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Integration of Mobile Learning and Project-Based Learning in Improving Vocational School Competence

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Abstract: This research is based on the need to improve the quality of learning in improving student's competencies through the development of learning models by utilizing smartphones as learning media. The purpose of this research is to develop an instructional model of integration of mobile learning and project-based learning to improve the competency of Vocational High School students on computer assembly and basic network subject. This research uses the Research and Development method and the experimental method at the stage of realizing the design. The subjects of this study were students majoring in Computer and Network Engineering expertise packages at a public vocational high school in West Java. The research instrument consisted of a questionnaire to determine the need for model development, a competency test and a questionnaire to determine student responses to the developed model. This model was developed and validated by experts and tested on a limited scale and wide scale. Has successfully developed a learning model of integration of mobile learning and project-based learning with the characteristics of the implementation of project-based learning syntax using mobile learning applications to be accessed online through smartphone devices in learning. The result of the assessment by comparing the competence of learning outcomes with N-gain in the high category, as well as the results of the test of the effect size on the increase competence in the cognitive realm of 77%, 94% psychomotor and 84% more effective compared with the results of limited trials. Significant improvement in psychomotor competence, caused there are the level of active participation of students, the direct participation of students, students who have high curiosity and the achieved progress by learning steps in the phases particular to use mobile media applications (smartphones) as learning resources. Learning uses the integration model of mobile learning and project-based learning shows an increase in student competence caused by effective learning, indicated by positive responses from students.

Keywords: Mobile learning, project-based learning, competence, vocational high school

1.   Introduction

Education becomes fundamental in the process of forming the character of each individual, so education is expected to optimise students into humans who have full competence. Increased competence can deliver someone to the world of association, which can be done in the business world, the industrial world, the social environment, management and technology media. The education system is facing a phenomenon of the rapid flow of information technology, so there is a change in the way people think and behave. The information technology industry, such as smartphones has an impact on the increasing number of users of communication technology, also affecting the pattern of character education in schools. Smartphones have many contributions by students at school, most teachers consider

smartphones to be a function of learning media, but most other teachers assume that smartphones should be nullified by reasons related to the learning process (Dahlstrom & Bichsel, 2014).

Digital data from We Are Social and Hootsuite published in January 2019, social media users with active mobile phones in Indonesia totalled 130 million people (Data, You, To, Internet, & Media, 2019). Learning activities in schools experience various changes in learning patterns, and E-learning approaches in the use of information technology such as the internet and multimedia have been developed in schools, used to facilitate the improvement of the quality of learning towards education and training (Hamidi & Chavoshi, 2017). According to Keegan (2002), learning activities are predicted to experience changes from e-learning to m-learning. The stage of development of educational technology, which moves through the stages of programmed instruction, computer-assisted instruction, e-learning connected to the internet, and even the context of wireless m-learning (Peng, Su, Chou, & Tsai, 2014). Mobile learning is an alternative electronic media learning (e-learning) to deliver knowledge, skills, and attitudes. Mobile learning incorporates critical pedagogical design input from teachers: "M-learning, providing digital support for adaptive, invasive, communicative, collaborative, and productive learning activities in the school environment" (Pachler et al., 2007). Mobile learning defined the use of digital devices capable of wireless and among learning environments or contexts that are designed pedagogically (Cochrane, 2017).

The use of media in the learning process aims to be able to take place appropriately and efficiently to increase student interest and attention (White & Martin, 2014). Mobile devices (smartphones) with the Android operating system make it easy for device developers to develop learning applications (Brian Fling, 2009). Learning using mobile learning is one to one learning model. One-to-one programs have deeper student involvement with what they are learning (Sung, Chang, & Liu, 2015). Collection of digital learning materials has the potential for use in education, these learning resources can increase their active involvement in education (Vrana, Gasci, & Podkonjak, 2017), (Chiu, Pu, Kao, & Wu, 2018). The learning method that is often used in vocational technology education is project-based learning (PjBL). The use of this methodology has been widely accepted and encouraged in the practice of learning techniques (Wildermoth & Rowlands, 2012). This model can understand the subject matter at a deeper level, students feel more involved in learning (Treadwell & Treadwell, 2018). The project-based learning model is considered relevant for the implementation of the learning process in vocational technology education because project-based learning is an instructional method that can be used (Li, 2014).

The mobile learning model and project-based learning become the learning model strategies used in vocational technology education. Both of these models can be integrated into new learning models. Information and communication technology (ICT) can facilitate the process of learning Project Based Learning (PjBL) as an active, effective learning model and can integrate knowledge and skills (D.Kavitha, 2016). The integration of mobile learning with project-based learning is one of the new alternatives, which can be implemented in vocational technology education. This integration model is needed to improve student competency. In this study, the integration of mobile learning and project-based learning is defined as a learning model using smartphones to access learning content and learning information sources through application platforms that are collaborated based on the stages of learning in the project-based learning model. The focus of this research is how to integrate mobile learning and project-based learning models in Vocational High Schools (SMK) to be implemented to increase student concentration in the learning process and increase student competency.

2.   Research Methods

The method used in this research is research and development (R&D) and continued with the experimental method at the stage of realising the design. The development method in this study refers to the R&D stage model recommended by Borg & Gall (1989) and Plomp (1997). Development according to Plomp includes stages: (i) preliminary investigation, (ii) making design, (iii) realising the design (realisation/construction), (iv) conducting tests, evaluations and revisions, and (v) implementation.

3.   Research Design

3.1.   Development Procedure

The development procedure in this study refers to the stages; conduct preliminary studies by looking at empirical reality and review relevant theories, determine prototypes and make product designs, display designs (demonstrations), conduct trials, evaluations, and revisions, develop further on products that have been tested, then present / implement the final product. Development procedures developed based on problems in the learning process as show in Figure 1: (i) the importance of increasing students' competence in learning, (ii) the discovery of smartphone devices that are owned and used by students in schools as potential resources for learning, (iii) the learning process tends to be monotonous, so students do not understand the learning material in detail, the lack of interactive learning activities and students are less critical in responding to problems encountered in the learning process. From the findings of the above problems, a preliminary study was conducted to collect data and observe, analyse the needs of the integration model of mobile learning and project-based learning to develop product designs/models that were developed. The product

design/model developed is validated by expert validation to validate the developed model and provide input from the developed model. Expert input and validation contributed to the revision and improvement of the model developed before a limited scale trial was carried out. The results of limited trials can provide input and improvements for model trials on a broader scale so that the final design model is produced as a model that can be implemented in the learning process at SMK to improve competence.
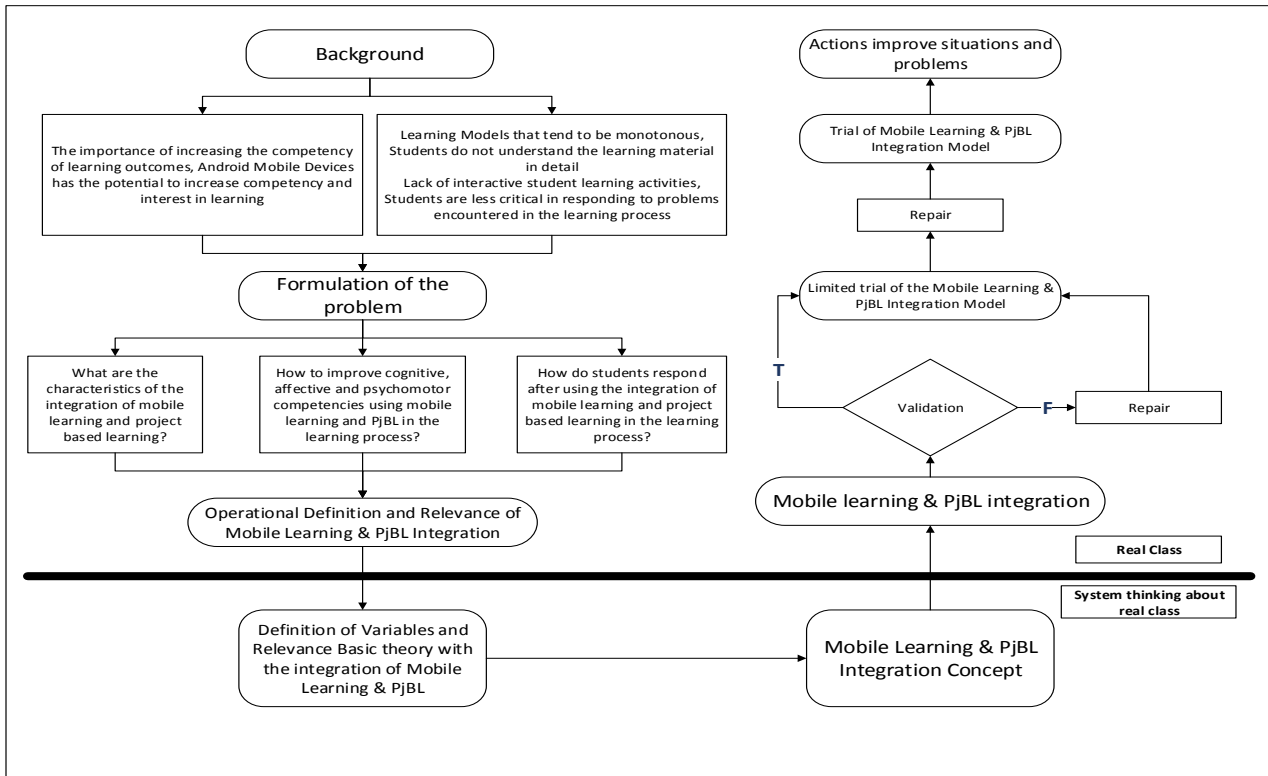

Fig. 1 - Research Method

3.2. Design Development Model

Figure 2 presented the design of mobile-based learning development and project-based learning in competency improvement, based on the development of learning needs in the classroom or outside of the classroom based on project-based learning and mobile-based learning by optimising the information technology resources that are developing at this time.

3.3. Research Instruments

Table 1 presents the relationship between research data, instruments used, data sources and technical analysis used in this study.

Table 1 - The Relationship between Data, Instruments, Data Sources and Research Data Analysis Techniques

Data	Instrument	Source Data	Data Analysis Technique
Development analysis model ML & PjBL	Document Analysis	Document	Descriptive Quantitative
Development Design	Document Analysis	Document	Descriptive Quantitative
Feasibility Test Analysis	Document Analysis	Student & teacher	Descriptive Quantitative
Result Cognitive, Psychomotor, Affective	Test Competence	Student	Descriptive Qualitative
Result Cognitive, psychomotor, affective	Test Competence	Student	Descriptive Qualitative

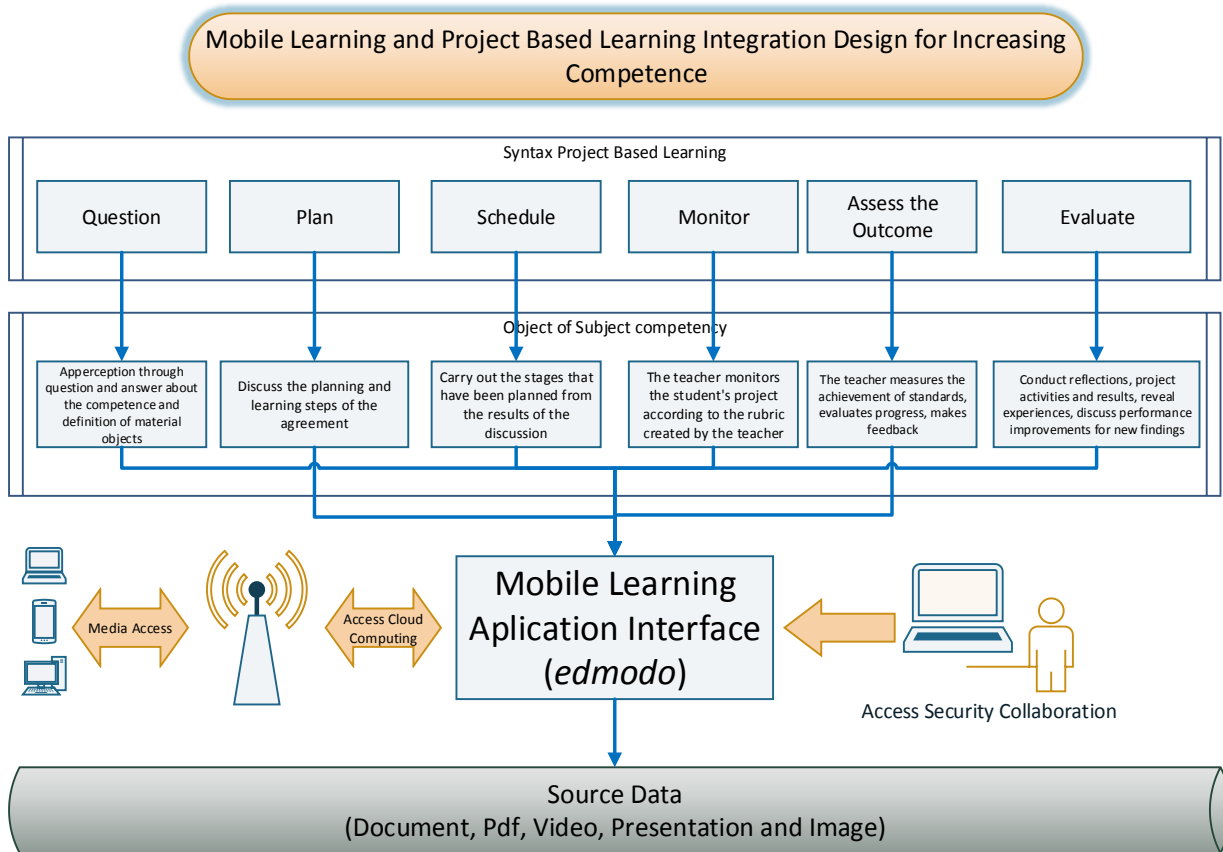| Data	Instrument	Source Data	Data Analysis Technique
Student responses	Closed questionnaire	Student	Descriptive Qualitative

Fig. 2 - Design of Integration of Mobile Learning and Project-Based Learning

3.4. Data Analysis Technique

After validating and revising the model and obtaining a product/model that was fit and good, the model was tested. The trial was conducted to obtain information on whether the model is more effective than the old model or other models / conventional. For this reason, testing was carried out using the pre-experimental method, which compares cognitive, affective and psychomotor competencies before and after the implementation of the integration of mobile learning and project-based learning.

This limited test is carried out on class X students majoring in computer and network engineering expertise packages in Vocational Schools with some students (36 students), and extensive tests conducted on class X students majoring in computer and network engineering expertise packages in Vocational Schools are different from the greater number of students (70 students). From the results of limited trials and extensive trials obtained an average value of 3 (three) competencies; affective, cognitive and psychomotor. Based on the provisions of Morgendoller (2019) states that learning is said to be effective in increasing the competence of learning if the average normalised gain is higher than other learning. To determine the effectiveness of increased learning requires determining the value of <g> first. Furthermore, the size of the effect (effect size) is tested to see the results of the influence developed on increasing competence in learning. Stages of competency improvement data analysis with the following steps: (1) Determine N-Gain, (2) Impact size analysis. The price coefficient of impact size obtained is then interpreted using the d criteria from Jacob Cohen (Jacob Cohen, 1969).

4. Result and Discussion

4.1. Preliminary Study Result

The results of observations on the availability of information technology infrastructure needs, which were done through the distribution of questionnaires to students, 98% of students have ICT devices (smartphones, laptops / personal computers). These findings indicate that device devices to access information and communication technology services

are available and adequate (Foley & Reveles, 2014). Android applications are preferred by students to access the internet than web applications, students like the android application (Eshet & Bouwman, 2014). These findings state that mobile learning applications can be implemented in the learning process in the department of computer and network engineering. This finding is reinforced by other research which indicates that the mobile learning platform has the potential for successful learning in different environments because of its easy portability and extensibility (Laine et al., 2017).

From the results of interviews and observations of student participation in this learning activity, students tend to actively participate in the learning process, have high curiosity, but do not dare to express opinions and express creative ideas (Mohamadi, 2018), while the tendency of students to want to have a close discussion is still considered low. Students can increase their participation in the learning process, if the teacher uses the right learning model, with a higher level of learning participation (Alasmari & Zhang, 2019). Planning in learning activities by teachers and students is an important indicator (Splichal, Oshima, & Oshima, 2018; Stolk, 2018). The data shows a lack of planning of learning activities and optimisation efforts are needed to be made by the teacher, so planning in learning activities is following the expected competency targets (Genc, 2014;). Evaluation and assessment in the learning process become an important indicator in the project-based learning process, this is an effort of the teacher to determine the level of success in achieving competence (Hake, 1998; Taylor, Märtens, & Umborg, 2012).

Teacher efforts to assess and measure student competency levels were almost fulfilled. However, the level of monitoring in the mentoring process and recording activities is still low, it requires a model that can meet these deficiencies (Choi, Lee, & Kim, 2019). The level of disclosure of conclusions in the learning process is considered low, the learning process that can be revealed either in the classroom or outside the classroom, given the opportunity for students to be able to think about and study the learning process, so that it can be reached and revealed properly (Kuswandi, Surahman, Zufar, Thaariq, & Muthmainnah, 2018). Teachers can use ICT tools in learning as a means of the learning process. Other studies reveal teachers and students have used mobile applications as a tool used in learning (Alias, Ahmad, & Hasan, 2017). At present, the level of use of the internet and e-books is still low even though learning resources from this tool were found in various sources. Mobile learning provides opportunities for learning resource developers to improve efficiency and overcome the digital divide (Bhardwaj & Jain, 2015). The level of use of mobile applications by teachers is still low, while students today, who like the use of mobile devices are quite high. Optimising the role of ICT as a learning tool is needed in the learning process so that it can be implemented in learning applications as a method of learning. Smartphone as a tool used by students to learn as a representation of experience, identity (Pimmer & Pimmer, 2016), and portable can be used (Welsh et al., 2015).

4.2. Model Design Development

This learning were done by transferring knowledge, content, tools, and applications that are accessed on smartphone devices (Adkins, 2015). Figure 4.1 presents the process of implementing Edmodo applications as applications used in the learning process. The contents of this mobile application were made in the form of pdf, Docx, audio and video document files that were integrated into the mobile learning application stored in the cloud on the Edmodo application server. The integration of mobile learning is in demand by many developers who are increasingly growing in the integration of the use of m-learning in learning (Nascimento, Santos, Oliveira, Vieira, & Oliveira, 2018; Technologies & Kingdom, 2017). In implementing this model, the teacher needs a development design framework using mobile learning technology so that it can be used effectively (Trongtortam, 2017). Developing online learning designs must be more adaptive to the devices preferred by students (Matzavela, 2017). Design development requires the implementation of strong IT leadership to help bridge the gap between student expectations and learning experiences (Dahlstrom & Bichsel, 2014).

The online learning process has 3 (three) processes carried out in the use of the Edmodo application in the integration of mobile learning with project-based learning, process 1.0 explains the registration and login process of the edmodo application, process 2.0 explains the online learning process, students carry out the online learning process by following the job sheet and content that has been uploaded by the teacher. Process 3.0 as an evaluation process used by students and teachers in carrying out online tests and evaluations. Figure 4 shows the process flow diagram of the use of Edmodo applications.
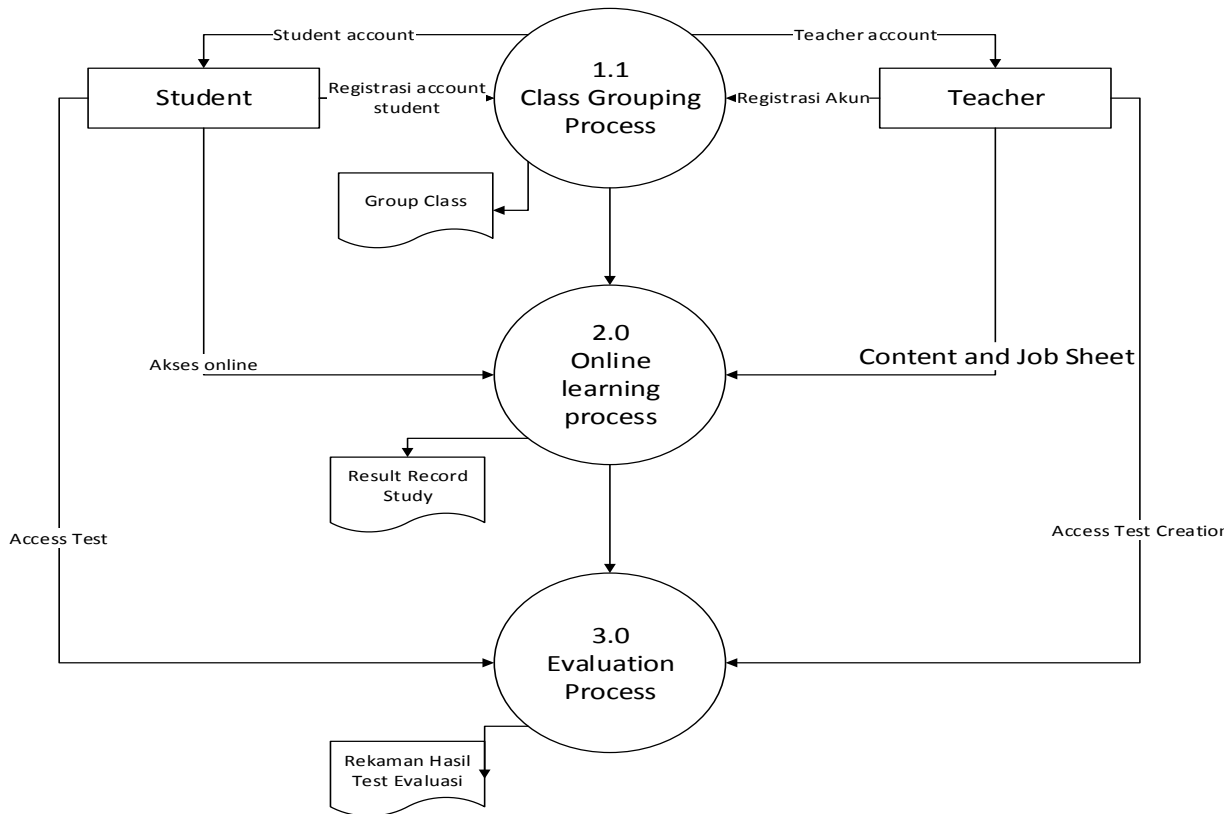
Fig. 3 - Flowchart of the process of using a mobile learning application

4.3. Model Validation by Experts

Expert validation carried out two components which were assessed. First, the assessment of the lesson plan aims to review the lesson plan that is following the developed model, secondly the assessment of the mobile learning application aims to assess the quality of the mobile application and the quality of the contents using the learning model of mobile learning integration with project-based learning in increasing competence in vocational technology education. The results of the expert study obtained information that the components of the lesson plan were stated following the criteria for the preparation of the lesson plan. The expert assessment of the quality of mobile learning applications and the quality of content, states that from the draft, mobile learning applications declared feasible. Input on the presentation of this model as follows: (i) project-based learning content must be included in instruments and applications, (ii) in general mobile applications using Edmodo can be used for research purposes, support systems are used based on Microsoft Windows, Android, IOS, can feedback is made to the user to improve the next version of the application, (iii) the language needs to be simplified, so that it is easily understood by respondents, (iv) at point "B" about the quality of the content is not focused on just assessing suitability, select a sharper indicator.

4.4. Limited Trial Results of Model

Testing the integration model of mobile learning and project-based learning is done through trials on a small and limited scale. The study was conducted by implementing the cognitive, psychomotor and affective competency pre-test in the experimental class. After the pre-test were done, the teacher carries out the treatment using the model and ends by carrying out the post-test at the end of the lesson. Figure 4.2. presents the results of the pre-test, post-test and N-gain in limited trials.

The results of the pre-test showed that the average ability of students was less than 55. After the implementation of the implementation of learning in the treatment, the results of the post-test showed a significant increase in cognitive, psychomotor and affective competencies shown in Figure 5.2. The results of the calculation of the average normalised N-gain in limited trial experiments, found cognitive N-gain of 0.64, psychomotor N-gain of 0.55 and affective N-gain of 0.59, this category was declared high for cognitive competence and affective, whereas for the psychomotor in the medium category. These findings indicate that the implementation of this model has an impact on increasing competence.

The results of the effect size trials presented in Table 4.1 show the impact on increasing cognitive, psychomotor, and affective competence. The results of this data conclude that the use of the developed model has a moderate impact on competency improvement. Other research states the impact of PjBL on student performance reveals increased understanding of student perception (Torres, Sriraman, Ortiz, & Torres, 2017). With collaborative learning assisted by online activities can develop the ability of teachers (Biasutti & El-deghaidy, 2015).
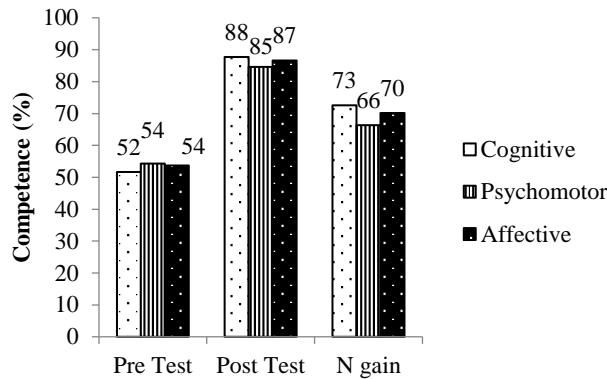

Fig. 4 - The graph of the calculation of the average N-gain normalised in limited trials

Table 2 - Impact Measures on Limited Trial

Source Data (Gain)	Pre-test		Post-test		Effect Size (d)	Category
	Average	Standard Deviation	Average	Standard Deviation		
Cognitive	51,67	14,41	83,72	5,36	0,29	Medium
Psychomotor	54,28	5,60	79,64	6,58	0,42	Medium
Affective	43,75	7,40	81,58	4,56	0,45	Medium

From the results of limited trials found various obstacles and enter from the teacher and students as users. Among the constraints and their inclusion are; (a) students are still experiencing problems when preparing to adjust tools and software, (b) time allocation at the beginning of the meeting needs to be added to provide detailed understanding of the learning steps, (c) internet network connection is needed backup with the addition of a school internet wireless network, (d) gives a more detailed explanation to the teacher as a facilitator in learning so that the learning scenario is understood in full by the teacher, (e) media and learning facilities must be prepared in more detail so as not to impede the learning process.

4.5. Improvements to the Limited Trial Model

Based on the findings, responses, constraints, and input of the limited test, the following improvements were made in this model: (1) Students experience difficulties in preparing tools and software adjustments, a solution that is carried out by all students who will conduct a trial to ensure the condition of the smartphone device has been installed by the Edmodo application and understand how to use it. (2) Increase the time allocation of 10 minutes for introduction and reduce the time allocation of 10 minutes for core activities to provide opportunities between teachers and students to understand the learning process carefully using this model. (3) Carry out the transfer of knowledge and skills of the learning strategy model to the facilitator teacher before the trial were conducted and carried out 1 day before the trial. (4) Study rooms are available with electricity and electricity terminals, ensuring internet connections in the classroom, the availability of projectors, the availability of practical equipment and other learning facilities needed.

4.6.   Result of Trial Extent of the Integration Model

Figure 4.3. presents the results of testing the integration model of mobile learning and project-based learning carried out through trials on a broader scale and a greater number of students by carrying out experiments in other similar schools. The extensive trial begins with implementing the pre-test in the experimental class and carrying out the treatment of the model implementation and ending with the post-test.
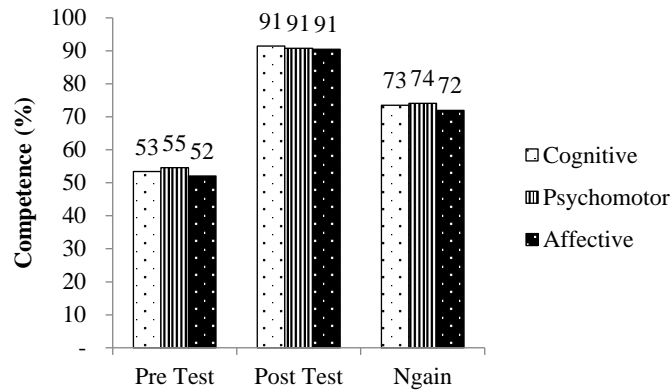

Fig. 5 – Graph of Extensive Trial Results

The post-test results showed that in 3 (three) cognitive, psychomotor and affective competencies had a significant increase. The results of the calculation of the average normalised N-gain in the experimental class in extensive trials found cognitive N-gain of 0.73, N-gain psychomotor of 0.74 and affective N-gain of 0.71. The categories of N-gain results in all three competencies are stated in the high category. These findings indicate that the implementation of this model has an impact on increasing psychomotor, cognitive and affective competencies in the high category. Table 3. From the results of the test of the impact size on increasing cognitive, psychomotor and affective competence, it can be concluded that the use of the developed model has a high impact on competency improvement.

Table 3 - Impact Measures on Extensive Trials

Source Data (Gain)	Pre-test		Post-test		Effect size (d)	Category
	Average	Standard Deviation	Average	Standard Deviation		
Cognitive	53,40	11,03	91,42	4,09	1,74	High
Psychomotor	54,59	5,42	90,79	4,58	2,47	High
Affective	52,09	10,23	90,50	4,64	1,97	High

4.7.   Test the Size of Impact on Increasing Student Competence

Table 4 present the results of the size of the impact size on increasing cognitive, psychomotor and affective competence from these results it can concluded that the use of the developed model has a high impact on competency improvement.

Table 4 - Impact Test Size on Competency Improvement

Source Data (Gain)	Post Test		Limited Tests		Effect size (d)	Category
	Average	Standard Deviation	Average	Standard Deviation		
Cognitive	73,47	11,47	63,51	14,82	0,75	Medium
Psychomotor	74,12	9,29	55,24	13,72	1,61	High
Affective	71,99	13,03	59,07	12,48	1,01	High

The results of the effect size trial presented in Table 4.3 are conducted to find out how big the impact of the use of the integration model of mobile learning and project-based learning in increasing competency in vocational students. The results of the size of the impact test on the increase in cognitive competence were 0.75 in an increase of 77.34%, psychomotor 1.61 in an increase of 94.63% and apective 1.01 in an increase of 84.13% from the results of a limited trial. These results can be concluded that the use of the developed model has a high impact on competency improvement.

4.8. Students Responses after Using the Model

Table 5 presents student responses after carrying out learning using the model. Collaboration in learning through smartphone technology media, can enable sharing, analysis, and synthesis of classroom experiences for teachers and students (Aubusson, Schuck, & Burden, 2016), during the PjBL process helps students develop ownership and control of learning (Kokotsaki et al., 2016).

Table 4 - Student Responses to the Trial Results of the Model Aspects of the Application Quality

Aspect Application Quality	% Criteria	
	Worthy	Not Feasible
1. Always available whenever the user needs to learn. (Very portable)	97	3
2. Applications can be personalized according to individual abilities, knowledge, and learning styles, and are designed to support personal learning rather than work in public offices. (Individual)	73	27
3. Do not interfere with the learning process of students in the classroom in learning situations when students access the application and not too conspicuously disturb the situation. (Do not disturb)	81	19
4. Students can use technology anywhere, to enable communication with teachers, experts and coworkers. (Available)	83	17
5. This mobile application can be adapted to the context of learning the skills and knowledge of students using the Project-Based Learning model. (Adapt)	79	21
6. Students can use their applications to manage learning throughout time, so that the accumulation of personal knowledge from students' resources and knowledge can be immediately accessed despite changes in the application.	74	26
7. This technology is in accordance with daily needs for communication, reference, work and learning. (Useful)	77	23
8. This technology is easy to understand and navigate by people without prior experience in using the application. (Easy to use)	84	16
Average	**82**	**18**

This response provides positive information that this model is considered appropriate for students to use in learning. Table 5 presenting responses to the quality aspects of the content of the learning model otherwise feasible. Collaborative mobile learning can function as a means to produce appropriate solutions to overcome difficult problems with the use of smartphone technology in the context of teaching and learning (Andrews, Dyson, & Wishart, 2015). The integration model of mobile learning with project-based learning in increasing the competency of vocational students is categorised as feasible to be implemented. Face-to-face instructions that collaborate with online methods tend to be more effective than pure online models (Mifsud, 2014).

5. Discussion of Research Results

The development of this model was based on the importance to improve the learning competency of vocational students. Efforts to improve student learning are expected to increase competency to be more efficient and effective in learning at SMK. Project-based learning develops over time, the emphasis on principles of learning, to the emphasis on complex incorporation, becomes a real-world challenge to meet the needs of the people needed by interdisciplinary thinking (Fernandes, 2016). The results of limited trials using this model provide N-gain competencies in the medium category, and extensive trials on N-gain with high categories, showing an increase in effectiveness in increasing competencies with high categories. Improved learning outcomes, after efforts made to improve and refine the results of limited trials. This finding also provides information that psychomotor competencies are higher than other competencies. This increase is strengthened by research into the integration of mechatronic elements in the education curriculum using project-based learning (Moll, Bordeaux, & Kavraki, 2014), this model can improve students' ability to think critically and choose creative design solutions substantially (Marques, 2017; Tauro et al., 2017; Yu, Liu, Qing, Wang, & Cheng, 2018). Smartphone owned by students, has the potential to be used in the learning process at school (Yamamoto, 2017). Students are hampered by remembering all the content they learn in class (Montoya, 2016; Yang et al., 2016).

Project-based learning is a learning method that teachers can use to prepare students to be ready to work and ready to continue their education in the 21st century (Allison, Sproule, Nash, & Martindale, 2015; Treadwell, 2018; Wan & Tong, 2018). This approach is relevant to be implemented in learning at vocational high schools, this PJB concept were widely applied in vocational education schools including technical universities (Li, 2014; Straub, Kerlin, & Whalen, 2018; Wilkinson, Evans, Mcalary, & Moore, 2019). Mobile learning has the potential to be more effectively used in the

learning process than manually (Indrayanto, 2019; Mulyani, 2019). The Edmodo application as a mobile learning technology can improve student management projects in the vocational field (Nur & Putra, 2018). Mobile learning is a portable strategy, with mobile devices that have multi-functions can eliminate learning from formal institutional learning, provide learning space with the concept of implementation in a variety of places, times, and expanded ways (Schuck, Kearney, & Burden, 2016; Yamamoto, 2016). Dolendo's research (2016) revealed that students considered edmodo to be the most appropriate LMS.

Table 5 - Student Responses to the Results of the Trial Model Aspects of the Quality Content

Aspect Quality of Content	% Criteria	
	Worthy	Not feasible
1. Can you actively participate in learning using this method?	91	9
2. Do you feel you are directly involved in the activities in the learning process?	86	14
3. Do you feel you can provide creative ideas in learning activities using this method?	80	20
4. Do you have more curiosity in learning to use this method?	77	23
5. Do you feel more disciplined in participating in this learning activity?	73	27
6. Do you feel the role of the teacher and students to monitor your activities while completing the task in implementing this learning method?	79	21
7. Do you feel your and teacher's role in guiding / being guided in learning activities and you / the teacher can record all of your important activities in this learning?	83	17
8. Do you feel any progress with the evaluation / assessment model used in this method?	86	14
9. Do you feel the teacher's role in assessing / evaluating the progress of each student?	74	26
10. Is this method, the role of the teacher and you is easier to reflect on the activities and results of work that has been carried out?	77	23
Average	**81**	**19**

The test results of this model are declared effective with high category results, showing that the use of smartphone devices can increase student competency and motivation to learn. This means that there is a direct and significant relationship between the use of smartphone devices and increasing student competency (Taleb, Ahmadi, & Musavi, 2015). In general, the current survey results are consistent with the results of the research achieved. Learning outcomes get positive responses from students, students feel more guided and monitored from the beginning to the end of learning. Cellular technology is used in learning experiences that are critically used as a medium for sharing and reflecting on their experiences and allowing participants to support learning reflection (Harshman & Harshman, 2017). The results of this finding provide confidence that the integration model of mobile learning has an effectivity effectivity on vocational secondary schools. Kumar Research (2017) reinforce this research, to improve student learning experiences and performance can be achieved by providing a learning environment that can be expanded with collaborative methods, to be able to motivate adaptive and collaborative learning in schools (Andrei Ternauciuc, 2019; AnaA, Luthfiyah Nurlaela, 2012; Dianah Nampijja, 2016;).

6. Conclusion

This research has succeeded in developing a model of integration of mobile learning and project-based learning with learning characteristics using smartphone devices to access theoretical content and simulation of learning materials through Edmodo application platform, as a strengthening of students' cognitive competence areas and stimulating psychomotor aspects which are carried out simultaneously, based on project-based learning syntax model. The learning process is done in real time accessed as a learning resource, evaluation tools and learning are carried out hands-on at certain phases using smartphone media that are accessed in a portable, independent, and can be accessed as needed. The integration model of mobile learning and project-based learning developed can significantly improve student competence in the cognitive, psychomotor and affective domains indicated by a cognitive N-gain of 0.73, N-gain of psychomotor of 0.74 and N-gain of effective 0.72 and effect size test results on increasing competence in the cognitive domain by 77%, psychomotor 94% and affective 84% compared to the results of limited trials. Significantly higher increase in psychomotor competence compared to other domains, due to the level of active participation of students, direct involvement of students, students have a high curiosity and the progress of progress with learning steps in certain phases is assisted using mobile media applications (smartphone) as a learning resource. This study got a positive response from students, this model can be used in the learning process of students in vocational schools and other

vocational education as indicated by the response of the trial results on aspects of application quality and content quality of the use of this model. Students feel the involvement, monitored and guided and evaluated directly by the teacher by using the integration model of mobile learning and project-based learning.

Acknowledgement

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