Development of Interactive Learning Media in Data Communication Subject Class XI TKJ at SMKN 1 Udanawu

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ABSTRACT

Observing the implementation of learning in the Data Communication Subject for Class XI TKJ at SMK Negeri 1 Udanawu shows that teachers still need help conveying material, and students need clarification in understanding the material presented by the teacher. Due to the absence of appropriate media in the learning process, students need help understanding the contents of the material. This study aims to develop interactive learning media in the data communication subject for class XI TKJ at SMKN 1 Udanawu. The developed learning media is expected to be used as a source of independent learning for students. The learning media development method adopts the ADDIE model with steps of Analysis, Design, Development, Implementation, and Evaluation. The research produced an interactive learning media for data communication subjects. Media and content experts validate the learning media. Then, students test the media individually, in small and large groups. The results of expert media validity were 94.5%, content expert validity was 97.6%, individual trials were 88.9%, small group trials were 90.7%, and large group trials were 91.5%. The validity and trial results show that the developed learning media is suitable for learning.

Keywords: Interactive Learning Media, Learning Resources, ADDIE.

1. INTRODUCTION

SMKN 1 Udanawu is a Vocational High School with a Computer and Network Engineering expertise program. The development of the curriculum has shifted the existing learning principles, namely "educators as the only source of learning" to "learning based on various learning resources." This shift makes the paradigm of learning resources obtained not only from teachers but can be obtained from any learning source. It is certainly the reason for the availability of learning media that can support students in independently carrying out the learning process.

The results of observations of teachers and students in the Data Communication subject at SMKN 1 Udanawu show that the learning process is still passive and not optimal, and students need help understanding the learning being given. It happens because the learning process still uses text-based PowerPoint media with the teacher-centred method. Students have yet to be facilitated with supporting media to motivate student understanding. Students also revealed that learning data communication is difficult to understand because

learning something abstract. Thus, students often interpret the material to be taught. It causes misconceptions in students.

One way to overcome misconceptions in students is to create learning media that is easy to understand from various aspects ranging from material to in-depth evaluation [1]–[4]. Media is a tool that can provide visual experiences to students, among others, to encourage learning motivation, clarify and simplify abstract concepts, and enhance learning absorption or retention [4]–[7].

Based on the problems above, efforts are needed to maximize the data communication learning process so that students can understand it well, namely by meeting the needs of existing learning resources through the development of interactive learning media. The developed interactive learning media combines learning with various aspects by combining audio, visual, and kinetic elements in presenting the material or message to be taught [2], [4]. The existence of interactive learning media that gives an attractive appearance will make students more interested in learning. In addition, the
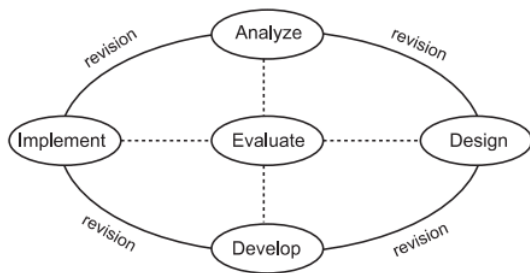
learning media is expected to reduce student saturation in learning.

This study aims to develop interactive learning media as a supplement to support learning in Data Communication subjects for class XI, majoring in Computer and Network Engineering in SMK Negeri 1 Udanawu. The developed learning media presents the material more interactively, involving elements of text, images, and videos, and is equipped with evaluation questions to measure students' understanding of the material presented.

2. METHOD

2.1. Research and Development Model

The model used in this research and development adapts the ADDIE research and development model (Analysis, Design, Development, Implementation, and Evaluation) [8]–[12]. Figure 1 shows the stages of the ADDIE development model. Each stage can be explained as follows.

Figure 1 ADDIE Development Model

2.1.1. Analysis

Information collection is carried out to achieve product development goals. This stage is carried out by gathering information about the problems in the field. Several analyses were carried out at this stage, including needs analysis, curriculum analysis, and learning environment analysis.

The needs analysis process is carried out by field observation and literature review to determine the purpose of the product to be developed. Researchers conducted a needs analysis through student questionnaires and interviews with data communication subject teachers at SMK Negeri 1 Udanawu.

Curriculum analysis is carried out as a material reference in product development. Curriculum analysis refers to the curriculum syllabus used in the Department of Computer and Network Engineering in SMK Negeri 1 Udanawu Blitar.

2.1.2. Design

This stage aims to make a design for preparing the material's structure and the interface of the conceptual learning media.

2.1.3. Development

This stage carries out the process of building a design into a real product which then goes to the product validation process to experts.

2.1.4. Implementation

The implementation stage of the ADDIE model is a step in the realization of the design and implementation in guiding students to achieve learning objectives without ensuring the final results of the learning program.

2.1.5. Evaluation

The Evaluation Phase is a process to provide value to the learning program. In the ADDIE model, evaluation can be carried out throughout implementation of the five stages. Evaluation can also be carried out to determine effectiveness, efficiency, and determine the continuation of the use of learning media products.

2.2. Product Testing

This stage aims to determine the feasibility of the design and material of data communication interactive learning media. Media experts and material experts carry out product testing. Learning media experts evaluate and validate in terms of media feasibility while learning material experts evaluate and validate in terms of material feasibility. Product improvement is carried out based on suggestions from experts.

After the media expert and material expert stated that the media being developed was feasible, the next trial phase was carried out with individual, small, and large group trials. Personal trials took a sample of 1 student, small group trials consisted of 10 students, and large group trials took 30 students. At this testing stage, students were asked to fill out a questionnaire containing their opinions on the interactive media that had been tried. The questionnaire includes a rating scale, using the numbers in stages for the four choice categories.

The feasibility of the developed media refers to the formula for analyzing the level of validity [13]

$$V = \frac{Tes}{Ems} \, x \, 100\%$$

V is Validity, Tes is the Total Empirical Score, and Ems is the Expected Maximum Score. The qualification criteria for assessing the eligibility level of the media are shown in Table 1.

Table 1. Validity criteria

Percentage	Feasibility level
85.01% - 100.00%	very valid
70.01% - 85.00%	valid
50.01% - 70.00%	less valid
00.00% - 50.00%	invalid

3. RESULT AND DISCUSSION

3.1. Product Development Results

Interactive learning media for Data Communication Subjects in Class XI were designed and developed to support the learning process of class XI students in semester 1 of the TKJ expertise program at SMK Negeri 1 Udanawu. The data communication interactive learning media consist of several sections: the start page, the instructions page, the KI/KD page, the material page, and the evaluation page. This learning media can be used by students accompanied by a teacher or not because this learning media is self-learning which is complemented by interactive and communicative learning evaluations that allow students to print evaluation results and study again or review material that has yet to be understood.

3.2. Testing Results

3.2.1. Material Expert Validation

Validation by material experts aims to determine the suitability of the learning media material developed. Proof of subject matter experts used a questionnaire instrument consisting of 21 questions. Material experts consist of 2 validators. The first validator is Arif Arianto, S.T from SMKN 1 Udanawu. The second validator is Iskandar Jaya, S.T., M.T. from SMKN 1 Purwosari. Table 2 shows the results of the material expert validation.

Table 2. Material Expert Validation Results

Learning Aspect	Expert 1	Expert 2	Average
Software Engineering	100 %	95.8 %	97.9 %
Learning Design	100 %	96.9 %	98.4 %
Visual Communication	96.4 %	96.4 %	96.4 %
Average	98.8 %	96.4 %	97.6 %

Total data from the accumulated validation results of the two media experts can be obtained with a validity result of 97.6%.

3.2.2. Media Expert Validation

Validation by media experts aims to determine the feasibility of the developed learning media. Media experts consist of 2 validators. The first validator is Dr. Hakkun Elmunsyah, S.T., M.T., and media expert 2 is Eka Pramono Adi, S.IP., M.Sc. The results of media expert validation are shown in Table 3.

Table 3. Media Expert Validation Results

Learning Aspect	Expert 1	Expert 2	Average
Software Engineering	87.5 %	95.8 %	91.7 %
Learning Design	92.9 %	100 %	96.4 %
Visual Communication	90.6 %	100 %	95.3 %
Average	90.3 %	98.6 %	94.5 %

The total data from the accumulated validation results of the two media experts can be obtained with a validity result of 94.5%.

3.2.3. Individual Testing

Individual trials were taken from class XII students of the Computer and Network Engineering Expertise Program at SMK Negeri 1 Udanawu Blitar, who had taken the Data Communication subject as many as three people. Individual trials were carried out after the media was declared valid from the results by experts, namely material and media experts. Personal tests were carried out at SMK N 1 Udanawu Blitar using an instrument in the form of a questionnaire with 15 questions. The results obtained from individual trials are shown in Table 4.

Table 4. Individual Testing Results

Assesment Aspect	Tse	Tsh	Average
Software Engineering	32	36	88.9 %
Learning Design	55	60	91.7 %
Visual Communication	73	84	86.9 %
Average	160	180	88.9 %

Overall, the results of the analysis of individual testing were obtained at 88.9%.

3.2.4. Small Group Testing

The small group testing was taken from class XII students of the Computer and Network Engineering Expertise Program at SMK Negeri 1 Udanawu Blitar, who had taken the Data Communications subject as many as ten people. The minor group try out was conducted at SMK N 1 Udanawu Blitar using an instrument in the form of a questionnaire with 15 questions. The results obtained from the small group trials are shown in Table 5.

Table 5. Small Group Testing Results

Assesment Aspect	Tse	Tsh	Average
Software Engineering	108	120	90.0 %
Learning Design	182	200	91.0 %
Visual Communication	254	280	90.7 %
Average	**544**	**600**	**90.7 %**

Overall, the results of the analysis of small group trials were obtained at 90.7%.

3.2.5. Large Group Testing

The large group trial was taken from class XII students of the Computer and Network Engineering Expertise Program at SMK Negeri 1 Udanawu Blitar, who had taken the Data Communications subject as many as 30 people. The extensive group try out was conducted at SMK N 1 Udanawu Blitar using an instrument in the form of a questionnaire with 15 questions. The results obtained from the large-group trials are shown in Table 6.

Table 6. Large Group Testing Results

Assesment Aspect	Tse	Tsh	Average
Software Engineering	340	360	94.4 %
Learning Design	537	600	89.5 %
Visual Communication	770	840	91.7 %
Average	**1647**	**1800**	**91.5 %**

Overall, the results of the analysis of large group trials were obtained at 91.5%.

After going through a series of validation and testing processes, further product development of data communication interactive learning media has several advantages and disadvantages.

The advantages are (a) media can be used on all computer devices with the windows operating system; (b) learning media developed based on the existing curriculum, which emphasizes the relationship between theory and problems in data communication subjects; (c) data communication interactive learning media is presented in several sections: the initial section, the instructions section, the CC/BC section, the material section, and the evaluation section. The evaluation results are used to determine student understanding and can be printed out in the form of Microsoft Office OneNote; and (d) there is an interaction between the media and the user then a clear, animated image appears in each execution process. So that complex material can be easily understood and learned without or with the assistance of a teacher (self-learning).

Meanwhile, the disadvantages are a search feature to find words or sentences to make it easier for students to find material, and learning material can be accessed online.

4. CONCLUSION

Based on data analysis and product revisions that have been carried out in the research and development of this learning media, the results show that: (a) Interactive Learning Media as a flash-based learning media in the Data Communication Subject for class XI of Computer and Network Engineering competence at SMK Negeri 1 Udanawu. The developed learning media comprises text, images, animations, learning evaluations, and offline videos; and (b) Interactive learning media has been validated by media experts and material experts and has been tested on users. Media expert validation results obtained a percentage of 94.5% (very valid), material expert validation results obtained a percentage of 97.6% (very valid), individual test results obtained a percentage of 88.9% (very valid), test results from the small group trial obtained a percentage of 90.7% (very valid), and the results of the large group trial obtained a percentage of 91.5% (very valid) so that the learning media was declared feasible for use.

Some suggestions for product development as other learning media are presented as follows: (a) The material can be further developed for the next semester, namely, semester 2; (b) Adding a search feature to find words or sentences makes it easier for students to find material, and learning materials can be accessed online; and (c) Interactive learning media can be further developed for other subjects.

REFERENCES

[1]   T. H. Hutagalung, "The Development of Interactive Learning Multimedia Based on Problem Based Learning on Software Engineering Skills Competencies in SMK," *Proc. 6th Annu. Int. Semin. Transform. Educ. Educ. Leadersh. (AISTEEL 2021)*, vol. 591, no. Aisteel, pp. 173–178, 2022, doi: 10.2991/assehr.k.211110.078.

[2]   H. Saputra, H. Mulyono, and R. A. Darman, "Development of Interactive Learning Media on Network Service Technology Subjects Class XI TKJ," *J. Ilm. Edutic Pendidik. dan Inform.*, vol. 9, no.   1,   pp.   10–19,   2022,   doi: 10.21107/edutic.v9i1.14543.

[3]   R. Ilham, P. Pascasarjana, and U. N. Padang, "Development of Interactive Learning Media in Information and Communication Technology (ICT) Class X IPA," vol. 7, no. 19, pp. 2664–2673, 2023.

[4]   M. K. Sophan, "Development of 'Introduction To Networking' Learning Materials for Class Xi Tkj in Smkn 1 Kamal Using Unity 3D," *J. Int. Conf. Proc.*, vol.   1,   no.   1,   pp.   13–19,   2018,   doi: 10.32535/jicp.v1i1.220.

[5]   S. Suyitno, I. Widianto, and S. B. Masrul, "Development of Learning Media for the Course of Two-Stroke Gasoline Motors to Improve Students' Learning Outcomes," *J. Pendidik. Teknol. dan Kejuru.*, vol. 24, no. 1, pp. 83–90, 2018, doi: 10.21831/jptk.v24i1.18008.

[6]   M. Ediyani, U. Hayati, S. Salwa, S. Samsul, N. Nursiah, and M. B. Fauzi, "Study on Development of Learning Media," *Budapest Int. Res. Critics Inst. Humanit. Soc. Sci.*, vol. 3, no. 2, pp. 1336–1342,

2020, doi: 10.33258/birci.v3i2.989.

[7] L. Azizah, W. K. Asri, and M. Mannahali, "Development of Learning Media for Listening Skills of German Language Based on Web DaF (Deutsch als Fremdsprache) for Students High School in Makassar," *Eralingua J. Pendidik. Bhs. Asing dan Sastra*, vol. 4, no. 1, pp. 113–121, 2020, doi: 10.26858/eralingua.v4i1.12468.

[8] B. M. Ngussa, "Application of ADDIE Model in instruction in teaching-learning transaction among teachers of Mara Conference Adventist secondary school, Tanzania," *J. Educ. Pract.*, vol. 5, no. 25, pp. 99–105, 2014.

[9] A. K. N. Hess and K. Greer, "Designing for engagement: Using the ADDIE model to integrate high-impact practices into an online information literacy course," *Commun. Inf. Lit.*, vol. 10, no. 2, pp. 264–282, 2016, doi: 10.15760/comminfolit.2016.10.2.27.

[10] A. L. Davis, "Using instructional design principles to develop effective information literacy instruction: The ADDIE model," *Coll. Res. Libr. News*, vol. 74, no. 4, pp. 205–207, 2013, doi: 10.5860/crln.74.4.8934.

[11] Robert Maribe Branch, *Approach, Instructional Design: The ADDIE*, vol. 53, no. 9. 2009.

[12] A. Bamrara and P. Chauhan, "Applying ADDIE Model to Evaluate Faculty Development Programs," *Int. J. Smart Educ. Urban Soc.*, vol. 9, no. 2, pp. 25–38, 2018, doi: 10.4018/ijseus.2018040103.

[13] Akbar, S. 2015. Instrumen Perangkat Pembelajaran. Bandung: PT Remaja Rosdakarya