-emotional, language, and social-communication, the appropriate learning approach in TVET will therefore help expand children's ways of thinking.

4. Conclusion

The goal of this project was to create a multimedia tool to aid pre-schoolers in their reading development. Pre-schoolers may find it simpler and clearer to learn about the history of the internet this way. According to research, this application can benefit pre-schoolers by imparting knowledge in an engaging and effective manner. Also, this study was able to offer a thorough and in-depth review as well as recommendations on how to design and create multimedia applications for pre-schoolers. By employing this programme as a teaching aid, this can further simplify the teaching and learning process and enhance the knowledge of these pre-schoolers. It is intended that this study may one day serve as a guide for everyone, particularly in assisting pre-schoolers' TVET growth.

Acknowledgement

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Tier 1 (vot Q531). We would also like to thank UTHM-Labtech Digital Innovation Centre of Industry for their efforts in assisting this project.

References

- [1] Maree, Jacobus Gideon. "Perspective: Promoting career development in the early years of people's lives through self-and career construction counselling to promote their career resilience and career adaptability." *Early Child Development and Care* 188, no. 4 (2018): 421-424. <https://doi.org/10.1080/03004430.2018.1438748>
- [2] Mohamed, Suziyani, Nor Atiqah Satari, Kamariah Abu Bakar, and Faridah Yunus. "Exploring career-related learning activities in the preschool classroom." *Journal of Technical Education and Training* 12, no. 3 (2020): 126-134.
- [3] Çelik, Eyüp. "Stress regarding academic expectations, career exploration, and school attachment: The mediating role of adolescent-parent career congruence." *Australian Journal of Career Development* 28, no. 1 (2019): 51-60. <https://doi.org/10.1177/1038416218792314>
- [4] Hartl, Eva, and Thomas Hess. "The role of cultural values for digital transformation: Insights from a Delphi study." (2017).
- [5] Omar, Rosmani, Md Sidin Ahmad Ishak, and Siti Ezaleila Mustafa. "Daripada Cetak Kepada Digital: Rekonstruksi Cerita Rakyat di Malaysia." *Melayu: Jurnal Antarabangsa Dunia Melayu* 12, no. 2 (2019): 291-319.
- [6] Nordin, Norazly, and Juppri Bacotang. "Issues and trends the usage of information and communication technology in early childhood education: Isu dan trend penggunaan teknologi maklumat dan komunikasi dalam pendidikan awal kanak-kanak." *Jurnal Pendidikan Awal Kanak-kanak Kebangsaan* 10, no. 1 (2021): 99-107.
- [7] Sonnenschein, Susan, Michele Stites, and Rebecca Dowling. "Learning at home: What preschool children's parents do and what they want to learn from their children's teachers." *Journal of early childhood Research* 19, no. 3 (2021): 309-322. <https://doi.org/10.1177/1476718X20971321>
- [8] Hamzah, Norhasyimah, Carolina Collin, Normah Zakaria, Arihasnida Ariffin, and Siti Nur Kamariah Rubani. "Android Application Development for Force Topics in Year Six (6) Science Subject." *Research and Innovation in Technical and Vocational Education and Training* 2, no. 2 (2022): 069-076.

- [9] Buang, Zurani, and M. M. Mohamad. "Kolaborasi dan Komunikasi dalam Kelestarian Pembelajaran Sepanjang Hayat." *Online Journal for TVET Practitioners* 4, no. 2 (2019): 105-113. <https://doi.org/10.30880/ojtp.2019.04.02.013>
- [10] Joosten, Tanya, Kate Lee-McCarthy, Lindsey Harness, and Ryan Paulus. "Digital Learning Innovation Trends." *Online Learning Consortium* (2020).
- [11] Basuki, Yudi, and Yeni Hidayati. "Kahoot! or Quizizz: The students' perspectives." In *Proceedings of the 3rd English Language and Literature International Conference (ELLiC)*, pp. 202-211. 2019. <https://doi.org/10.4108/eai.27-4-2019.2285331>
- [12] Reijmersdal, Eva A. van, and Esther Rozendaal. "Transparency of digital native and embedded advertising: opportunities and challenges for regulation and education." *Communications* 45, no. 3 (2020): 378-388. <https://doi.org/10.1515/commun-2019-0120>
- [13] Hiew, Jemimah, Suziyani Mohamed, Noratiqah Satari, and Kamariah Abu Bakar. "The Readiness of Preschool Teachers in Integrating 4th Industrial Revolution Skills in Classroom: A Recent Study." *Current Research in Language, Literature and Education Vol. 3* (2022): 1-11. <https://doi.org/10.9734/bpi/crll/v3/15306D>
- [14] Uralova, Dilfuza. "The use of ICT in preschool education while teaching English language." *TJE-Tematics journal of Education* 5 (2021). <https://doi.org/10.2139/ssrn.3779250>
- [15] Chan, M. Ildal Hafiz, Edja Annisa Septia, Kurnia Febrianti, and Desnita Desnita. "Efektivitas Model Pembelajaran Terhadap Peningkatan Pemahaman Konsep Fisika Siswa SMA: Meta-Analysis." *ORBITA: Jurnal Kajian, Inovasi dan Aplikasi Pendidikan Fisika* 7, no. 2 (2021): 238-245. <https://doi.org/10.31764/orbita.v7i2.5714>
- [16] Szymkowiak, Andrzej, Boban Melović, Marina Dabić, Kishokanth Jegannathan, and Gagandeep Singh Kundi. "Information technology and Gen Z: The role of teachers, the internet, and technology in the education of young people." *Technology in Society* 65 (2021): 101565. <https://doi.org/10.1016/j.techsoc.2021.101565>
- [17] Haldorai, Anandakumar, Suriya Murugan, and Arulmurugan Ramu. "Evolution, challenges, and application of intelligent ICT education: An overview." *Computer Applications in Engineering Education* 29, no. 3 (2021): 562-571. <https://doi.org/10.1002/cae.22217>
- [18] Delgado, José Lucas Delgado, Yolanda Inés España Bone Bone, Maholy Antonella García Lascano Lascano, and Saskia Giorlet García España España. "Dyslexia as learning problem and its pedagogical intervention." *International Journal of Health Sciences* 3, no. 3 (2019): 1-7. <https://doi.org/10.29332/ijhs.v3n3.333>
- [19] Aken, Joan E. van. "Management research based on the paradigm of the design sciences: the quest for field-tested and grounded technological rules." *Journal of management studies* 41, no. 2 (2004): 219-246. <https://doi.org/10.1111/j.1467-6486.2004.00430.x>
- [20] Molenda, Michael. "In search of the elusive ADDIE model." *Performance improvement* 42, no. 5 (2003): 34-37. <https://doi.org/10.1002/pfi.4930420508>
- [21] Hamzah, Norhasyimah, Nor Farah Emilia Mohd Rosli, Siti Nur Kamariah Rubani, Arihasnida Ariffin, and Normah Zakaria. "Aplikasi Android Pembelajaran Abjad Bahasa Jepun (JingoCat Apps)." *Innovative Teaching and Learning Journal* 6, no. 1 (2022): 52-60. <https://doi.org/10.11113/itlj.v6.88>
- [22] Sofian, Nadiah Mohamad, Ahmad Sobri Hashim, and Aliza Sarlan. "Multimedia elements in designing mobile app interface for autistic children: proxy user perspective." In *2021 International Conference on Computer & Information Sciences (ICCOINS)*, pp. 96-101. IEEE, 2021. <https://doi.org/10.1109/ICCOINS49721.2021.9497180>
- [23] Makmuroh, Umniyyatul. "Digital training of kinemaster application for learning video: perspectives from kindergarten school teachers." *International Journal of Research in Education (IJRE)* 1, no. 2 (2021): 121-128. <https://doi.org/10.26877/ijre.v1i2.8612>
- [24] Sriwahyuni, T., and S. Saehana. "Developing android-based teaching material on temperature and heat using ADDIE model." In *Journal of Physics: Conference Series*, vol. 2126, no. 1, p. 012021. IOP Publishing, 2021. <https://doi.org/10.1088/1742-6596/2126/1/012021>
- [25] Setiawan, Arie, Okta Alpindo, and Puji Astuti. "Development of Interactive Multimedia Using Adobe Animate Software on the Material of Sequences and Series For Class XI MAN Bintan." *Jurnal Gantang* 7, no. 1 (2022): 29-38. <https://doi.org/10.31629/jg.v7i1.4523>
- [26] Harun, Fauzia, Yahya Hairun, Tedy Machmud, and Idrus Alhaddad. "Improving Students' Mathematical Communication Skills through Interactive Online Learning Media Design." *Journal of Technology and Humanities* 2, no. 2 (2021): 17-23. <https://doi.org/10.53797/jthkss.v2i2.3.2021>
- [27] Jemimah, Hiew, and Mohamed Suziyani. "The Readiness of Preschool Teachers in Integrating 4th Industrial Revolution Skills in Classroom." *International Journal of Academic Research in Progressive Education and Development* 8, no. 3 (2019): 84-98. <https://doi.org/10.6007/IJARPED/v8-i3/6286>