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Development of physics learning e-module based on local culture wisdom in Pontianak, West Kalimantan

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Abstract. This study aims to determine the feasibility and effectiveness of physics learning e-module based on local culture wisdom. This study is a development using ADDIE model of study design comprised five steps of analysis, design, development, implementation and evaluation. The sample used by 70 students with one group pretest-posttest design. Based on the research results, e-module based on local wisdom that is validated by three experts and three experts media material showed 83% in the category of very viable for use in learning. The effectiveness of e-module was tested using paired sample t test. The results showed no effect of the use-based e-modules of local wisdom to the learning process of physics. Values of N-Gain score indicates the percentage of 81% (in the effective category). E-modules used in this study utilizes the android based smartphone technology. Local wisdom that becomes a source of learning is a game "carbide cannon" who came from Pontianak, West Kalimantan, the terms of the concepts of physics and chemistry. Students' response to the media developed showed an average score of 87% ratings with very good category.

Keyword: E-Module, Physics, Wisdom of Local Culture, Research and Development

Introduction

Learning media is everything that used to deliver the message and to stimulate thoughts, feelings, concerns and volition of the study so as to encourage the process of learning a deliberate aim and control. Utilization of instructional media can be applied wherever possible in all subjects, including physics. The media should be packed interesting learning so that students can linger study material. If media be understood, the meaning is human, material, or events that establish conditions under which students are able to acquire the knowledge, skills or attitudes [1]. In this sense, teachers, textbooks and school environment is a medium. More specifically, the notion of media in learning processes tend to be interpreted as graphics tools,

Advancement of Information and Communication Technology (ICT) in Indonesia is growing very rapidly. ICT advances that can be felt in many areas, one in the field of education. The development of ICT in education will make education in Indonesia today can be more advanced and developed. The development of ICT can be used by teachers to create learning interesting and more colorful in the classroom. Regular instructional media packaged in the form of a power point, video learning physics textbooks and worksheets but over the times, learning media is also provided in electronic form, or better known as Mobile Learning. M-Learning is able to create a conducive academic atmosphere for students to learn anywhere and anytime.



There is a close relationship between the quality of learning resources (learning media) with an understanding of the nature of science, such as empirical aspects, methods, theories, creative, social, and cultural [3]. Student culture has changed drastically as the era of the industrial revolution 4.0. shows that the technology has important and positive if managed properly on science learning [4]. Especially physics science education should involve technology, innovation in learning in school settings, and accelerate technological innovation [5]. The motivational characteristics of learning resources (learning media) will increase interest in learning, especially involving issues that emerge at the international level or even interdisciplinary [6].

Instructional media developed in this study was associated with a typical local knowledge of West Kalimantan. Supposedly learning involves aspects of art, science and technology and value / value, and the implementation of local knowledge [7]. Local knowledge by utilizing traditional technologies as a source of learning in the learning of physics. Physics learning resources (learning media) based on the study of the traditional technology when implemented in the classroom from the perspective of sustainability is expected to bring new innovations example of environmentally friendly technologies.

Method

The method used in this research is the method of Development (Research and Development / R & D). Method R & D is the research methods used to produce a specific product and test the effectiveness of such products [8]. The study design used in the study is the ADDIE model of research design consisting of five stages consisting of analysis, design, development, implementation and evaluation [9]. The sample used in this study consisted of 70 students in Physical Education IKIP PGRI Pontianak, Indonesia. Data collection techniques used in this study in the form of interviews, questionnaires, tests of learning outcomes, and documentation. The study design using one group pretest posttest.

Result

Research development of e-module based on local knowledge is done by utilizing the android application. The research activities started from the observation phase of the study (research) and development (development), the design and testing of products. Based on the research goal is to determine the effectiveness of the e-module according to subject matter experts, media experts, to determine the student's response. Standardized assessment of subject matter experts and media experts are used as a reference for whether or not the media used. While the effectiveness of instructional media depend on the results of trials that have been given to the study of media users. In summary the data results of research and development are as follows:

1. According to the feasibility Learning Media Expert Content

Before the product tested to the range, products are validated in advance by subject matter experts. Validation is done so that the media developed products is guaranteed that the initial product developed decent tested on students. Additionally validation of subject matter experts is useful to anticipate material errors, material deprivation, anticipation as range trials and so on. Expert validation is done so that the products developed are not having a lot of mistakes and in accordance with the needs of students in the range. Once the completed product design, product design was submitted to the validator to be validated and assessed its feasibility.

Validator matter experts in the validation of the e-module is based on local wisdom one physics education study program lecturers and one teacher subject matter experts in the range of physics. Validation is done by giving subject matter experts along with the assessment sheet products. Assessment sheet form validation sheet with seventeen grains of assessment of the matter, matter / quizzes, language and enforceability as Table 1.

The process of assessment of the subject matter expert validation performed twice matter experts. After validation of the product can be seen there are deficiencies and necessary improvements to the Android-based learning media products that will be developed. Then to subject matter experts in the assessment did consist of 4 aspects of materials, Questions / Quiz, Linguistic and Keterlaksanaan which translated into 17 statement. The following Table 4.1 the results of expert assessment materials based on every aspect that is in use.

Table 1. Acquisition of Material Aspects Validation Sheet

Aspect	Percentage	Criteria
Matter	81%	Very Decent
Problem / Quiz	84%	Very Decent
Linguistic	85%	Very Decent
keterlaksanaan	82%	Very Decent
Average Percentage	83%	Very Decent

Based on Table 1, it can be concluded that based on aspects of material to get an average score of 83% with the criteria very decent, aspects of a matter / quiz to get an average score of 86% with the criteria very decent, aspects of language to get an average score of 87% with the criteria very decent and adherence to get an average score of 85% with a very decent criteria. Based on the above data that the development of e-module based on local knowledge has an average score of 85% and in the category of very decent.

2. According Feasibility Study Media Expert Media

Before the products tested to the range, products are validated in advance by media experts. At the stage of design validation is performed by submitting and presenting the initial product design to be validated by a team of experts. Media validation assessment based media perspective contained in the e-module. Validation is done so that the products developed can be said is reasonable and tested on students. Besides expert validation is useful to anticipate material errors, material deprivation, anticipation is currently in trials in the range and others. In addition to a completed product design, product design can be submitted to the validator for validation and in the value of its feasibility.

Validator media experts carried out by one person expert lecturers in the field of media. Media expert validation done by providing products along with the assessment sheet. Assessment sheet form validation sheet with 18 point ratings on software engineering and visual communication.

The process of assessment of media experts do one media expert validation. After validation of the product can be known nothing too significant revisions in the media developed. Then for media expert assessment will be undertaken consists of two aspects: Software Engineering and Visual Communication were translated into 18 statements such as Table 2.

Table 2 Acquisition Aspects Validation Sheet Media

Aspect	Percentage	Criteria
Software engineering	80%	very Decent
Visual communications	84%	very Decent
Average Percentage	82%	very Decent

Based on Table 2, the media expert's assessment of the aspects of software engineering is 80% and visual communication is 84%. The overall rating is 82% and the very feasible category is used to support the learning process.

3. Respond of The Students

After the media is said to be appropriate by material and media experts, the researchers then test the learning media with the aim of knowing students' responses to the products developed. Trials are conducted in the classroom using e-modules for each student with permission from the school and subject teachers. Furthermore, the learning process ends with knowing the responses of students using questionnaires. The results of student responses are classified into 7 aspects, namely content quality, pleasure, character, evaluation, grammar, motivation and use of illustrations which are then described into 18 statements such as Table 3.

Table 3. Obtaining Student Response Aspects

Aspect	Percentage	Criteria
Quality	90%	Very Good
Pleasure	86%	Very Good
Character	85%	Very Good
Evaluation	83%	Very Good
Grammar	88%	Very Good
Motivation	86%	Very Good
use of illustrations	91%	Very Good
Mean	87%	Very Good

Based on Table 3, the percentage of the content quality aspect is 90%, the pleasure aspect is 86%, the character aspect is 85%, the evaluation aspect is 83%, the grammar aspect is 88%, the motivation aspect is 86%, and the illustration use aspect is 91 %. Overall, from 7 aspects in the category it is very good.

4. Effectiveness Test

Based on statistical tests using SPSS, the output table "Paired Sample Test" is known as the Sig. (2-tailed) of 0.008. So it can be concluded that there are differences in the average between the pretest learning outcomes with the posttest value. This means that there is the influence of the use of e-modules based on local cultural wisdom on student learning outcomes. The next step, the N-Gain test was carried out to determine the effectiveness of the e-module developed. The result is a Gain Score of 81%, which means that the product is developed effectively to support the learning process.

Discussion

The stages of e-module development start from (1) the analysis phase of the achievement of competencies and characteristics of students about their learning capacity, knowledge, attitudes, and skills; (2) the design stage is carried out with the following terms of reference: (a) for whom is learning designed? (learners); (b) what abilities do you want to learn? (competence); (c) how can subject matter or skills be learned? (learning strategies); (e) how do you determine the level of mastery of the lessons already achieved? (assessment and evaluation); (3) the development stage in the form of activities to translate design specifications into physical forms, so that this activity produces a development product prototype. Everything that is done at the design stage, namely the selection of material in accordance with the characteristics of students and the demands and evaluations used are realized in the prototype; (4) the stage of implementation of the development results applied in learning to determine the effect on the quality of learning which includes effectiveness, attractiveness and efficiency of learning; and (5) stages which include formative evaluation and summative evaluation. Formative evaluation is done to collect data at each stage used for refinement and summative evaluation at the end of the program to determine the effect on student learning outcomes and the quality of learning widely. The final product of this development is an e-module that integrates local cultural wisdom.

Increasing students' understanding of the material learned can be measured using a score post test. Measurement of this understanding is done by essay test with 5 items. From the measurement of students' understanding of the material obtained a classical completeness score of 70% with very good criteria. The use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of learning activities and even bring psychological influences to students. The use of learning media at the learning orientation stage will greatly help the effectiveness of the learning process and the delivery of messages and content of the lesson at that time. In addition to arousing students' motivation and interests, learning media can also help students improve understanding, present data interestingly and reliably, facilitate interpretation of data and obtain new information ([10]).

The use of e-modules in this learning is significantly effective and can improve student learning outcomes. The integration of technology and information in the learning process actually depends on

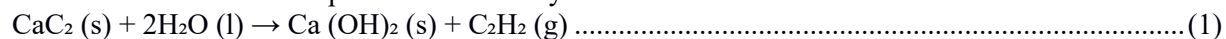
the probability of each student. However, if the lecturer is able to present an interesting e-learning concept it will be able to motivate students to use it. The potential of ICT is very useful to improve the skills of each individual. Students will be trained to use electronic media to learn and communicate positively [11]. Other research also mentions that the use of e-learning is more effective than learning with a regular face in a conventional manner and is able to improve learning outcomes [12]. E-learning in fact reduces interaction between individuals directly, resulting in good communication between students through the internet network. Collaboration between students also increases [13].

Local wisdom is part of the culture that exists in the community. One of the local wisdom taken from Pontianak, West Kalimantan is the Karbit Cannon. Karbit Cannon is the main tool that is played as a marker for the arrival of the month of Ramadan until the eid feast of Eid or Eid for the Malaya who live in Pontianak. This tradition began in 1771 and has become the identity of the Malaya people of Pontianak. The history of carbide cannons associated with the establishment of the city of Pontianak in the form of the Pontianak Sultanate with its first king was Syarif Abdrrahman Al Qadrie. The sound of the explosion of the carbide cannon is very hard to vibrate the nearby building. Carbide cannons are made of large wood with a diameter of 50 cm - 80 cm and a length between 4-7 meters perforated in the middle. The wooden bar which has been hollow in the middle is filled with water and carbide is inserted as the machine. Carbide which reacts with water will produce gas which if ignited with fire will produce an explosion. If the cannon is 50-80 cm in diameter, then one explosion requires 3-5 ounces of carbide. The sound will be louder if the carbide mass of carbide used is getting bigger.

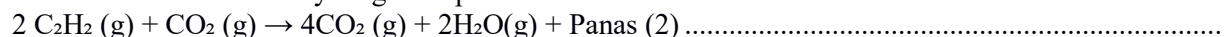
Integration of the values of local wisdom in the learning process associated with the cultivation of the spirit of nationalism and the character of students. It is intended that regional cultures is not lost and can be preserved as any part of the national culture. Lecturers can take the example of the cultural wisdom but remain linked and discussed in science. As an example of the use of carbide cannon who discussed the concept of physics and chemistry. Another goal of planting the value of local wisdom capable of educating students to always be close to the environment and the daily problems [14].

The times, technology and information are the main factors in the loss of local culture. Many young people are beginning to forget the culture of the region and move to modern culture and technology such as smartphone and others. Based on this, the role of the teacher must be able to facilitate between technological developments while not leaving the regional culture [15]. The learning process becomes more varied and not boring. So that the material provided will be absorbed and easily understood by students. There are many ways that lecturers can take in integrating the content of local cultural wisdom in learning. One of them is through the curriculum. The opening of pedagogic innovation based on local wisdom can motivate students to learn according to their own traditions, so that they are not free from the prevailing culture in their social systems) [16].

The chemical concepts contained in carbide cannons can be explained as follows. Chemically, carbide in the form of grey crystal rhombies is used for welding, asitelin gas factory with CaC_2 chemical formula. In solid form it is not dangerous, but if mixed with water / steam it will cause ASETYLEN gas which is flammable and explosive. Chemically the reaction occurs as follows:



and at the time of the asetylen gas eruption there was a reaction



Based on reaction (1), calcium carbide (CaC_2) before reacting with water (H_2O) does not produce any reaction. But when calcium carbide is reacted with water, expansion will occur which produces asetylen gas (C_2H_2). Production of acetylene gas by mixing C_2H_2 . In water that is put in to the cannon made of bamboo in the cap, causing the development of the bamboo inside because there is gas that has reacted in it. The gas molecules are moving in all directions at high speed and collide with the walls of the cannon so that the pressure in the larger cannon. When using a fire lit, the reaction that occurs as the equation (2). An eruption would form karbondiokasida, water, and heat. The more a mixture of calcium carbide and water was added to the cannon made of wood, the resulting explosion will be even greater.

In physics, students can learn about concept of the collision. In the carbide cannon blast, including the concept of the collision is not elastic at all ($e = 0$). Then apply the law of conservation of momentum:

$$mv = m_1 v_1' + m_2 v_2' \dots\dots\dots(3)$$

Based on the equation 3, when the carbide cannon blast the mass of matter before the collision is greater than after the collision. While the speed of the substance before the explosion was smaller than the speed of substance after the collision. Therefore, the kinetic energy of the substance after the explosion is also greater. The kinetic energy of the substance produced causes vibrations of matter particles in the air. So that the energy of these vibrations cause sound energy is greater. If the variable mass is increased, then the sound energy generated is also getting bigger.

Conclusion

This study reports important findings about the concept of using e-learning which is integrated with local cultural wisdom. The research was conducted by developing technology-based modules. As the final product in the form of an electronic module or e-module. The concept of local wisdom values taken is adjusted to the material given and studied in physics and chemistry. Based on the results of product trials and discussion, it can be generally concluded that the use of e-module based on local cultural wisdom is appropriate to be used and applied in the learning process. The feasibility aspect of the media developed can be seen from the results of the assessment by material experts with an average score of 83% with very feasible criteria and the results of the assessment from media experts get an average score of 82% with very feasible criteria. The responses of students obtain an average score of 87% with very good criteria. The conclusion of this study is that e-module has a significant impact on improving learning outcomes. Material can be learned anytime by students. However, the weakness in this study is that there are still some students who have not been able to make maximum use of the e-module. Students get tired faster when reading modules in electronic form. There are even some students who cannot open e-modules via their own smartphone.

Reference

- [1] Tabor, S. W., & Minch, R. P. (2013). Student Adoption & Development of Digital Learning Media: Action Research and Recommended Practices. *Journal of Information Technology Education*, 12.
- [2] Pratama, H., & Prastyaningrum, I. (2019, February). Effectiveness of the use of Integrated Project Based Learning model, Telegram messenger, and plagiarism checker on learning outcomes. In *Journal of Physics: Conference Series* (Vol. 1171, No. 1, p. 012033). IOP Publishing.
- [3] Ramnarain, U. D., & Chanetsa, T. (2016). An analysis of South African Grade 9 natural sciences textbooks for their representation of nature of science. *International Journal of Science Education*, 38(6), 922-933.
- [4] Rehmat, A. P., & Bailey, J. M. (2014). Technology Integration in a Science Classroom: Preservice Teachers' Perceptions. *J. Sci. Educ. Technol.*, 23: 744–755.
- [5] Sotiriou, S., Riviou, K., Cherouvis, S., Chelioti, E., & Bogner, F. X. (2016). Introducing large-scale innovation in schools. *Journal of Science Education and Technology*, 25(4), 541-549.
- [6] Morris, H. (2014). Socioscientific Issues and Multidisciplinarity in School Science Textbooks. *International Journal of Science Education*, 36, 7, 1137–1158.
- [7] Kun, P. Z. (2013, September). Pembelajaran Sains Berbasis Kearifan Lokal. In *PROSIDING: Seminar Nasional Fisika Dan Pendidikan Fisika* (Vol. 4, No. 1).
- [8] Sugiyono. (2015). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Bandung: Alfabeta.
- [9] Tegeh, Made., I Nyoman Jampel dan Ketut Pudjawan. *Model Penelitian Pengembangan*. Yogyakarta: Graha Ilmu.
- [10] El-Seoud, S., Seddiek, N., Taj-Eddin, I., Ghenghesh, P., & El-Khouly, M. (2013). The Effect of E-learning on Learner's Motivation: A Case Study on Evaluating E-Learning and its Effect On Egyptian Higher Education. In *The International Conference on E-Learning in the Workplace* (pp. 12-14).

- [11] Abou El-Seoud, M. S., Taj-Eddin, I. A., Seddiek, N., El-Khouly, M. M., & Nosseir, A. (2014). E-Learning and Students' Motivation: A Research Study on the Effect of E-Learning on Higher Education. *International Journal of Emerging Technologies in Learning*, 9(4), 20-26.
- [12] Martiningsih, I., Lisdiana, L., & Susilowati, SME (2019). Development of Module Based on Scientific Contextual Additives Material to Increase Learning Outcomes and Science Process Skills in Junior High School. *Journal of Innovative Science Education*, 8 (1), 372-381.
- [13] Getuno, DM, Kiboss, JK, Changeiywo, JM, & Ogola, LB (2015). Effects of an E-Learning Module on Students' Attitudes in an Electronics Class. *Journal of Education and Practice*, 6 (36), 80-86.
- [14] Albantani, AM, & Madkur, A. (2018). Think globally, act locally: the strategy of incorporating local wisdom in foreign language teaching in Indonesia. *International Journal of Applied Linguistics and English Literature*, 7 (2), 1-8.
- [15] Darojah, R., Winarni, R., & Murwaningsh, T. (2018). The Local Culture Values of “Perdikan Cahyana” as a Source of Instructional Material for Elementary Students. *International Journal of Multicultural and Multireligious Understanding*, 5(2), 69-78.
- [16] Sulisty, E. T., Prayitno, B. A., & Pratama, H. (2014). Integrasi Budaya Jawa Pada Pengembangan Bahan Ajar Bumi Dan Alam Semesta. *Jurnal Pendidikan Fisika Indonesia*, 10(1).