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Development of DPIB Basics E-Module at SMK Dhuafa Padang

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Abstract: In this research, the 4D model development stages (Define, Design, Develop, and Disseminate) were used which include needs analysis, design, development, and dissemination. The validation results of media experts and material experts show that this E-Module is very suitable with a validity percentage of 75.78% by experimental group experts and 64.67% by control group experts. These results indicate that the E-Module developed through the 4D model is suitable for use in the learning process. The development of E-Modules in vocational schools can be an effective solution to overcome the challenges of students' understanding and skills in DPIB subjects. By using a 4D model in its development, high validation results from media and material experts show that this E-Module has very good quality. It is hoped that the use of this E-Module can improve students' understanding and skills in basic areas that are important for preparation for the world of work. Furthermore, this research also provides recommendations for E-Modules in the broader context of learning, teacher training and other material development.

Keywords: DPIB basics; E-Modules; Experimental and control group

Introduction

Trilling et al. (2009) stated that 21st century learning goes hand in hand with digital lifestyles, critical thinking instruments, learning research, and knowledge structures. Knowledge work, thinking tools, learning research, and digital lifestyle. In the 21st century, vocational education is closely related to three of the four learning paths, namely digital lifestyle, enhanced thinking instruments and knowledge structures.

Education is a complex learning process that develops along with human development. This is in line with Sari et al. (2018) opinion which states that education is a complex process, and its complexity always develops along with human development. This should encourage people to engage in a process of personal improvement, foster self-confidence, foster curiosity, and increase knowledge throughout life. Therefore, education aims to improve the quality of life and society (Ambiyar, 2012). In accordance with Government Regulation Number 57 of 2021 as quoted by Arif et al. (2022) which emphasizes that students must actively develop their potential, including spiritual strength, self-control, personality, intelligence, noble morals and the skills needed by themselves, society, the nation and country.

According to Watrianthos et al. (2022), this is The education system in Indonesia separates vocations education from academic education. Vocational education which previously was not the main focus for prospective students, now it must be equal academic education at both secondary and tertiary levels level of education. Vocational education is the main thing Journal of Science Education Research (JPPIPA) December 2023, Volume 9, Special Edition, 836-842 837 facilitated by Vocational High Schools (SMK). According to Saleh et al. (2015), vocational school education is skills-oriented, aiming to equip students with knowledge and skills specific to their chosen field, with an emphasis of 30% on theory and 70% on practical training.

According to Hairuni (2022), Industrial revolution 4.0 characterized by the continued development of technology and innovations that are updated regularly

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to meet community needs. Rahdiyanta (2020) explains, new technologies and combined approaches the physical and digital world will basically do it transforming humanity. Technological advances provide has a huge impact on all aspects of life, so it requires innovation in education to keep pace with change in this technological era.

DPIB Basics is one of the subjects in class X and is also a mandatory subject as a prerequisite for carrying out Field Work Practices. The DPIB Basics subject at SMK Dhuafa Padang has 7 elements, including element 5 (Five) with technical drawing material. Lessons in element 5 consist of theory and practice of Technical Drawing. Students are expected to master the skills of this lesson because it is the basis for the next lesson. The DPIB Basics learning process so far still uses facilities and infrastructure in the form of whiteboards and other supporting media such as PowerPoint slides and the material provided is still in PDF form without using modules. So students still don't understand the basics of DPIB learning and in fact student learning outcomes are still not good. Students' lack of understanding of the DPIB Basics material can be seen from the learning results in the final grade for this subject. Putra et al. (2020) explains, the lack of teaching materials in education results in suboptimal student learning outcomes.

Learning outcomes are influenced by two factors, namely factors within the student and factors outside the student (Hamid et al., 2022; Harefa et al., 2023). Another expert opinion, namely Moreno-Marcos et al. (2020), states that the learning process and outcomes can be influenced by several factors including: Raw input factors are factors that come from the students themselves. This factor is seen from the conditions that each child has based on sociological conditions and psychological conditions, environmental input factors come from the environment. This factor is seen from the influence of the student's environment, both the natural environment and the social environment, instrumental factors, these factors consist of the curriculum, teaching programs/materials, facilities and teaching staff (teachers) (Anggreani et al., 2019; Nopea, 2021). In conclusion, there are several factors that influence learning outcomes. This research will focus on teaching materials. Teaching materials or learning resources greatly influence the quality of learning so that optimal learning outcomes can be achieved

According to Lestari (2013) teaching materials are learning resources which currently have an important role in supporting the learning process. To create learning that involves students to be more active, there must be teaching materials to complement learning. One form of teaching material is a module. Modules are printed teaching materials. The presentation of the module can be transformed into electronic form so that it is given the term E-Module (Nurhikmah et al., 2021; Rahmatsyah & Dwiningsih, 2021). Electronic modules or e-modules are a form of presentation of independent teaching materials which are systematically arranged into the smallest learning units to achieve certain learning objectives which are presented in electronic format which includes animation, audio, navigation which makes users more interactive.

Method

Research and Development (R&D) is a type of research carried out in this research, based on the problem formulation and background. This development model follows a 4-D modeling approach with four stages, namely: Define, Design, Develop and Disseminate (Adiatmana & Hasan, 2022; Bimantara et al., 2022; Marlena et al., 2022). This development model was chosen for research because it has a systematic process in accordance with the problems underlying this research. By carrying out curriculum analysis and student analysis, it is hoped that this model can be used in developing e-modules for DPIB Basics subjects that are practical, valid and effective in increasing student creativity and learning outcomes.

The DPIB Basics e-module which was developed uses a 4-D model through several stages, including (Sugiyono, 2019).

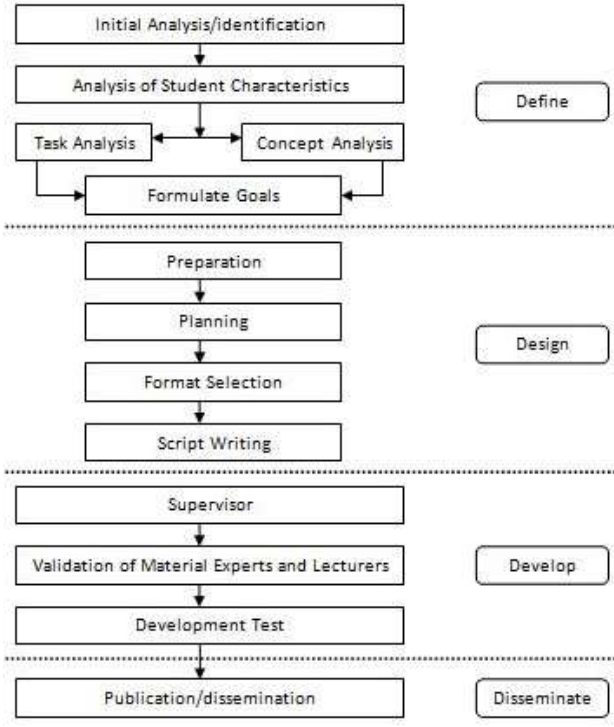

Figure 1. Research procedure

Product trials were carried out at Subject Learning Outcomes (CPMK) no.4. The selection of CPMK 4 was tested because it has quite extensive material and takes quite a long time to complete. This development trial was carried out to determine the level of validity, practicality and effectiveness of the e-module. This testing is carried out to find out whether the product produced can achieve the expected learning objectives. Product testing is carried out after expert validation using Posttest-Only Control Design. Where a group of subjects are subjected to treatment for a certain period of time. Measurements were taken before and after the treatment was given. In this way, the results of the e-module treatment are more precise because they can be compared with the situation before the treatment was given. The research design used can be seen in Table 1.

Table 1. Research Design

R1	X	O1
R2	-	O2

Information:
R1 : Experimental Class
R2 : Control Class
X : Learning using E-Module
O1 : Experimental class learning outcomes
O2 : Control class learning outcomes

The group of students who will carry out learning activities using the DPIB Basics e-module are the subjects who will receive a trial. Students in the trial process in developing the DPIB Basics e-module are students majoring in DPIB studying at SMK Dhuafa Padang who are taking DPIB Basics lessons in the 2023/2024 academic year. Local A Testing of the questions was carried out in another class of 15 people.

The form of data that will be used in e-module development is primary data. The instruments used are validation instruments, practicality instruments that have been validated. Data obtained by media experts/experts, students and teachers who attended lectures using e-module learning media for the DPIB Basics subject of technical drawing elements. The research used is quantitative by experts/teachers and students through questionnaires which provide easy results.

Result and Discussion

DPIB Basics E-Module Validation Stage
Media Validation

Three media experts mentioned as validators 1, 2, and 3 provided media validation results which were then assessed using the Aiken's V (AV) algorithm. By completing the media validation sheet which has 27 assessment items covering didactic aspects, construction aspects and technical aspects, the validator gives a score to the media (Appendix 7). The Likert scale on the media validation form has a maximum value of 5 and a minimum score of 1. The final media validity value determined from the calculation of the media validation sheet is 0.884, because this value is higher than 0.667, the media validity aspect is considered "valid". The media validation results for each validator are shown in Table 2.

Table 2. Media Validation Assessment Results

Validator	Value V	Average	Category
Validator 1	0.87	0.88	Valid
Validator 2	0.88		
Validator 3	0.89		

Content/Material Validation

Three material experts mentioned as validators 1, 2, and 3 provided material validation results which were then assessed using the Aiken's V (AV) formula. The validator completes the material validation form which contains 18 assessment points covering the quality of the material and the quality of learning, as well as giving a score to the material (Appendix 6). The Likert scale on the material validation form has a maximum value of 5 and a minimum score of 1. The calculation results from the validation sheet show that the final validity value for the material aspect is 0.945, this shows the validity value for the material is 0.915 > 0.667, so it is concluded that the material is in the category "valid". The material validation results from each validator are shown in Table 3.

Table 3. Material Validation Assessment Results

Validator	Value V	Average	Category
Validator 1	0.91	0.91	Valid
Validator 2	0.92		
Validator 3	0.90		

Practicality Test Data
Practicality of Teacher Response

Practitioner opinions regarding the suitability of the module are used to determine the suitability of the DPIB Basics-based e-module for technical drawing elements. DPIB Basics subject teachers are practitioners for implementing teacher responses. Practicality refers to the level of ease of using the DPIB Basics e-module. Data on practicality was collected by asking practitioners to complete a questionnaire. Questionnaire responses show the usefulness of using the DPIB Basics e-module that has been created. Table 4 presents the findings of the feasibility evaluation of the DPIB Basics e-module for technical drawing elements.

Table 4. Teacher Response Regarding the Practicality of the Module

Teacher	Score Obtained	NA (Final Value) %
Teacher 1	99	94.29
Teacher 2	100	95.24
Teacher 3	101	96.19
Amount	300	95.24

Practicality of Student Responses

The practicality of the e-module for the DPIB Basics subject was also obtained from student responses via questionnaires. The results obtained are based on assessing students' responses to the practicality of the learning modules developed can be seen from Table 5.

Table 5. Practicality Results Based on Student Responses

The Number of Students	Total Score	NA (Final Value)
15	Got it 1148	89.42%
	Maximum 1425	

Effectiveness Test Data

The e-module for the DPIB Basics subject obtained effectiveness data by looking at the comparison of learning outcomes from students given teaching media in the form of the DPIB Basics e-module (experimental group) with students who were not given the module (control group). The posttest consists of 30 multiple choice questions which have been selected based on the results of the test items. For effectiveness analysis, the independent sample T-test is also used. This test was carried out in order to prove that there was a post-test difference between the experimental group that was given teaching using the DPIB Basics e-module and the group that was not given treatment. The T-test can be carried out if the sample has a normal and homogeneous distribution. To see whether students' responses to the e-module used had a linear relationship with the experimental class learning outcomes, a linearity test was carried out. The efficiency of using e-modules for learning DPIB Basics.

Table 6. Posttest Results for Both Groups

Class	Average	Standard Deviation
Experiment	75.78	13.48
Control	64.67	14.74

Testing subjects was measured by comparing the posttest results between the experimental group that received treatment with e-modules and the control group that did not use e-modules (Delita et al., 2022; Sharma, 2023). Students in the experimental group obtained better learning outcomes than students in the control group. This is shown by the experimental group outperforming the control group in terms of average learning outcomes, the experimental class 75.78 and the control class 64.67.

Based on these learning results, the DPIB Basics e-module is effective in improving student learning outcomes. To see the significance of the differences in learning outcomes of the control group and the experimental group, the data was tested with an independent sample T-test. This test was carried out in order to obtain evidence that there was a difference in post-test results between the group that was treated using the DPIB Basics e-module (experiment) and the group that was not given the same treatment. This test can be carried out if the sample has a normal distribution and is also homogeneous. The SPSS version 25 program was used to carry out this test.

After conducting an evaluation using a collection of selected questions that had been tested, it was seen that the learning outcomes of students in the experimental group were superior to the learning outcomes of students in the control group. This finding is strengthened by a comparison of the average learning outcomes, where the experimental group achieved an average of 75.78, while the control group only achieved an average of 64.67. To identify whether students' responses to the e-modules used were linearly correlated with learning outcomes in the experimental group, a linearity test was carried out. The results of the analysis using SPSS version 25 software show that the Sig. deviation from linearity is 0.668. Because the Sig. deviation from linearity value is > 0.05, it can be concluded that there is a linear relationship between student responses to the e-module and DPIB Basics learning outcomes. To assess the significance of this difference, a test was carried out using the independent sample T-test. Previously, learning outcome data from both groups had to pass a normality test and a homogeneity test.

The normality test was carried out to ensure that the posttest results in both groups had a normal distribution. Test results using SPSS version 25 show that the Sig. control group > 0.05, as well as the Sig value. experimental group > 0.05, indicating that the data from both groups had a normal distribution. Next, a homogeneity test was carried out to ensure homogeneity between the first and second groups in this study. Testing using SPSS version 25 shows that the Sig. = 0.983, with a Sig value > 0.05. Based on the results of the homogeneity test, it can be concluded that the two groups are homogeneous. The independent sample T-test was carried out because the data from both groups had a normal and homogeneous distribution. The test results with SPSS version 25 show a P-Value = 0.040, which indicates that the P-Value < 0.05. Therefore, it can be concluded that there is a significant difference

between the posttest results of the control group and the experimental group, which indicates that the DPIB Basics e-module has an effect on the learning outcomes of the experimental group.

The findings regarding effectiveness in this research are also in line with the results of previous research conducted by Zaini et al. (2023). The study showed that the average learning outcome for the experimental group reached 84.9, while the control group reached 67.66. These results confirm that the module has proven effective in improving student learning achievement. Similar research conducted by Hafizza (2018) also indicated that the module developed in his research was successfully used as a teaching tool to improve students' academic performance. Therefore, it can be concluded that the effectiveness results of this research, which are supported by related research findings, show that the DPIB Basics e-module produced has an effective impact on the learning process.

Conclusion

In this research, the 4D model development stages (Define, Design, Develop, and Disseminate) were used which include needs analysis, design, development, and dissemination. The validation results of media experts and material experts show that this E-Module is very suitable with a validity percentage of 75.78% by experimental group experts and 64.67% by control group experts. These results indicate that the E-Module developed through the 4D model is suitable for use in the learning process. The development of E-Modules in vocational schools can be an effective solution to overcome the challenges of students' understanding and skills in DPIB subjects. By using a 4D model in its development, high validation results from media and material experts show that this E-Module has very good quality. It is hoped that the use of this E-Module can improve students' understanding and skills in basic areas that are important for preparation for the world of work. Furthermore, this research also provides recommendations for E-Modules in the broader context of learning, teacher training and other material development.

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References

Adiatmana, D., & Hasan, M. (2022). Developing an electronic module based on local wisdom in dokan village to optimize the character education. *JIIP-Jurnal Ilmiah Ilmu Pendidikan*, *5*(9), 3838–3843. https://doi.org/10.54371/jiip.v5i9.947

Ambiyar, A. (2012). *Profesional Development Education Vocational High School Teacher Knowledge Century*. Retrieved from http://repository.unp.ac.id/id/eprint/16108

Anggreani, J., Harmi, H., & Khair, U. (2019). *Implementasi Pembelajaran Tematik Berdasarkan Kurikulum 2013 di MIN 04 Daspetah Kepahiang*. Retrieved from https://e-theses.iaincurup.ac.id/1116/

Arif, C., Muskir, M., & Refdinal, R. (2022). Pengembangan E-Modul Pembelajaran Berbasis Web pada Mata Pelajaran Gambar Teknik Listrik di Sekolah Menengah Kejuruan. *Scaffolding: Jurnal Pendidikan Islam Dan Multikulturalisme*, *4*(2), 170–196. https://doi.org/10.37680/scaffolding.v4i2.1409

Bimantara, E., Purnomo, S., Yudantoko, A., Johan, A. B., Ratnawati, D., & Syafiq, A. (2022). Learning system suspension using e-module in vocational education with model 4D. *Jurnal Taman Vokasi*, *10*(2), 149–157. Retrieved from https://jurnal.ustjogja.ac.id/index.php/tamanvokasi/article/view/13558

Delita, F., Berutu, N., & Nofrion, N. (2022). Online learning: The effects of using e-modules on self-efficacy, motivation and learning outcomes. *Turkish Online Journal of Distance Education*, *23*(4), 93–107. https://doi.org/10.17718/tojde.1182760

Hafizza, S. (2018). The Meaning of Happiness by Teenagers Broken Home. *PSYMPATHIC: Psychological Scientific Journal*, *5*(1), 59–66. https://doi.org/10.15575/psy.v5i1.1956

Hairuni. (2022). *Media Online Di Era Revolusi Industry 4.0 dan Society 5.0 Serta Peran Humas Dalam Menyajikan Informasi*. Retrieved from https://prokopim.paserkab.go.id/berita/media-online-di-era-revolusi-industry-4-0-dan-society-5-0-serta-peran-humas-dalam-menyajikan-informa

Hamid, A., Herliana, F., Fatta, M. H., Mahzum, E., Elisa, E., Musdar, M., & Rizal, S. (2022). Implementation of e-learning module to increase physics learning outcomes. *AIP Conference Proceedings*, *2659*(1). https://doi.org/10.1063/5.0113545

Harefa, D., Sarumaha, M., Telaumbanua, K.,

Telaumbanua, T., Laia, B., & Hulu, F. (2023). Relationship student learning interest to the learning outcomes of natural sciences. *International Journal of Educational Research & Social Sciences*, *4*(2), 240–246. https://doi.org/10.51601/ijersc.v5i3

Lestari, I. (2013). *Development of Competency Based Teaching Materials*. Permata Academy.

Marlena, N., Patrikha, F. D., & Dwijayanti, R. (2022). Electronic Modules in an Indonesian Higher Education: Conceptualisation, Development and Application. *AL-ISHLAH: Jurnal Pendidikan*, *14*(3), 3943–3954. https://doi.org/10.35445/alishlah.v14i3.1473

Moreno-Marcos, P. M., Pong, T.-C., Munoz-Merino, P. J., & Kloos, C. D. (2020). Analysis of the factors influencing learners' performance prediction with learning analytics. *IEEE Access*, *8*, 5264–5282. https://doi.org/10.1109/ACCESS.2019.2963503

Nopea, F. (2021). *Pengaruh Pemanfaatan Sumber Belajar Berbasis Lingkungan Terhadap Minat Belajar Siswa Mata Pelajaran Tematik Subtema Hewan dan Tumbuhan Di Lingkungan Rumahku Sekolah Dasar Negeri 66 Kota Bengkulu*. Retrieved from http://repository.iainbengkulu.ac.id/5471/

Nurhikmah, H., Hakim, A., & Wahid, M. S. (2021). Interactive e-module development in multimedia learning. *Al-Ishlah: Jurnal Pendidikan*, *13*(3), 2293–2300. https://doi.org/10.35445/alishlah.v13i3.863

Putra, R. F., Syahril, S., Yufrizal, A., & Arafat, A. (2020). Pengembangan Panduan Pengunaan Mastercam Pada Mata Pelajaran NC-CNC dan. *Jurnal Vokasi Mekanika*, *2*(1), 46–52. https://doi.org/10.24036/vomek.v2i1.86

Rahdiyanta, D. (2020). *Tantangan Pembelajaran Pemesinan di Era Revolusi Industri 4.0.* Retrieved from https://www.uny.ac.id/id/fokus-kita/prof-dr

Rahmatsyah, S. W., & Dwiningsih, K. (2021). Development of interactive E-Module on the periodic system materials as an online learning media. *Jurnal Penelitian Pendidikan IPA*, *7*(2), 255. https://doi.org/10.29303/jppipa.v7i2.582

Saleh, R. R., Ramdani, D., & others. (2015). Pengembangan Media Video Tutorial dalam Pembelajaran Komputer untuk Keterampilan Membuat Server di SMK. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK)*, *4*(10). https://doi.org/10.26418/jppk.v4i10.11909

Sari, P., & Ampera, D. (2018). Pengembangan Model Pembelajaran Berbasis IDI (Intructional Development Institute. In *Seminar Nasional Royal (SENAR)* (pp. 573–576). Retrieved from https://jurnal.stmikroyal.ac.id/index.php/sena/

Sharma, A. (2023). Effect of Self-Developed E-Content Modules in Biology to Enhance Learning Agility: An Experimental Analysis. *Indian Journal of Natural Sciences*, *14*(79), 58711–58720. Retrieved from https://shorturl.asia/tfXjD

Sugiyono. (2019). *Metodelogi Penelitian Kuantitatif dan Kualitatif Dan R&D*. Bandung: Alfabeta.

Trilling, B., & Fadel, C. (2009). What is 21st Century Learning. In *21st Century Skills: Learning for Life in Our Times*. Retrieved from http://www.smjk.edu.my/smjk_agm08/21stCenturyLS.pdf

Watrianthos, R., Ambiyar, A., Rizal, F., Jalinus, N., & Waskito, W. (2022). Research on vocational education in indonesia: a bibliometric analysis. *(JTEV) Jurnal Teknik Elektro Dan Vokasional*, *8*(2), 187–192. https://doi.org/10.24036/jtev.v8i2.117045

Zaini, M., & Kapsul, K. (2023). The Quality of E-Student Worksheet on the Concept of Vertebrate Based on Critical Thinking Skill in Senior High School Level. *Islamic Journal of Integrated Science Education (IJISE)*, *2*(1), 16–29. https://doi.org/10.30762/ijise.v2i1.891