

RESEARCH ARTICLE | JUNE 09 2023

Android-based interactive application development in the subject of design and technology for the topic of manufacturing technology

R. Mutarah; M. N. A. Azman ✉; G. K. Kassymova; B. K. Kenzhaliyev



AIP Conf. Proc. 2750, 040065 (2024)

<https://doi.org/10.1063/5.0149272>



CrossMark



Lock-in Amplifier



Zurich
Instruments

Find out more



Boxcar Averager

Boost Your Optics and Photonics Measurements

Android-Based Interactive Application Development in the Subject of Design and Technology for the Topic of Manufacturing Technology

R Mutarah¹, M N A Azman^{1,a)}, G K Kassymova² and B K Kenzhaliyev²

¹*Faculty of Technical & Vocational, Universiti Pendidikan Sultan Idris, Tanjung Malim, Malaysia*

²*Institute of Metallurgy and Ore Beneficiation, Satbayev University, Almaty, Kazakhstan.*

^{a)}Corresponding author: mnazhari@ftv.upsi.edu.my

Abstract. Design and Technology is one of the important subjects taught in secondary or primary schools. However, it is often said that most students are less interested in design and technology subjects. This study was conducted to develop an interactive application based on android in the design and technology subject for the topic of manufacturing technology form 2. The research method of this study was qualitative. The research tool was an interview method. The study respondents consisted of 3 teachers and Design and Technology experts and two design expert lecturers. Study data were collected by recording audio of each interview session conducted by the researcher with 5 respondents and transcribed in Microsoft Word and then categorized into several parts and commented in more detail by the researcher to see the answers given by respondents more clearly. The results of this study found that the developers of this Manufacturing Technology application are well educated. This is because the development of this application will to some extent facilitate the teaching of teachers when PdPc and PdPr take place. In terms of the views of expert teachers and expert lecturers, most respondents gave positive views related to the use of this interactive application in schools compared to negative views, and most gave views resulting from experience while teaching. Some planning suggestions before, during, and after using interactive applications in Learning and Facilitation (PdPc) in Home Teaching and Learning (PdPr) schools were also put forward by expert teachers and expert lecturers for ensuring the use of these interactive applications and it is at an optimal level. The implication of this study is that teachers can improve their skills in using interactive applications in PdPc and PdPr in the future. RBT expert teachers and RBT expert lecturers and teachers in schools are also aware of the importance of the use of these interactive applications in improving students' thinking skills at a higher level.

INTRODUCTION

The existence of the covid-19 pandemic has had a greater impact on the global world. The impact in the world of education is so great that face-to-face learning cannot be implemented. What the government is doing is that all learning will be done online or known as Open Distance Learning (ODL), defined as teaching conducted by someone in a time and space separate from the students and the mission aims to encompass greater dimensions of openness and flexibility, whether in terms of access, curriculum or other structural elements [1]. ODL is divided into two methods of Learning and Teaching (PdP), synchronous and asynchronous. Synchronous refers to electronic interactions that occur synchronously in real-time or directly at that time. Asynchronous refers to electronic interactions that occur asynchronously or in a delayed mode [2].

The era and transformation of education of the 21st century is a current of change in which teachers and students will both play an active role in teaching and learning in the classroom. The role of the teacher is no longer as a god but as an active facilitator to unearth the potential in students. Teachers' knowledge, skills, and experience are integrated to build robust teaching for more effective teaching and learning. The government's efforts in providing a 21st-century workforce can also be seen through the Smart Schools project [3].

PdP in the subject of design and technology involves two aspects such as theory and practice. Practical sessions in the laboratory are one of the important elements in the subject of design and technology, to prepare students with the necessary skills [4]. Similarly, project-based learning is very important to further improve the STEM of students.

Project-Based Learning is a learning method that allows students to study a given topic to produce a product as a result of learning [5]. In addition, the level of computer and technology literacy is still low and this makes project-based learning less successful. In a study that was conducted at Universiti Teknologi Malaysia, the ability of students to operate electrical measurement equipment is still below the competent level [6].

Teaching aids are an important tool in today's classrooms and labs in a variety of subjects and levels [7]. Teaching aid with the help of smartphones is increasingly being produced to improve the quality of education in our country. It is no longer a foreign thing in the field of education. Therefore, teachers should take seriously engaging themselves to provide ABM to students. In a classroom, each individual has different psychology and intellectual abilities from others [8]. Therefore, the planned teaching must be appropriate, arranged (according to the level of students), and supported (with teaching aids) to stimulate the development of individual potential to the maximum level [9]. When a teacher prepares an ABM, then a high level of knowledge and readiness must be present in the teacher.

METHODOLOGY

This PdP application development framework uses the analysis, design, development, implementation, and evaluation (ADDIE) model. The ADDIE model is often used because of its clear level and it facilitates the implementation of development [10]]. Figure 1 describes the methodology flow of My Manufacturing teaching and learning application development using this model.

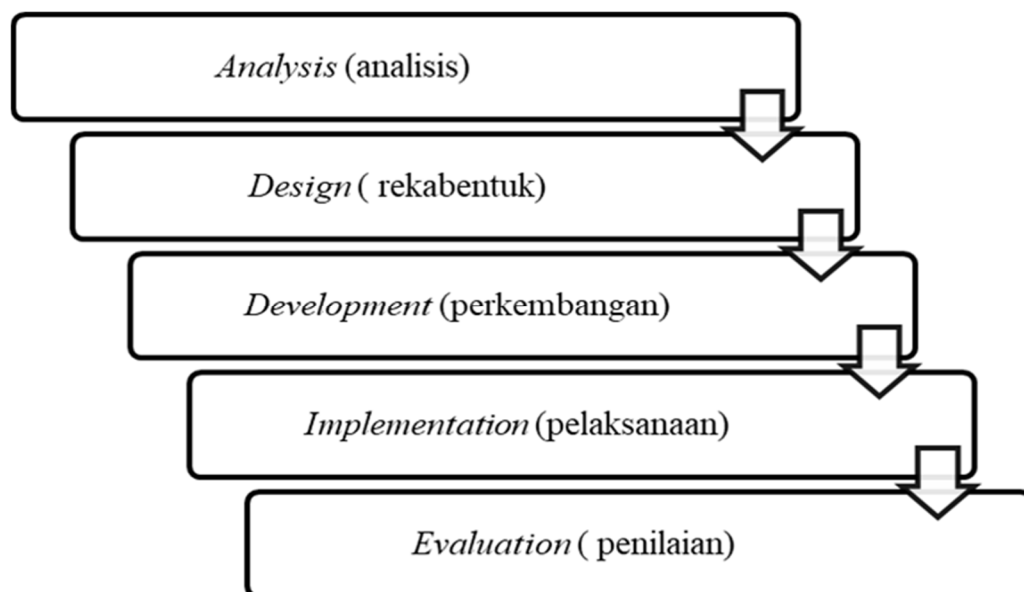


FIGURE 1. The flow process of the ADDIE model.

Phase of Analysis

The first phase is analysis. In this stage, there are several analyses carried out, and among the most important are the problems related to identifying the problem and how to solve it. The purpose of this analysis process is to ensure that the instructional design, that will be produced, meets the actual needs of students. In this analysis phase, the researcher will make some analysis related to android based applications involving three main platforms as Android, IOS, and Huawei Apps Gallery. However, this study only focused on Android applications. Aspects, that will be analyzed, are the objectives and goals of application development, user needs, user scope, application content, and information delivery methods [11]. Before developing real mobile software, developers will use Microsoft Powerpoint software to create a storyboard presentation by collecting information on the topic of manufacturing technology in the software [12]. The software used to develop this android mobile application is iSpring. The required period is one month in terms of drafting a plan and also collecting materials that will be used in developing these teaching and learning applications.

Phase of Design

The second phase is design. This phase describes the overall look and technology that will be used in developing the manufacturing technology application. For this phase, the researcher will begin to draw ideas on the appearance and functionality of the application to be developed. The application produced must also meet the needs or it can attract students to know the content of learning on the application developed. A storyboard will be produced first as a guide before using the actual application. It is to show the raft for the arrangement of elements in the form of illustrations or images, the arrangement of the application structure, and the division of information. The storyboard has a visual effect where it allows the software programming used in application development to run smoothly and orderly. This storyboard will be produced using Microsoft PowerPoint. Developers will also include hyperlinks for each storyboard to show the facing relationship for each storyboard in the development of the final application that will be developed. The iSpring software used to develop real applications for this Manufacturing Technology topic is very appropriate and it can also provide an interesting form of presentation as this software has various functions in terms of application design and animation [13]. The objective of the development of this application is to be a medium of learning support and ensure that students can know the methods of manufacturing correctly. For the arrangement of the manufacturing technology application layout, the content included in the application is carefully arranged and does not use many words or multimedia elements that make it difficult for students to understand the content that will be presented in the application. Figure 2 shows the storyboard of manufacturing technology.



FIGURE 2. (a) Interface of Manufacturing Technology content; (b) Interface for Application Info; (c) Note page; (d) Interface for Mind Test; (e) Interface for Mind Test Question.

Phase of Development

In this development phase, researchers will start to develop such as Android learning applications. All initial planning such as storyboards, module division, and interface design made in the design phase will be implemented. Researchers will ensure that the app has all the required content and it is user-friendly. The Android-based mobile device application for this Form 2 manufacturing technology subtopic was developed using 'iSpring'.

' Phase of Implementation

This implementation phase refers to the development and design of teaching materials that have been prepared and will be implemented according to the needs of students. This implementation phase aims to combine all the elements to be included in the application of the manufacturing technology. Its functionality can be tested properly without involving any problems. This is a determinant to ensure that the mobile application to be developed can achieve the objectives of the project using iSpring software will be converted into Android Application Package (APK) files. Then, it will be inserted into the mobile smartphone.

Phase of Evaluation

The last phase is evaluation when the application is already used and the researcher will get many opinions or feedback from users about the functionality of the application developed. The purpose of this phase is to ensure that each process performed meets the objectives of the development in this project. Once the evaluation is done, if there are some problems from users about the application, the researcher can make improvements well. After that, it does not cause problems in the final result of the project to be done. Finally, after the improvement process is done, the researcher will request validation from the experts involved to validate the manufacturing mobile application.

FINDINGS

The method for this study is purposive sampling. Therefore, the selected respondents are those who have the characteristics of expertise in the subject RBT and the field that focuses on the duty. The selected population is lecturers and teachers who have experience in the field related to Design and Technology. Since the interviews could provide a deeper insight into the storyboard for this application. The respondents were carefully selected from among those with knowledge and experience related to the subject of Design and Technology form 1. The researcher prepared a set of interview questions before the interview with the five respondents was conducted as presented in Table 1. This interview method aims to study the suitability of mobile applications that have been developed on the content according to the curriculum of Design and Technology form 1.

TABLE 1. Respondents Background.

Respondent	Position	Background Education	Experience
Respondent 1	Lecturer for the Design and Technology course at the Sultan Idris University of Education	Doctor of Philosophy in Technical and Vocational Education and Electrical and Electronics Engineering	10 years
Respondent 2	Lecturer for the Design and Technology course at the Sultan Idris University of Education	Doctor of Philosophy in Mechanical Engineering (Industrial Design and Product Design	7 years
Respondent 3	Teacher for Design and Technology subjects at SMK Simpang Perak	Bachelor's Degree of Technical and Vocational Education	1.5 years
Respondent 4	Teacher for Design and Technology subjects at SMK Tinggi Setapak	Master of Technical and Vocational Education	8 years

There are 10 questions and have four sections, first section A introduction, section B content of the application (Table 2), section C the elements of the application interface (Table 3), and section D closing questions (Table 4). All the questions were asked by researchers to all respondents to get feedback about the produced application. Data saturation is verified when no new information is obtained from the interview transcript.

TABLE 2. Part B Question and experts opinion.

No	Question	Expert views
1	Does the content information in this Manufacturing Technology application coincide with the textbook and the Curriculum and Assessment Standard Document (DSKP) for the subject of Form 1 Technology Design?	The content in this application coincides with the DSKP and the textbook that has been proposed by the Malaysia Ministry of Education.
2	In your opinion, are the sentences used in this Manufacturing Technology application clear and easy to understand?	All panels interviewed give positive responses by agreeing that the sentences used in this application are simple and easy to understand.
3	Is the description for each topic given in this Manufacturing Technology application clear?	The description for each topic is summarized really good and one expert suggests adding a different explanation from other resources.
4	Are the questions made as a mind test activity appropriate to the content of the application?	All panel agree with the questions and 1 panel suggest to used subjective questions.

Section C deals with the design of the application developed. This section consists of four related questions about the design elements used such as text, graphic, interface design, navigation design, color usage and suggestions for improvement.

TABLE 3. Question and expert views for Section C.

No	Question	Expert views
1	Are the images/ elements such as pictures, symbols, and icons included in this app interesting?	One panel like the use of simple images and elements and the other suggested using more interesting elements and images.
2	What about the typographic elements, namely the size of the text and the type of text, is it appropriate according to you?	All panels are agreed that the typographic elements are appropriate and interesting.
3	Are the layout and navigation elements of the content in this mobile application very organized?	All panels agreed and like the use of simple navigation in the application.
4	Is the use of color in terms of background and text in this application appropriate?	The color that used in the background application and text is interesting from all five panels. One of the panels also thought that the color of text is clear.

TABLE 4. Question and expert views for Section D.

No	Question	Expert views
1	In your opinion, to make this application more effective in the future, what suggestions for improvements can be implemented over this application.	There are 3 suggestions that have been proposed by all the panels. 1. Use of Musical elements for this application is more interesting especially to students. 2. Inserting Kahoot quiz and Quizziz links on each topic section. This aims to strengthen students memory when answering the question 3. Make short video application content such as hydroponic techniques, then make a video in terms of sketches and mock-up. This method can increase the creativity of students in producing a project.

To prepare master and doctoral students for science research, the given android-based mobile device application can be used during their studies, for instance, an android-based interactive application can be developed for future engineer-researchers from the metallurgy industry as well. Rare earth elements have a special place in the development of the economy and technology. They are used in the manufacture of electronic equipment, automobiles, aerospace, rockets, and even in medical diagnostics [14, 15]. The developed research technology project results can be content for our Android-Based Interactive Application. Such research results in the digital application will allow master and doctoral students, future young scientists to introduce real research experiments in manufacturing [16, 17]. So, science-based and technology-based education systems will be effective for adult education [18, 19]. Using the android-based interactive application in subjects for technical sciences for developing manufacturing technologies enhances the competency of vocational education students and also develops their cognitive abilities and skills [20]. In addition, image analysis and artificial intelligence, for example, would be useful additions to such applications [22]. It also enables the research and development, startups of scientific projects [21].

CONCLUSION

In general, this study has discussed each phase of the design and development process of the MyManufacturing PdP application. Past studies have proven that the use of dynamic mobile applications has a better impact than learning the conventional way. The development of PdP MyManufacturing application is expected to help lecturers to diversify teaching methods and apply various learning approaches such as flipped classrooms and collaborative learning in PdP implemented. The presence of students from generations Y and Z who have a high technological background and literacy should move in line with the PdP methods used so that the latest technology can be fully utilized in education. The design and development of applications that apply the elements of technology are able to provide benefits in the implementation of PdP. Hopefully, the use of the latest technology will continue to be utilized to improve the quality of PdP in Malaysia and worldwide.

ACKNOWLEDGMENTS

We are gratefully and would like to thank the Research Management and Information Centre, Sultan Idris Education University for the financial support and particularly those from the Faculty of Technical and Vocational, for their contributions and opinions to this project directly or indirectly, which were extremely useful in completing this research.

REFERENCES

1. Information on <http://unesdoc.unesco.org/images/0012/001284/128463e.pdf>
2. Information on https://drive.google.com/file/d/11yVQj2hvVKhc_mEw09Y7DePWfjJm0qDB/view
3. N. S. Sukor, "Kesediaan murid mmenghadapi pembelajaran dan kemahiran kimia abad ke-21", (Selangor, Malaysia: Universiti Kebangsaan Malaysia, 2011).
4. R. Krivickas and Krivikas, J, Global Journal of Engineering Education **11**, 191-196 (2007).
5. R. Mustapha, Sadrina, I. Mat Nashir, M. N. A. Azman and K. A. Hasnan, Journal of Technical Education and Training **12**, 100-118 (2020).
6. K. R. Salim, M. Puteh, and S. M. Daud, *Procedia - Social and Behavioral Sciences* **56**, 546–555 (2012).
7. B. Rahmatullah, A. T. Papageorgiou and J. Noble, "Image analysis using machine learning: Anatomical landmarks detection in fetal ultrasound images" (*Proceedings of International Computer Software and Applications Conference*, 2012), pp. 354–355.
8. A. Hasan, "Penteorian Sosiologi dan Pendidikan" Edisi Kedua (Tanjung. Malim: Perak, 2002).
9. T. Tomoliyus, S. Sumaryanti and H. M. Jatmika, Asian Journal of Assessment in Teaching and Learning **6**, 41-49 (2016).
10. I. A. F. Manan, M. A. Embi and Z. Mahamod, Asean Journal of Teaching and Learning in Higher Education **2(2)**, 64-76 (2010).
11. D. N. Dumbiri and C. O. Nwadiani, *Asian Journal of Vocational Education And Humanities* **1**, 1-8 (2020).
12. I. Zulmaidas, S. Syahrul, A. Ambiyar and A, Y, *Teknomekanik* **2**, 20-23 (2019).
13. F. E. Abanyam and V. A. Abanyam, *Journal of Technology and Humanities* **2**, 31-41 (2021).

14. A. V. Panichkin, B. K. Kenzhaliyev, A. K. Kenzhegulov, A. T. Imbarova, Zh. A. Karboz, A. Shah, [Kompleksnoe Ispol'zovanie Mineral'nogo syr'â = Complex Use of Mineral Resources = Mineraldik Shikisattardy Keshendi Paidalanu](#) **4**, 82–95 (2020).
15. O. S. Baigenzhenov, A. M. Toishybek, A. T. Khabiyev, I. O. Aimbetova and A. T. Dagubayeva, [Kompleksnoe Ispol'zovanie Mineral'nogo Syr'a. = Complex Use of Mineral Resources = Mineraldik Shikisattardy Keshendi Paidalanu](#) **3**, 97-103 (2021).
16. B. E. Abdikerim, B. K. Kenzhaliyev, T. Yu. Surkova, N. Didik, A. N. Berkinbayeva, Z. D. Dosymbayeva and N. S. Umirbekova, [Kompleksnoe Ispol'zovanie Mineral'nogo Syr'a = Complex Use of Mineral Resources = Mineraldik Shikisattardy Keshendi Paidalanu](#) **3**, 84-90 (2020).
17. A. K. Koyzhanova, B. K. Kenzhaliev, E. I. Kuldeev and E. M. Kamalov, [Obogashchenie Rud](#) **3**, 54–59 (2019).
18. J. Arlinwibowo, H. Retnawati and B. Kartowagiran, [Challenges of Science](#) **4**, 18-25 (2021).
19. H. Pratama, M. N. A. Azman, O. B. Kenzhaliyev, H. Wijaya and G. K. Kassymova, News of the National Academy of Sciences of the Republic of Kazakhstan, [Series of Geology and Technical Sciences](#) **4**, 21-29 (2021).
20. B. M. Triyono, N. Mohib, G. K. Kassymova, G. N. I. P. Pratama, D. Adinda and M. R. Arpentieva, [Vysshee obrazovanie v Rossii = Higher Education in Russia](#) **29**, 151-158 (2020).
21. O. B. Kenzhaliyev, Zh. B. Ilmaliyev, B. M. Triyono, A. D. Minghat, M. R. Arpentieva, and G. K. Kassymova [International Journal of Advanced Science and Technology](#) **29**, 18-28 (2020).
22. K. F. Tamrin, B. Rahmatullah and S. M. Samuri, [Optics and Lasers in Engineering](#) **68**, 93–103 (2015).