Increasing Student Knowledge and Skills through the Implementation of Project Base Learning-based Animation Videos and E-Modules in Wood Construction Theory and Practice Courses

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ABSTRACT

One characteristic of a vocational education program is the availability of practice-based courses/workshops. One of them is a course on the theory and practice of wood construction in which there is material on Occupational Health and Safety (K3), work equipment, types of wood joints, and practice of making wood joints. The results of preliminary observations and analysis obtained information that students had difficulty understanding the concepts, types, and processes of making wood joints. One reason is that they have difficulty understanding the explanations given directly by the teacher. Based on this, it can be concluded that it is necessary to implement technology that can provide an overview and basic knowledge before students carry out actual learning activities. The implementation of the latest technology in learning is needed by students, one of the implementations of this technology includes the application of learning media in the form of animated videos and e-modules. This research was carried out using a research and development approach. The method used in this study is a research and development method adopted from the method developed by Brog and Gall which consists of (1) research and initial information collection; (2) media planning; (3) initial product development; (4) expert validation; (5) product analysis and revision; (6) Field Trials. The results of this study were an increase in the knowledge and skills of students related to Occupational Health and Safety (K3), work equipment, types of wood joints, and the practice of making wood joints. The results of this study were the acquisition of learning media in the form of e-modules and animated videos with very decent validation results with an assessment of material experts at 87.5% and media experts at 98.2%. The results of student responses obtained a value of 89.80%, which means it is feasible and interesting to use in the learning process. The trial results of the application of learning media in the learning process obtained an average value of increasing knowledge throughout the class by 51.75%. Thus it can be concluded that the application of the developed learning media can increase students' knowledge and skills in a fairly good category.

Keywords: *Learning Media, Video Animation, E-Module, Wood Construction, Increase in Knowledge.*

1. INTRODUCTION

The development of learning media is currently undergoing a change towards learning media that is more adaptive, responsive, and personalized. The current technology allows learning media to adapt to the level of understanding and ability of students [1]. Mayer (2021) emphasizes the importance of using appropriate multimedia in learning media, namely multimedia that can support cognitive learners and help them understand the material better, and emphasizes the importance of developing learning media that is based on scientific research and strong learning theory as a whole so that the current development of learning media demands the development of more adaptive and personalized technology, as well as the use of appropriate and

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research-based multimedia, and this can help increase the effectiveness and efficiency of learning, as well as provide a more meaningful learning experience for students [2].

Clark (2022), explains that technology cannot be the only focus in developing learning media [3]. The development of quality and relevant learning content is also very important to create an effective and meaningful learning experience for students and the importance of social aspects in online learning, especially in terms of collaboration between students and between students and teachers. Therefore, effective learning media must enable interaction and collaboration between students, as well as provide adequate support for teachers in managing and facilitating online learning.

Learning patterns that are cantered on lecturers and institutions can still be found in tertiary institutions, this graduate achievement should require students to be more active and their learning cantered on them. Class meetings are still held at scheduled times and use instructional methods and are generally still lecturing in nature. The process of teaching and learning often occurs without regard to differences in individual student characteristics such as cognitive, motivation, interests, learning styles, and difficulties that may be encountered.

Facilitating the communication process and improving learning outcomes is the goal of preparing learning media. In learning building construction, especially in the basic competencies of applying good wood specifications for building materials, good wood characteristics, and types of wood whose use is based on wood strength, it requires a clear explanation so that students can describe the types of wood that are good for building materials and are also appropriate. with the power of the wood. In addition, the introduction and implementation of material on the types of wood joints is also an important thing to convey in the learning process. This of course aims to increase the knowledge of students.

The use of electronic modules makes it easier for teachers and students to learn teaching materials, especially if asynchronous learning is carried out using digital learning [4]. The electronic module used by the teacher aims to convey teacher learning to students so that it can stimulate students' thoughts, feelings, interests, and willingness to learn [5]. Electronic modules have several advantages, including making modules more interesting [6]. Electronic modules are expected to increase interest, motivation, and activity as well as increase students' understanding of learning. The learning modules that will be developed and implemented are electronic modules based on Android applications that can later be used with smartphones or laptops. This is because electronic units used with mobile phones can be accessed by students anywhere and anytime [7] [8] [9]. The use of electronic units that are practically carried everywhere and designed with an attractive appearance can make it easier for students to learn independently and attract attention to reading. Previous research also stated that learning with electronic modules also facilitates the implementation of learning, because it can not only be used during face-to-face learning processes but can also be used anywhere and anytime [10] [11] [12].

In addition to the use of digital-based modules, theoretical and practical learning also requires learning media in the form of animated videos. The use of animated videos in learning is expected to assist in imparting knowledge that requires depiction or in the form of simulations. Some of the results of research and development carried out show that the use of animation-based learning media makes students experience an increase in learning achievement and learning outcomes [13] [14]. In addition, students' enthusiasm for learning has also increased after using animated videos in the learning process, this is because this media is interactive [15].

The use of digital-based learning media is needed at all levels of education and all materials. Especially in the context of courses such as Theory and Practice of Wood Construction in the Department of Civil Engineering and Planning, Faculty of Engineering, State University of Malang, where students often experience difficulties in understanding the material presented in the form of text sheets and presentations using commonly used presentation software. In this case, the development of digital-based learning media that has the latest elements is interesting, easy to use, and is more varied can help increase students' understanding of the material being taught. One application that can be used to develop learning media such as e-modules is Flip Builder. However, it should be noted that the use of digital-based learning media cannot completely replace the role of the lecturer as a learning facilitator. Therefore, it needs to be balanced with appropriate learning strategies such as project-based learning or cooperative learning to ensure the effectiveness of learning [16].

E-modules are modules in the form of soft files that students can open and read wherever and whenever [17]. E-module is digital media that is effective, efficient, and prioritizes student independence in carrying out learning activities so that students are able to solve problems in their own way [18]. One application that can be used to create e-modules is the Flip PDF Builder. The advantages of the flip pdf builder are that the flip pdf builder media can be flipped back and forth like a real book, can be inserted with animations or videos that support learning materials and can be interactive learning media in conveying information.

Based on the author's observations while doing it in the Wood Construction Theory and Practice Laboratory, there were several learning problems for students,

namely: 1) During the course of Wood Construction Theory and Practice courses, some students had difficulty understanding the material presented, especially during the learning process; 2) When getting project assignments, some students have difficulty completing project assignments; 3) There is still a lack of variation in the use of learning media because learning often uses conventional learning. Based on this, teachers must be creative and solutive so that learning is easily accepted by students. The development of learning media is needed to help develop student learning processes. The learning model that can arouse students' interest in learning is the same as learning in the laboratory.

The existence of this development research aims to provide learning media for students during the learning period. The e-module material on Theory and Practice of Timber Construction for the Undergraduate Program in Building Engineering Education is a key component in facilitating flexible learning activities. The results of this development are expected to be an additional learning resource to maximize knowledge and learning outcomes.

The development of learning media for the Theory and Practice of Wood Construction course must be carried out to meet quality teaching media to increase student resources in facing global competition. One of the efforts to improve the quality of education is to get quality material, and you can start by providing it. Good learning media must be able to present material according to curriculum guidelines, follow the development of science and technology, and bridge learning so that it can run smoothly.

2. METHOD

The design of this study used the Research and Development (R&D) research method which was adopted and modified from Brog and Gall and from Sugiyono (2009) with 6 research stages [19]. The flow of research and development carried out is as follows:

Figure 1. Research and Development Flowchart

The trial of this learning media product was carried out using the true experiment method, in which the application of this learning media product was carried out in 3 classes, previously starting with pre-test data collection on students in the 3 classes. Furthermore, after collecting pre-test data, it is continued with the application of the product in 4 meetings for each class and ends with collecting post-test data.

2.1 Research Subject

The subjects of this learning media product research consisted of material experts, media experts and product users. The product test subjects were experiments for students of the Building Engineering Education study program with a total of 75 students from the Department of Civil Engineering and Planning, especially in the Building Engineering Education study program who were taking the Theory and Practice of Wood Construction course.

2.2 Data Analysis

Data collection was carried out using a questionnaire with a Likert scale of 4 alternative answers which were distributed directly to students. The type of data obtained is in the form of quantitative data derived from the acquisition of points on each statement and qualitative data derived from suggestions and input provided by experts and students.

Researchers used quantitative descriptive analysis as a data analysis technique. The quantitative descriptive analysis technique is a numerical quantitative research method. This study is related to the development of statistics. According to Akbar and Sriwiyana (2010), the formula used is [20]:

$P=\Sigma x/\Sigma xi \times 100\%$ .....(Equation 1)

Description :

P = Percentage sought

Σx = Number of test subject

Σxi = Number of ideal answers

100% = Constant number

Based on the thick level and validity criteria above, it can be concluded that the criteria for learning to use the E-Module must reach a validity level of 80.00% so that the E-Module can be used without the need for revision. If the validity criterion is below 55.00%, learning using the E-Module is not good and needs to be reviewed before use.

Whereas for data analysis of product trial results to determine the increase in student knowledge and skills using simple descriptive analysis with percentages [21]. Furthermore, scoring is carried out on average from all pre-test and post-test scores. The criteria for concluding the use of the reference are in Table 1 below.

Table 1. Criteria for increasing knowledge and skills.

No	Range Value	Interpretation
1	81% - 100%	Very Good
2	61% - 80%	Good
3	41% - 60%	Pretty Good
4	21% - 40%	Not Good
5	1% - 20%	Very Not Good

3. RESULT AND DISCUSSION

3.1. Learning Media Product

Researchers developed a product in the form of an e-module learning Theory and Practice of Wood Construction with access to animation-based learning videos for students of the S1 Building Engineering Education study program. The process of developing learning e-modules with access to animation-based learning videos uses the help of the Flip PDF Corporation Edition (Flip Builder) application. In the product design stage, there are three stages including the pre-production stage, the production stage, and the post-production stage.

1) Pre Production Stage

There were several activities in the pre-production stage including determining ideas or ideas which were the big themes in making learning e-modules and animated videos. Then, determining ideas, analyzing targets, compiling an outline of media content, compiling material descriptions, compiling narratives, and studying narratives..

2) Production Stage

The resulting product is an E-Module learning media with access to animation-based learning videos where the learning media is made using several computer software that support each other.

3) Post Production Stage

Development of the Wood Construction E-Module for the Wood Construction Theory and Practice course consisting of: Front Cover Page, Foreword, Table of Contents, List of Tables, List of Figures, Introduction, Competency Map, Material Contents, Bibliography, Glossary, Compiler's Biodata, Back Cover Page. Fill in the Timber Construction E-module according to the predetermined CPMK. The material discussed in the Wood Construction E-Module is an introduction to special wood components, wood construction, types of tools, wooden beams and columns, and types of wood connections. The form of the E-Module resulting from this development is complemented by pictures and animation-based learning videos so that looks more attractive and not monotonous in its use.

Figure 2 Cover.
Source: Author Documents

Figure 3 List of contents.
Source: Author Documents

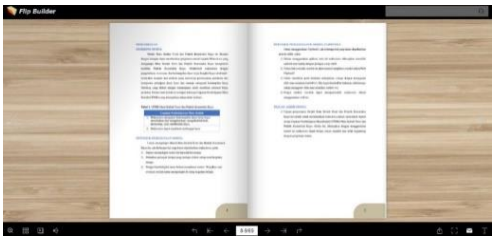

Figure 4 Introduction.
Source: Author Documents

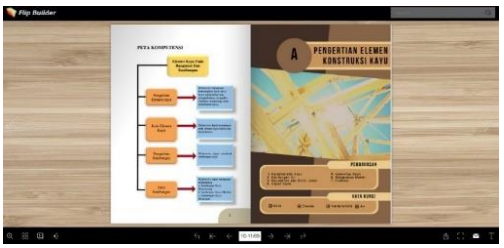

Figure 5 Competency mapping.
Source: Author Documents

Figure 6 Contents.
Source: Author Documents

Figure 7 Bibliography.
Source: Author Documents

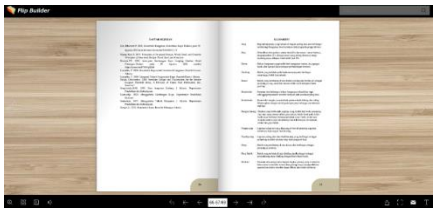

Figure 8 Glosarium.
Source: Author Documents

3.2. Product Validation and Trial Results

To find out the level of feasibility of the developed media, a design validation was carried out by material experts and media experts as well as product trials on 75 respondents from the S1 Building Engineering Education study program. In addition to knowing the feasibility level, through this stage suggestions and input are also obtained so that the product quality becomes better.

1. Contents Expert Validation

Material validation is carried out by supporting lecturers in the S1 Building Engineering Education study program. Material validation is carried out directly through a questionnaire with the following assessment results:

Table 2. Contents expert validation results.

No.	Validator	Results
1	Validator 1	(87,5%)

Source: Author Documents

Based on the validation results, the learning e-module with access to learning videos in terms of material has a very decent level of eligibility.

2. Media Expert Validation

The media validation was carried out by Mr. Eka Pramono Adi, S.IP, M.Si as a lecturer in the Department of Educational Technology, Faculty of Science, Malang State University and Mr. Made Wena, S.T, M.T as a lecturer in the Civil Engineering Department, Faculty of Engineering, Malang State University. Media validation is carried out directly through a questionnaire with the following assessment results:

Table 3. Media expert validation results.

No.	Validator	Results
1	Validator 2	(98,2%)
2	Validator 3	(98,2%)

Source: Author Documents

Based on the validation results, the learning e-module with access to learning videos in terms of media has a very good level of feasibility.

3. Product trials

Products that have been declared feasible by the validator are then revised for further product trials. The product trial was carried out in a one-on-one trial involving 75 students of the Building Engineering Education Study Program. Assessment by students is carried out directly using a questionnaire sheet with the following results:

Table 4. Product trial results.

No.	Results Validation
1	(89,80%)

Source: Author Documents

The trial results of learning e-module products with access to animation-based learning videos are stated to have a very feasible feasibility level for use in the learning process with a percentage score of 89.80%.

Based on the results of product trials in the field which showed responses from respondents to the learning media developed with very good criteria, then pre-tests and post-tests were carried out. The results of the pre-test and post-test conducted on students in 3 different classes are presented in Table 5 below.

Table 5. Class A student pre-test and post-test results.

No	Respondents	Pretest Score	Post-test	Percentage of Increase (%)
1	R1	50	85	70,00
2	R2	52	90	73,08
3	R3	54	84	55,56
4	R4	55	85	54,55
5	R5	60	90	50,00
6	R6	50	85	70,00
7	R7	53	91	71,70
8	R8	60	90	50,00
9	R9	70	98	40,00
10	R10	72	97	34,72
11	R11	64	94	46,88
12	R12	68	98	44,12
13	R13	62	92	48,39
14	R14	55	90	63,64
15	R15	54	92	70,37
16	R16	50	88	76,00
17	R17	59	89	50,85

No	Respondents	Pretest Score	Post-test	Percentage of Increase (%)
18	R18	62	92	48,39
19	R19	64	94	46,88
20	R20	68	98	44,12
21	R21	70	98	40,00
22	R22	71	99	39,44
23	R23	60	90	50,00
24	R24	55	90	63,64
25	R25	64	94	46,88
Total		**1502**	**2293**	**1349,16**
Average		**60,08**	**91,72**	**53,97**

Based on the results of the pre-test and post-test carried out in class A, it can be seen that the average percentage increase in value is 53.97%, which is quite good. The average pre-test value is 60.08 and the average post-test value is 91.72. The highest percentage increase in value was 76% obtained by respondent R16, while the lowest percentage value was 34.72. Overall student scores have increased.

Table 6. Class B student pre-test and post-test results.

No	Respondents	Pretest Score	Post-test	Percentage of Increase (%)
1	R26	53	91	71,70
2	R27	60	98	63,33
3	R28	70	98	40,00
4	R29	72	97	34,72
5	R30	55	85	54,55
6	R31	54	84	55,56
7	R32	50	80	60,00
8	R33	54	89	64,81
9	R34	55	85	54,55
10	R35	60	90	50,00
11	R36	66	96	45,45
12	R37	68	98	44,12
13	R38	50	78	56,00
14	R39	55	85	54,55
15	R40	58	88	51,72
16	R41	50	85	70,00
17	R42	70	100	42,86
18	R43	72	97	34,72
19	R44	54	84	55,56
20	R45	58	88	51,72
21	R46	64	89	39,06
22	R47	66	96	45,45
23	R48	66	98	48,48
24	R49	60	90	50,00
25	R50	58	96	65,52
Total		**1498**	**2265**	**1304,43**
Average		**59,92**	**90,6**	**52,18**

The results of the pre-test and post-test in class B showed an average value of increasing knowledge of 52.18%, with the highest increase in value (71.70%) being obtained by respondent R26 while the lowest increase in value was obtained by respondents R29 and R43 with a percentage of 34.72%.

Table 7. Class C student pre-test and post-test results.

No	Respondents	Pretest Score	Post-test	Percentage of Increase (%)
1	R51	60	90	50,00
2	R52	50	80	60,00
3	R53	64	99	54,69
4	R54	55	93	69,09
5	R55	70	95	35,71
6	R56	72	97	34,72
7	R57	64	94	46,88
8	R58	68	93	36,76
9	R59	72	97	34,72
10	R60	54	86	59,26
11	R61	70	100	42,86
12	R62	60	90	50,00
13	R63	55	89	61,82
14	R64	64	94	46,88
15	R65	55	93	69,09
16	R66	70	100	42,86
17	R67	68	93	36,76
18	R68	60	90	50,00
19	R69	62	92	48,39
20	R70	53	91	71,70
21	R71	60	88	46,67
22	R72	68	93	36,76
23	R73	74	99	33,78
24	R74	60	90	50,00
25	R75	58	92	58,62
Total		**1566**	**2318**	**1228,02**
Average		**62,64**	**92,72**	**49,12**

The results of the analysis of the pre-test and post-test scores for class C showed the lowest percentage increase in scores compared to the other classes. The percentage increase in pre-test to post-test scores obtained an average of 49.12%, with the highest percentage obtained by respondent R70 at 71.70% and the lowest by respondent R73 at 33.79%.

Based on the results of the increase in scores from the pre-test to the post-test of the three classes, it was obtained an average percentage increase of 51.75%. In general, the use of developed learning media can increase students' knowledge and skills in taking wood construction courses.

3.3. Product Strengths and Weaknesses

The development of the Wood Construction Electronic Module with access to animation-based learning videos developed by researchers has several advantages, namely: The Wood Construction electronic module with access to learning videos has material that is coherent and easy to understand. The material discussed in the Wood Construction Learning E-Module is regarding the introduction of special components of wood, wood construction, types of tools, wooden beams and columns, and types of wood joints. From the results of the material expert validation, a validity level value of 87.5% was obtained, which means it was very feasible in every aspect, namely the content feasibility aspect and the presentation feasibility aspect. Judging from the aspect of content feasibility, where this aspect discusses the suitability of the content of the learning E-Module with the Basic Competence of the subject, the content of the material is in accordance with the sequence of the material. From the aspects discussed in the suitability of the contents of the E-Module with CPMK, a percentage of 100% is obtained, which means it is very feasible. However, for the content of the material, the percentage is 75%, which means it is feasible. For the average overall aspect of content feasibility, it gets a validity level of 87.5%, which means it is very feasible. As for the assessment of the feasibility aspect of presenting the average rating item, it gets a percentage of 100%, which means it is very good with an example, namely the module is easy to use, the module has clear material, clear pictures and videos, the module can be used from anywhere. However, the items for the conformity assessment of the questions with the material and evaluation got a percentage of 88%, which means very good but there is a need for additional items related to the questions discussed so that the questions given are more optimal and in accordance with the material discussed in the learning E-Module.

In addition, the results of the next validation test, namely validation according to media experts related to this learning media, get a very good validation level of 98.2%. The percentage assessment is seen from the module size aspect, the module cover design aspect, the media aspect, and the module content design aspect. Judging from the aspect of module size, it gets a percentage of 100%, which means it is very feasible. Then from the aspect of module cover design, the average rating item gets a percentage of 100%, which means it is very feasible. However, for color contrast, you get a percentage of 88%, which means it is very feasible and needs to provide a more optimal color contrast The development of the Wood Construction Electronic Module with access to animation-based learning videos developed by researchers has several advantages, namely: The Wood Construction electronic module with access to learning videos has material that is coherent and easy to understand. The material discussed in the Wood Construction Learning E-Module is regarding the introduction of special components of wood, wood construction, types of tools, wooden beams and columns and types of wood joints. From the results of the material expert validation, a validity level value of 87.5% was obtained, which means it was very feasible in every aspect, namely the content feasibility aspect and the presentation feasibility aspect. Judging from the aspect of content feasibility, where this aspect discusses the suitability of the content of the learning E-Module with the Basic Competence of the subject, the content of the material is by the sequence of the material. From the aspects discussed in the suitability of the contents of the E-Module with CPMK, a percentage of 100% is obtained, which means it is very feasible.

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With the Wood Construction learning E-Module it can help students learn independently. Because there is access to educational videos related to the material covered in the e-module, the developed e-module can motivate students to be enthusiastic about learning. The Wood Construction electronic module can be learned from anywhere. The development of learning E-Modules made by researchers is in accordance with the characteristics of E-Modules according to [23], namely: The developed E-Modules must have Self-instructional properties, namely having instructions that can be studied independently, Self-Contained, that is, all material can be learned on the electronics module. Adaptive, namely electronic modules can motivate students, User Friendly, namely modules can be easy to use. The Wood Construction Learning Module with access to learning videos has weaknesses regarding the distribution of E-Modules. The result of the E-Module product is in the form of a website link that can only be accessed via the internet and electronic media. If students do not have an internet network, they cannot access the learning E-Module and cannot make optimal use of the media in independent learning

The learning media for Wood Construction E-Modules with access to learning videos that have been developed by researchers have several advantages, namely the E-Modules are easy to use and learn from anywhere because they are only in the form of html links or applications that can only be clicked or installed via a smartphone. E-Modules are easy to carry, no need to print or carry thick and heavy E-Modules. E-Modules are easily added with sound, images, and animated videos. The appearance of the E-Module is very attractive and not monotonous.

From the several advantages above, the Wood Construction E-Module learning media has weaknesses, namely the Wood Construction E-Module learning media can only be accessed through electronic media such as laptops, Smartphones, etc. so students who do not have electronic media will have difficulty accessing the E-Module. The Timber Construction E-Module only presents three materials and the materials are limited.

4. CONCLUSION

The final product of the E-Module development is in the form of an E-Module application that is installed via a smartphone. Teaching materials for the development of the Wood Construction E-Module S1 Building Engineering Education study program consist of: Front Cover Page, Foreword, Table of Contents, List of Tables, List of Figures, Introduction, Competency Map, Material Content, Bibliography, Glossary, Compiler's Biodata, Pages Back Cover. The material presented in the Wood Construction Learning E-Module is by the established CPMK. The material discussed in the Wood Construction E-Module is the introduction of special wood components, wood construction, types of tools, wooden beams and columns and types of wood joints. The form of the E-Module resulting from this development is complemented by pictures and learning videos so that the display is more attractive and not monotonous in its use.

The percentage of validation results that are highly feasible is obtained based on validity-level data obtained from material experts, media experts, and students. Material experts get a validity level of 87.5%, which means it is very feasible in every aspect. For media experts to get a validity level of 98.2% which means it is very feasible.

The results of student responses as users of this learning media get a value of 89.80% which means it is very interesting from every aspect. From the results of student responses, it can be concluded that the learning media products developed are feasible and interesting when used in the learning process.

The trial results of the application of instructional media in the learning process obtained an average pre-test score of class A students of 60.08, class B of 59.92 and class C 62.64, while for the post-test results of class A students obtained an average value of 91.72, class B of 90.60, and class C of 92.72. Based on these results, the average percentage increase in grades for class A was 53.97%, class B was 52.18% and class C was 49.12%, with an average grade for the whole class of 51.75%. Thus it can be concluded that the application of the developed learning media is able to increase students' knowledge and skills in a fairly good category.

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REFERENCES

[1] R. E. Mayer, L. Fiorella, Learning as a generative activity, Eight learning strategies that promote understandin, Cambridge University Press, 2015.

[2] R. E. Mayer, Multimedia learning, In Psychology of learning and motivation, Academic Press, 41, 2002, pp. 85-139.

[3] R. C. Clark, Developing technical training: A structured approach for developing classroom and computer-based instructional materials, John Wiley & Sons, 2011.

[4] F. S. Irwansyah, I. Lubab, I. Farida, M. A. Ramdhani, Designing interactive electronic module in chemistry lessons, in Journal of Physics: Conference Series, IOP Publishing, 895(1), 2017, p. 012009. DOI: https://doi.org/10.1088/1742-6596/895/1/012009.

[5] A. R. Asmi, A. N. D. Surbakti, C. Hudaidah, E-Module Development Based Flip Book Maker for Character Building in Pancasila Coursework Sriwijaya University Jurnal Pendidikan Ilmu Sosial, 27(1), 2018, pp. 1-10. DOI: https://doi.org/10.17509/jpis.v27i1.9395.

[6] S. Y. Ningsih, N. Mahyuddin, Desain e-module tematik berbasis kesantunan berbahasa anak usia dini di taman kanak-kanak, Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 6(1), 2021, pp.137-149. DOI: https://doi.org/10.31004/obsesi.v6i1.1217.

[7] I. Aprilia, I. G. P. Suryadarma, E-module of mangrove ecosystem (emme): development, validation and effectiveness in improving students' self-regulated, Biosfer: Jurnal Pendidikan Biologi, 13(1), 2020, pp. 114-129. DOI: https://doi.org/10.21009/biosferjpb.v13n1.114-129.

[8] I. Hamzah, S. Mentari, Development of accounting e-module to support the scientific approach of students grade X vocational high school, Journal of Accounting and Business Education, 2(1), 2017, pp. 78-88. DOI: https://doi.org/10.26675/jabe.v1i1.9751.

[9] M. N. Aufa, R. Rusmansyah, M. Hasbie, A. Jaidie, and A. Yunita, The effect of using e-module model problem based learning (PBL) based on wetland environment on critical thinking skills and environmental care attitudes. Jurnal Penelitian Pendidikan IPA, 7(3), 2021, pp. 401-407. DOI: https://doi.org/10.29303/jppipa.v7i3.732.

[10] Y. Fisnani, Y. Utanto, F. Ahmadi, The development of e-module for batik local content in pekalongan elementary school, Innovative Journal of Curriculum and Educational Technology, 9(1), 2020, pp. 40-47. DOI: https://doi.org/10.15294/IJCET.V9I1.35592.

[11] R. M. Logan, C. E. Johnson, J. W. Worsham, Development of an e-learning module to facilitate student learning and outcomes, Teaching and Learning in Nursing, 16(2), 2021, pp. 139-142. DOI: https://doi.org/10.1016/j.teln.2020.10.007.

[12] S. Sunismi, A. H. Fathani, Uji Validasi E-Module Matakuliah Kalkulus I untuk Mengoptimalkan Student Centered Learning dan Individual Learning Mahasiswa S-1, Jurnal Review Pembelajaran Matematika, 1(2), 2016, pp. 174-191. DOI: https://doi.org/10.15642/jrpm.2016.1.2.174-191.

[13] M. Habibulloh, Pengembangan Media Pembelajaran Fisika Berbasis Multimedia Animasi Pokok Bahasan Kemagnetan Untuk SMP Kelas IX, Skripsi tidak diterbitkan, Universitas Negeri Malang, 2018.

[14] M. Hanif, The Development and Effectiveness of Motion Graphic Animation Videos to Improve Primary School Students' Sciences Learning Outcomes, International Journal of Instruction, 13(3), 2020, pp. 247-266.

[15] A. Nurharini, Yuyarti, Development of Learning Media of Animation Video as Learning Sources of Cultural and Craft Arts, in: 9th International Conference for Science Educators and Teachers (ICSET), Atlantis Press, Advances in Social Science, Education, and Humanities Research, 118, 2017.

[16] R. S. Hartanto, H. Dani, Studi Literatur: pengembangan media pembelajaran dengan software autocad, Jurnal Kajian Pendidikan Teknik Bangunan, 6(1), 2020.

[17] D. T. Andani, M. Yulian, Pengembangan bahan ajar electronic book menggunakan software kvisoft flipbook pada materi hukum dasar kimia di SMA Negeri 1 Panton Reu Aceh Barat, Jurnal Ipa & Pembelajaran Ipa, 2(1), 2018, pp.1-6.

[18] M. Fausih, T. Danang, Pengembangan media e-modul mata pelajaran produktif pokok bahasan "instalasi jaringan lan (local area network)" untuk siswa kelas xi jurusan teknik komputer jaringan di smk nengeri 1 labang bangkalan madura, Jurnal Unesa, 1(01), 2015, pp.1-9.

[19] Sugiyono, Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D), Bandung: Alfabeta, 2017.

[20] S. Akbar and H. Sriwijaya, Pengembangan Kurikulum dan Pembelajaran Ilmu Pengetahuan Sosial (IPS), Malang: Cipta Medika, 2010

[21] H. Usman, R. P. S. Akbar, Pengantar statistik, Jakarta: Bumi Aksara, 1995.

[22] R. Ruddamayanti, Pemanfaatan buku digital dalam meningkatkan minat baca, in Prosiding Seminar Nasional Program Pascasarjana Universitas PGRI Palembang, 2019.

[23] I, Anwar, Pengembangan Bahan Ajar, Bahan Kuliah Online, Direktori UPI: Bandung, 2010.