Content lists available at SRN Intellectual Resources

International Journal of Advances in Social Sciences and Humanities

Journal homepage: https://journal.srnintellectual.com/index.php/ijassh

Article

Developing the Project based Learning using Mobile Media Application among Vocational High School Students in Sumatera Utara Province, Indonesia

Azizul Kholis [a,*], Esa Setiana [a] and Choms Gary Ganda Tua Sibarani [a]

[a] Department of Accounting, Faculty of Economics and Business, Universitas Negeri Medan, 20221 Medan Tuntungan, Sumatera Utara, Indonesia; esasetiana@unimed.ac.id (E.S); chomsgary@unimed.ac.id (C.G.G.T.S)
* Correspondence: azizulkholis@unimed.ac.id (A.Z)

Citations: Kholis, A., Setiana, E., & Sibarani, C.G.T., (2022). Developing the Project based Learning using Mobile Media Application among Vocational High School Students in Sumatera Utara Province, Indonesia. *International Journal of Advances in Social Sciences and Humanities*, 1(1), 26-33.

Academic Editor: A. Hariharasudan.

Received: 1 November 2021 Accepted: 20 February 2022 Published: 28 February 2022

Abstract: This study determines the feasibility and effectiveness of the media mobile application project-based learning on service company materials. This type of research is development research using the Borg and Gall product development model combined with the Dick and Carey design model. This research was conducted on Sei Suka Vocational High School, Batubara Regency. The method used in this research is a quasi-experimental method. The research sample of 62 students consisting of 31 students as an experimental class who was taught using media mobile application based on Project Based Learning and 31 students as a control class who was taught using conventional media. The results of the hypothesis test prove that there is a significant difference between the results of student Service Company Accounting material taught using the media Mobile Application based Project Based Learning and the results of Service Company Accounting used in conventional media. This is indicated by the data acquisition, namely t-stat was 4.43 while t-table was 1.67 and significant level of 0.05 through the interpolation of table was 1.63. We concluded that the effectiveness of media mobile application-based Project Based Learning with Service Company Accounting material is higher than using conventional media.

Keywords: mobile application; conventional; learning outcomes; accounting service company.

1. Introduction

Accounting services company is very important to be mastered by students in the Vocational High School (SMK) Accounting study program. This lesson is highly needed because of the competence of students to be able to understand the concepts of financial statements taught in this lesson. The material is the basis for understanding the types of transactions, it can also determine the post/ account of each transaction that occurs correctly. Thus, it can reduce the risk of errors in financial management. During this time many business actors do not make proper financial statements due to lack of understanding in the basic concept of accounting. Understanding of business actors in making financial reports that are still very low is actually an opportunity for SMK graduates in the field of Business and

Accounting expertise to be able to assist entrepreneurs, especially in Small and Medium Scale Enterprises, in order to be able to make correct financial reports. This is evidenced by the large number of job vacancies for graduates of the Accounting Department as a financial staff and even a record of deviations and cost control.

The success of an educational goal depends on how the teaching and learning process experienced by students. A teacher besides being demanded to be careful in choosing and applying teaching methods in accordance with the objectives to be achieved, is also able to choose media that is appropriate to the material to facilitate the delivery of material, therefore it is needed media that can cause students' attractiveness in absorbing the material. One of the media that can be developed is an interactive learning practicum in the form of a mobile phone application.

Current learning activities emphasize process skills and active learning, so learning media are becoming increasingly important (Greenhow & Lewin, 2016). Mobile Practicum can facilitate students in independent and conventional learning. The application has instructions for self-study, so students can learn according to their abilities and can meet all the competencies that must be mastered by students. Practicum application is a learning tool or tool that contains material, methods, limitations, and ways of evaluating that are systematically and attractively designed to achieve the competencies expected according to their level of complexity (Yandra & Sari, 2020). In accordance with the characteristics of Basic Electronics material, in conveying material or explanations to students requires a variety of media, because for students to understand this material requires a high abstraction. It is not enough just to describe how an electric current flow, but simulations are needed to be interesting and students can remember well.

So far, teaching materials or programs in schools are still focused on financial accounting subjects. This is evidenced by the large number of teaching material software for financial accounting practices used by the vocational level such as the General Ledger application, MYOB Accounting, and Accurate Accounting. On the other hand, for the application of subjects Accounting services companies have not been found to date.

Teaching material (Instructional Materials) is a set of knowledge, skills and attitudes that students must learn in order to achieve predetermined learning goals. These learning materials are arranged systematically both written and not to create an environment / atmosphere that allows students to learn. There are several things that must be considered in determining teaching materials (Zazkis et al., 2009), namely: (1) teaching materials should support the achievement of learning objectives (relevance between objectives and materials); (2) teaching materials should be in accordance with the level of education / development of students in general; (3) teaching materials must support the achievement of learning objectives; (4) teaching materials should be organized systematically and continuously; (5) teaching materials should be sufficient in helping students master the basic competencies taught (the principle of adequacy).

Practicum applications through mobile applications can make the learning process more interesting, more interactive, able to convey historical messages through pictures and videos, encourage student learning through instrumental, it can develop auditory senses or student hearing so that the material delivered is easier to understand. A good mobile application can present various kinds of events that can be used as learning media just like the object to be presented through various manipulations of circumstances that can be simulated. Of all the objects depicted, in order to deliver the media in accordance with the real situation there needs to be a good design and must pay attention to the coherent events that will be presented so that students can understand coherently and lead to a good understanding of the concepts to be explained.

The nature of the mobile application practicum should be a source of information that is easily observed and used. Basically, the media are all forms of intermediaries used by humans to convey or spread ideas, ideas, or opinions so that the ideas, ideas or opinions expressed reach the intended recipient (Sulistyaningtyas et al., 2020). Good media should be media that are easy to operate, instructions are easy to understand and easy to respond to by students. Presentation of lesson material, the language used makes students feel familiar with mobile application practicum and motivated to learn it, because one of the characteristics of mobile application practicum is user friendly.

The development of mobile application practicum is intended so that teachers do not rely on / fully rely on conventional teaching materials such as textbooks from other writers, but it is hoped that teachers will be able to create their own teaching materials that are in accordance with student conditions, curriculum and science and technology. Teaching materials that can be created by teachers can be mixed from various sources of teaching materials. Sources of teaching materials are places / parties where teaching materials can be obtained, which among others consist of printed materials, multimedia, environment and people.

Someone's introduction to the results or progress of learning is very important, because by knowing the results that have been achieved then students will try to improve their learning achievement. So, an increase in learning outcomes can be more optimal. One of the parameters used to measure the level of educational success is student learning outcomes, in addition to that students are also expected to help businesses in preparing their business accounting reports.

To achieve satisfying learning outcomes, the most fundamental thing to achieve all of that is to foster interest in learning itself. In the process of teaching and learning activities a lot of problems faced by a teacher, especially in dealing with students who do not pay attention to lessons, problems that exist in students or difficulties in themselves

so that they can successfully learn in teaching and learning activities. When teaching and learning activities (KBM) take place not a few students who have low capture power, this is influenced by several factors including because they have low intelligence quotient (IQ) or the student lacks learning. However, there are also some students who feel that learning methods are not properly applied by the teacher in the delivery of material so that students have difficulty in understanding the material delivered when teaching and learning activities take place. To overcome this, we need a method that can increase student interest in learning. In this case making digital based teaching materials is one of the right methods to improve student learning outcomes.

Turgut (2008) reports the results of the AutoDesk Foundation's research on the characteristics of Project Based Learning. The results of the study state that Project Based Learning is a learning approach that has the following characteristics: students make decisions about a framework, the existence of problems or challenges raised to students, students design processes to determine solutions to the problems or challenges that are proposed, learners are collaboratively responsible for accessing and managing information to solve problems, the evaluation process is carried out continuously, students periodically reflect on activities that have been carried out, the final product of learning activities will be evaluated qualitatively, and the learning situation is very tolerant of errors and changes. Project Based Learning Method is a refinement of the Problem Based Learning method. Project Based Learning is one of the training strategies oriented to CTL or the contextual teaching and learning process (Jones et al., 1997). CTL is a learning concept that helps educators link learning material with real-world situations and encourages students to use the knowledge they have can be applied in their lives as members of the community.

Project Based Learning is learning that places more emphasis on solving problems that occur daily through practical learning experiences directly in the community (Slough & Milam, 2013). The use of digital-based teaching materials will help and simplify the learning process for students and teachers. Students can learn in advance by seeing and absorbing the subject matter more fully. Learning media are used as a tool used to channel information from teacher to student and stimulate students' thoughts, feelings, concerns and interests. Thus, the teacher does not have to explain the material repeatedly so that the learning process can take place more interesting, more effective and efficient. By using mobile application practicum, teachers can present learning material in the form of mobile applications coupled with written and delivered material that seems more interesting. Thus, the delivery of material by teachers becomes easier to understand and be understood by students so that it can improve student learning outcomes. This problem encourages us to investigate the feasibility and effectiveness of the media mobile application project-based learning on service company materials.

2. Literature Review

2.1. Learning Media

Learning media is all things that can be used to channel messages from the sender to the recipient so as to stimulate the thoughts, feelings, concerns and interests and will of the students in such a way that the learning process occurs in order to achieve the objectives of effective learning (Sulihin et al., 2020). Explanation of what was stated by Sukiman that learning media is a supporting tool used by educators to deliver material / teaching materials to students in order to achieve effective learning goals. The ease of educators in delivering material is one of the important things in improving the quality of education. Puspitarini & Hanif (2019) added that learning media is anything that can be used to convey messages or information in the teaching and learning process so that it can stimulate students' attention and interest in learning. This explains that learning media is a tool with all forms that can help teachers convey knowledge / information to students. So that the use of these tools can provide its own charm in the delivery process. Associated with the understanding of learning media, Novaliendry et al., (2020) defines that learning media is a tool that can help the teaching and learning process and serves to clarify the meaning of the message conveyed, so as to achieve learning goals better and perfect. In addition, the media can also be a means to improve teaching and learning.

2.2. Mobile Learning

Mobile Application is an application that allows you to mobility using equipment such as PDAs, cellular phones or cellphones (Zhang & Adipat, 2005). By using a mobile application, you can easily do a variety of activities ranging from entertainment, selling, studying, doing office work, browsing and so forth (Prensky, 2005; Squire, 2009; Zulfadhilah et al., 2020). Utilization of mobile applications for entertainment most favored by nearly 70% of cell phone users, because by utilizing the features of games, music player, until the video player makes it easier for us to enjoy entertainment anytime and anywhere (Kirriemuir, 2002).

2.3. Project based Learning

Project Based Learning is one of the learning models developed in teaching and learning activities (Boondee et al., 2011; Jalinus et al., 2017; Krajcik & Blumenfeld, 2006; Ulseth et al., 2011). According to Aldabbus (2018), project

based learning is a learning model that provides an opportunity for teachers to manage learning in the classroom by involving project work. The Project Based Learning Model is almost the same as the Problem Based Learning. This is because the beginning of learning is based on the problems that are revealed, as well as collaborative or group learning activities that emphasize the student environment being active. The difference lies in the object where problem-based learning requires the formulation of problems, data collection and analysis while in Project Based Learning students are more emphasized in designing or designing activities from starting to formulate jobs, design, carry out work, and evaluate results.

2.4. Accounting Learning Outcomes

Accounting is a service activity whose function is to provide quantitative data, especially those of a financial nature, from a unit of economic business that can be used in making economic decisions in making alternative to a situation (Godfrey et al., 2010). From the above understanding it can be concluded that the accounting learning outcome is a result that has been achieved or achieved by a student after carrying out the process of accounting learning activities, so that the student can master knowledge and skills which are in the form of numbers, letters and actions in the period. certain.

3. Materials and Methods

This study is designed using research and development approach which is a research method that is usually used to produce a certain product and test the feasibility of the product (Burns & Groove, 2014). The main purpose of development research is to produce an effective product for schooling (Baker, 2006). This research produces a product that can be used in the learning process in the form of a mobile phone-based learning practicum application. Research on the development of a product for learning media is carried out to determine the feasibility of the media in the learning process. Therefore, it is necessary to have a research design that has stages so that this research can run in the right direction. The stages of the research conducted refer to the Borg & Gall development model (Gustiani, 2019), which includes: research and information collecting, planning, developing preliminary forms of product, preliminary field testing, main product revision, main field testing, operational product revision, operational field testing, final product revision, and dissemination and implementation.

In this research development using the Dick & Carey development model in order to produce a mobile application development accounting learning project-based learning accounting. The reason researchers chose the Dick & Carey development model is because the steps and stages possessed by this model are very systematic and more complex, so it is suitable for use in developing a product such as mobile application in the field of education. The instructional development model used is the Dick & Carey learning design model. The Dick & Carey model is a development model that was developed through a system approach (System Approach). Against the basic components of the learning system design which includes analysis, design, development, implementation and evaluation. The learning system model developed by Dick & Carey consists of several components that need to be carried out to design a larger learning activity.

Implementation of this learning system design model requires a thorough systematic process. This is needed to be able to create a learning system design that can be used optimally in overcoming learning problems. There are 10 components as well as the steps of the development model revealed by Dick & Carey (2001: 6) namely (1) analysis of the need to identify objectives, (2) instructional analysis, (3) analysis of learners and context, (4) formulating performance goals , (5) developing research instruments, (6) developing learning strategies, (7) developing and selecting learning materials, (8) conducting formative evaluations, (9) making revisions, (10) designing and conducting summative evaluations, Dick & Carey include cognitive elements and behavioristic that emphasizes student responses to the stimulus presented (Dick & Carey 2001). The flow of Dick & Carey's development can be seen in Figure 1 below:

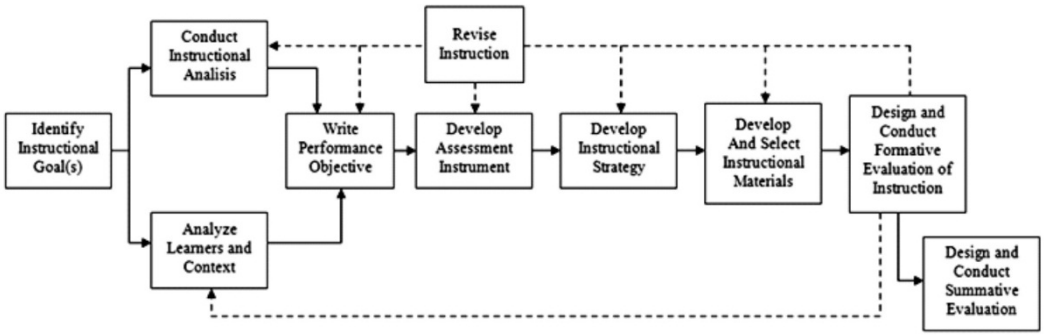

Figure 1. Development flow Dick & Carey

4. Results

On the basis of product validation through a series of trials and revisions that have been made, the project-based learning mobile application has a valid status. The trial was conducted in six stages, such as validation of learning design experts, validation of instructional media experts, validation of material experts, individual trials, small group trials, and field trials.

4.1. Learning Design Validation

The validation of learning design expert on mobile application development based on project-based learning was done by 1 learning design expert from educational technology study program, Universitas Negeri Medan, Indonesia. The assessment was conducted aiming to obtain information that will be used to improve the feasibility of project-based learning based mobile application media. Overall design aspects (XI) = 77; Item design aspect criteria = 17; Highest score = 4; Lowest score = 1. Then, Ideal maximum score = 17 XI 5 = 85; Ideal minimum score = 17 XI 1 =17; Mi = (1/2) (Ideal maximum score + Ideal minimum score) = 51; Sbi = (1/6) (Ideal maximum score – Ideal minimum score) = 11,3. The results of the learning design expert validation in the form of an assessment score of the components of the project-based learning mobile application-based media, as seen in Table 1 below.

Table 1. The results of the learning design expert validation the components of the project-based learning mobile application.

Range of Scores		Category
Mi+1,5 Sbi<XI≤Mi + 3 Sbi	67,9< XI ≤ 85	Very Decent
Mi < XI≤Mi + 1,5 Sbi	51 < XI ≤ 67,9	Worthy
Mi-1,5 Sbi<XI≤Mi	34< XI ≤ 51	Decent Enough
Mi-3 Sbi<XI≤Mi – 1,5 Sbi	17 < XI ≤ 34	Not Worth

Table 1 shows the result of media expert evaluation data, the average score for all aspects of 77 is in the range of scores 67.9 <XI ≤ 85. So, all these aspects fall into the "Very Eligible" category. The percentage of eligibility for media experts are calculated as follows:

$$\text{Appropriateness \%} = \frac{\text{Observation Value}}{\text{Reality Value}} \text{ x } 100\% = \frac{77}{85} \text{ x } 100\% = 90{,}5\%$$

4.2. Media Validation

The validation of the application based mobile application media experts based on project-based learning in the Accounting Services Company was conducted by 1 person, a lecturer at the Medan State University Educational Technology Study Program. The assessment is carried out to obtain information that will be used to improve the feasibility of project-based mobile application-based learning media in the Accounting Services Company. All aspects of media (XI) = 68; Media aspect criteria items = 16; Highest score = 5; Lowest score = 1. Thus, Ideal maximum score = 16 XI 5 = 80; Ideal minimum score = 16 XI 1 =16; Mi = (1/2) (Ideal maximum score + Ideal minimum score) = 48; Sbi = (1/6) (Ideal maximum score – Ideal minimum score) = 10,6. The results of the media expert validation in the form of an assessment score of the components of the mobile application-based project-based learning media in the Accounting Services Company can be seen in Table 2 below:

Table 2. The results of the media expert validation for the components of the project-based learning mobile application.

Range of Scores		Category
Mi+1,5 Sbi<XI≤Mi + 3 Sbi	63,9 < XI ≤ 80	Very Decent
Mi < XI≤Mi + 1,5 Sbi	48 < XI ≤ 63,9	Worthy
Mi-1,5 Sbi<XI≤Mi	32,1 < XI ≤ 48	Decent Enough
Mi-3 Sbi<XI≤Mi – 1,5 Sbi	16,2 < XI ≤ 32,1	Not Worth

Table 2 displays that the average score for all aspects of 68 is in the range of scores 63.9 <XI ≤ 79.8. So, all aspects of this media fall into the "Very Eligible" category. As for the percentage of feasibility learning design experts are calculated as follows:

$$\text{Appropriateness \%} = \frac{\text{Observation Value}}{\text{Reality Value}} \text{ x } 100\% = \frac{68}{80} \text{ x } 100\% = 85\%$$

4.3. Material Validation

The validation of mobile application-based project expert learning material on Service Company Accounting material is carried out by 1 person, the lecturer at Medan State University in Accounting Study Program. The assessment is carried out to obtain information that will be used to improve the feasibility of project-based mobile application-based learning media in the Accounting Services Company. The aspects consist of suitability of the material, ease of understanding, ease of access, usefulness of the material, language communication, completeness of the material. Overall material aspects (XI) = 43; Item criterion material aspects = 10; Highest score = 5; Lowest score = 1; Then, Ideal Maximum Score = 10XI 5 = 50; Ideal Minimum score = 10 XI 1 =10; Mi = (1/2) (Ideal Maximum Score + Ideal Minimum score) = 30; Sbi = (1/6) (Ideal Maximum Score – Ideal Minimum score) = 6,6. The results of the validation of media material in the form of an assessment score of the components of a mobile application-based project based learning media on the Accounting Services Company can be seen in Table 3 below:

Table 3. The results of the validation of media material for the components of the project-based learning mobile application.

Range of Scores		Category
Mi+1,5 Sbi<XI≤Mi + 3 Sbi	63,9 < XI ≤ 80	Very Decent
Mi < XI≤Mi + 1,5 Sbi	48 < XI ≤ 63,9	Worthy
Mi-1,5 Sbi<XI≤Mi	32,1 < XI ≤ 48	Decent Enough
Mi-3 Sbi<XI≤Mi – 1,5 Sbi	16,2 < XI ≤ 32,1	Not Worth

Table 3 describes that the average score for all aspects of 68 is in the range of scores 63.9 <XI ≤ 79.8. So, all aspects of this media fall into the "Very Eligible" category. As for the percentage of feasibility learning design experts are calculated as follows:

$$\text{Appropriateness \%} = \frac{\text{Observation Value}}{\text{Reality Value}} \text{ x } 100\% = \frac{68}{80} \text{ x } 100\% = 85\%$$

5. Discussion

From the results of data processing research conducted there are average learning outcomes of Service Company Accounting after using mobile application media in class XI students of SMK Negeri 1 Sei Suka Batubata Regency which amounted to 78.19. While learning outcomes of Accounting Services Companies before using 83.99 mobile application media. From this data prove that mobile application media is feasible and effective to be used in increasing student competence, this is in line with Project Based Learning, which is learning that emphasizes solving the unique problems that occur daily through practical learning experiences in the community (Kirriemuir, 2002). Project Based Learning Method is a refinement of the Problem Based Learning method. Project Based Learning is one of the training strategies oriented to CTL or the contextual teaching and learning process (Jones et al., 1997).

According to Greenhow & Lewin (2016), the benefits of using instructional media in the teaching and learning process are as follows: (1) Learning media can clarify the presentation of messages and information so as to facilitate and improve the process and learning outcomes. (2) Learning media can increase and direct children's attention so that it can lead to learning motivation, more direct interaction between students and their environment, and the possibility of students to learn independently according to their abilities and interests, (3) Learning media can overcome sensory limitations, space, and time, and (4) Learning media can provide students with a shared experience about the events in their environment.

From Arsyad's explanation about the benefits of the media, it can be concluded that the learning media already has benefits as a learning medium that has been revealed by Novaliendry et al., (2020), Puspitarini & Hanif, (2019) Squire, (2009) and Sulihin et al., (2020), so that the learning media can improve student learning outcomes. The use of mobile application media allows students to more easily understand learning and better understand the material because of this mobile application media allows students to be able to understand the material delivered with the contents of the mobile application media that is designed as attractive as possible so that students can better understand the material presented.

6. Conclusions

In conclusion, this study identified that mobile media application with accounting service company is feasible to use with 86% material expert validation presentation included in the "very feasible" category, 85% media expert validation is in the "very feasible" category, 90.5% learning design expert validation is included in the "very decent ". Individual trials 94.84% included in the category of "very feasible", the results of a small group trial 94.15% included in the category of "very feasible". field trials 93.96% included in the "very feasible" category. Besides that, student

accounting learning outcomes by using mobile media applications are higher than learning outcomes of Corporate Accounting Student services taught without Mobile Application tested through statistical tests t with the test results showing prices t-stat was 4,43 > 1,671. Based on the results of this study also obtained data on average value of students who were taught by using the Mobile Application media higher than the average value of students who were taught without Mobile.

Author Contributions: Conceptualization, A.K., E.S., and C.G.G.T.S.; methodology, A.K. and C.G.G.T.S.; software, A.K.; validation, E.S. and C.G.G.T.S.; formal analysis, A.K., E.S. and C.G.G.T.S.; investigation, A.K., E.S. and C.G.G.T.S.; resources, A.K.; data curation, E.S.; writing—original draft preparation, A.K., and E.S.; writing—review and editing, A.K., E.S., C.G.G.T.S.; visualization, A.K. and C.G.G.T.S.; supervision, E.S. and C.G.G.T.S.; project administration, A.K.; funding acquisition, A.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The author would like to thank Universitas Negeri Medan for supporting this research and publication. We would also like to thank the reviewers for their constructive comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

References

Aldabbus, S. (2018). Project-based learning: Implementation & challenges. *International Journal of Education, Learning and Development*, *6*(3), 71–79.

Baker, L. (2006). Observation: A complex research method. *Library Trends*, *55*(1), 171–189.

Boondee, V., Kidrakarn, P., & Sa-Ngiamvibool, W. (2011). A learning and teaching model using project-based learning (PBL) on the web to promote cooperative learning. *European Journal of Social Sciences*, *21*(3), 498–506.

Burns, E., & Groove, W. (2014). Research method. *Ergonomics*, *32*(3), 237–248.

Godfrey, J., Hodgson, A., Tarca, A., Hamilton, J., & Holmen, S. (2010). *Accounting*. John Wiley & Sons, Inc.

Greenhow, C., & Lewin, C. (2016). Social media and education: Reconceptualizing the boundaries of formal and informal learning. *Learning, Media and Technology*, *41*(1), 6–30.

Gustiani, S. (2019). Research And Development (R&D) Method As A Model Design In Educational Research And Its Alternatives. *Holistics*, *11*(2), 12–22.

Jalinus, N., Nabawi, R. A., & Mardin, A. (2017). The seven steps of project based learning model to enhance productive competences of vocational students. *International Conference on Technology and Vocational Teachers (ICTVT 2017)*, 251–256.

Jones, B. F., Rasmussen, C. M., & Moffitt, M. C. (1997). *Real-life problem solving: A collaborative approach to interdisciplinary learning.* American Psychological Association.

Kirriemuir, J. (2002). The relevance of video games and gaming consoles to the higher and further education learning experience. *Techwatch Report TSW*, *2*, 15.

Krajcik, J. S., & Blumenfeld, P. C. (2006). *Project-based learning*. na.

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart learning media based on android technology. *International Journal of Innovation, Creativity and Change*, *12*(11), 715–735.

Prensky, M. (2005). What can you learn from a cell phone? Almost anything! *Innovate: Journal of Online Education*, *1*(5).

Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, *4*(2), 53–60.

Slough, S. W., & Milam, J. O. (2013). Theoretical framework for the design of STEM project-based learning. In *STEM project-based learning* (pp. 15–27). Brill.

Squire, K. (2009). Mobile media learning: multiplicities of place. *On the Horizon*.

Sulihin, S., Asbar, A., & Elihami, E. (2020). Developing of instructional video media to improve learning quality and student motivation. *Edumaspul: Jurnal Pendidikan*, *4*(2), 51–55.

Sulistyaningtyas, T., Jaelani, J., & Suryani, Y. (2020). Power of knowledge and community social class above Covid-19 pandemic information on social media. *Jurnal Komunikasi Ikatan Sarjana Komunikasi Indonesia*, *5*(1), 52–62.

Turgut, H. (2008). Prospective Science Teachers' Conceptualizations about Project Based Learning. *Online Submission*, *1*(1), 61–79.

Ulseth, R., Froyd, J. E., Lotzinger, T. A., Ewert, D., & Johnson, B. (2011). *A new model of project based learning*.

Yandra, M., & Sari, N. M. (2020). Development of E-Modules Based on Project Based Learning Model for Highway and Bridge Construction Subject at Vocational High Schools. *1st Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2019)*, 184–187.

Zazkis, R., Liljedahl, P., & Sinclair, N. (2009). Lesson plays: Planning teaching versus teaching planning. *For the Learning of Mathematics*, *29*(1), 40–47.

Zhang, D., & Adipat, B. (2005). Challenges, methodologies, and issues in the usability testing of mobile applications. *International Journal of Human-Computer Interaction*, *18*(3), 293–308.

Zulfadhilah, M., Hidayah, N., & Pebriadi, M. S. (2020). Design an Android-based Chemical Bond Application. *International Journal of Computer Applications*, *117*(29), 1–5.