

Application of Redundancy Principles in the Digital Module of Learning Material Development Courses

Made Duananda K. Degeng^{1,*}, Yulias Prihatmoko², Felisia Hemilia³, Nunung Nindigraha⁴

^{1,2,3,4} Faculty of Education Universitas Negeri Malang 1

*Corresponding author. Email: made.degeng.fip@um.ac.id

ABSTRACT

This study aims to develop a digital module by applying the principle of redundancy is to produce an appropriate learning media product in the form of a digital module by applying the principle of redundancy that can accommodate student learning styles. The method used is a research and development approach. Based on the results of the digital module feasibility test by material experts, the total percentage was 95%, the media expert test results obtained a total percentage of 97%, and the respondents' test results obtained a total percentage of 89%. The results of the selection of the format of learning materials presented between audio, video, and text obtained 93.3% of students chose material in the form of video, 23.3% chose audio and 33.3% chose text. It can be concluded that digital module media by applying the principle of redundancy is feasible and can accommodate students' audio, visual, and audio-visual learning styles.

Keywords: *Development, Digital Module, Redundancy.*

1. INTRODUCTION

The era of globalization is an era where technology has developed a lot, in era globalization computer-based information technology is used by people to meet their needs. In the learning process, the development of information and communication technology has influenced the world of education (Sudibyo 2011). In the 21st century, the role of information and communication technology in education is very important, because the world is moving fast to digital media and information (Hidayat and Khotimah 2019). As a means to support learning, digital technology has begun to be used in the world of education (Selwyn 2011). The process of education/learning is always identical to the communication process (Prasasti, Solin, and Hadi 2019). And one of the communication tools that are often used in the learning process is learning media. With the learning media, it can facilitate the interaction/communication that occurs between lecturers

and students so that learning can run more effectively and efficiently (Karo-karo and Rohana 2018). Learning media can create a conducive learning environment because it can convey messages in a planned manner (Asyar 2012). Submission of communication and information between lecturers and students can be delivered easily using the help of learning media.

The module is one of the many learning media that is often used in the learning process. In general, teachers provide modules in the form of printed books. But in the current era, students tend to live depending on electronic media to get information. So along with the development of technology, a combination of computer technology with printing technology appears so that the form of the module changes in its presentation, which is presented electronically or can be called an e-module. E-module is a learning media in digital form that is made systematically that is used for independent study (Jaenudin dkk.,2017). According to (Suarsana dan

Mahayukti 2013), the advantages of digital modules are that they are interactive, can contain material in various formats, and can also be equipped with formative tests that allow automatic feedback. Learning style is one of the things that must be considered by the teacher in the implementation of the learning process in addition to learning media. If someone already understands their learning style, it will be faster and easier for someone to accept new knowledge (Gilakjani Dalam Rahmawati 2016). Along with the times, innovation is needed in teaching the current generation of children. Especially for teachers who still use teacher-centered learning methods. So, courses whose delivery method is still lecture and teacher-centered are not suitable for the current generation. On the other hand, learning that can make students choose what kind of learning they want will easily attract their learning abilities (Purnomo dkk., 2016).

The learning process carried out in the study material development course in the Department of Educational Technology does not yet have digital module learning media. The results of interviews with lecturers who are in charge of learning material development courses, developers get problems explained by the lecturers, namely during the lecture process the lecturer explains the material verbally and is assisted by ppt (PowerPoint) media. He said that he is currently in need of media that can be used regularly considering that lecturers do not only teach and of course, making complete media takes a long time. And the results of interviews with several students who have finished taking learning materials development courses, the majority of them said that learning material development materials were quite difficult to understand and material delivery was only assisted by using ppt (PowerPoint), thus causing students difficulties in understanding learning materials and easy to bore them. And from the results of interviews, the developer found that there were differences in the learning styles of students which of course had not been facilitated by the existing learning media.

The developer's goal in developing a digital module for learning materials is to produce learning media that can assist lecturers in delivering material according to the student's learning styles. The principle of redundancy is one of the basic principles of multimedia development proposed by Richard E. Mayer, and this principle will be used by developers to develop digital modules for this learning material. In the principle of redundancy, it is said that people learn better using animation and narration than using animation, narration, and text. Redundancy itself can be interpreted as excessive (Mayer 2001) it can

be interpreted that the purpose of redundancy is to present excessive multimedia images, audio, and text simultaneously on one screen. The developer uses the principle of redundancy in developing this digital module because of the different learning styles that each student has. So to accommodate different learning styles, it is best to present the material on the module in various formats. For example, if a student prefers to learn from the spoken words, then the student can learn by paying attention to the narrative; and if a student prefers to learn by using printed words, then the student can learn by paying attention to the text on the screen. And by providing material using multiple presentation formats, teachers can accommodate any preferred learning style. The application of the principle of redundancy in lecture presentations gives positive results and helps students absorb learning material (Halim dkk., 2012).

From the problems above, the developer developed a digital module for learning materials to make it easier for lecturers to convey material and make it easier for students to understand the material and the presentation of material that applies the principle of redundancy can accommodate differences in student learning styles.

2. METHODS

The type of research used is development research that produces products in the form of digital modules. The method used is a research and development (R&D) approach. This research uses Lee & Owens model. According to (Lee & Owens, 2004) The stages that need to be carried out in this model have a complete flow starting from the analysis, design, development, implementation, and evaluation stages.

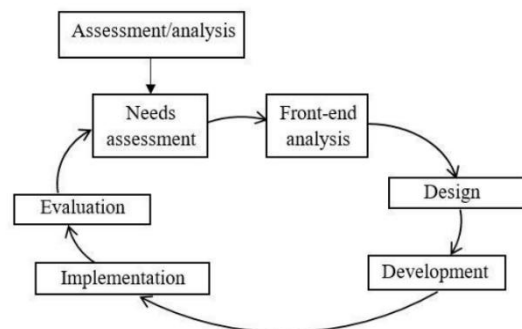


Figure 1. Lee & Owens. Research and Development Model (2004)

2.1. Analysis

The analysis is divided into 2, namely:

1. Need Assessment

To analyze the needs of developers, they conducted observations by interviewing the lecturers in charge of the courses and also to several students who had completed the coursework for the development of learning materials. The results of interviews with lecturers who are in charge of learning material development courses, developers get problems explained by the lecturers, namely during the lecture process the lecturer explains the material verbally and is assisted by ppt (PowerPoint) media. He said that currently, he was in need of media that could be used regularly considering that lecturers did not only teach and of course, making complete media took quite a long time. And the results of interviews with several students who have finished taking learning materials development courses, the majority of them said that learning material development materials were quite difficult to understand and material delivery was only assisted by using ppt (PowerPoint), thus causing students difficulties in understanding learning materials and easy to bore them. And from the interview results, the developer found that there were differences in the learning styles of students which of course had not been facilitated by the existing learning media.

2. Front-End Analysis

In Front-End Analysis there are 10 stages, in this study the researcher only carried out the analysis as needed with the results:

1. Audience Analysis

There are differences in learning styles for each student that have not been fully facilitated by the existing media, thus making it difficult for students to understand the material presented.

2. Technology Analysis

The majority of respondents already have laptops and smartphones that can be used to access digital modules. This digital module of study materials is distributed in html format.

3. Objective Analysis

The purpose of developing a digital module for learning materials is for students to understand what they need to know when developing learning materials and how to proceed. And so that students know the types of learning materials.

4. Media Analysis

The digital module for the development of learning materials is developed by presenting 3 formats of material, namely text with pictures, audio podcasts, and video podcasts.

2.2. Design

In the design stage, there are several steps, namely: scheduling, determining media specifications, determining content, and finally configuration control. In the process of designing the digital module design includes making material in the form of text and images, audio podcasts, and video podcasts. Then the 3 material formats are arranged into a digital module using the principle of redundancy.

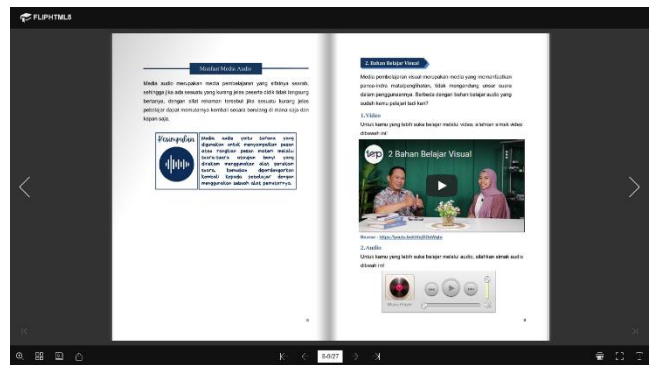


Figure 2. Display of material content in the digital module of learning materials presented in the form of text, video, and audio.

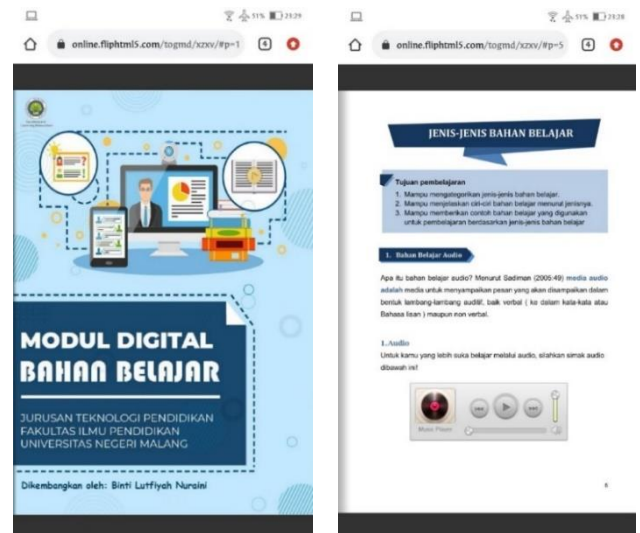


Figure 3. Display of a digital module that is operated using a smartphone presented in the form of text, video, and audio.

2.3 Development & Implementation

The next stage is Development & Implementation. Digital module development is carried out using fliphtml5 software. Fliphtml5 is a software used to convert PDF files into flipbook form.

At this stage the developer compiles the material. Next, the developer designs the module layout, makes the material in the form of video, and finally changes the material in the form of video into audio. Then the material that has been collected is arranged in such a way and made into a digital module using fliphtml5 software. The module is exported in the form of an html link, so students can easily access it.

Product feasibility tests and field trials are carried out using a rating scale (Sugiyono 2010). In this development rating scale there are answer criteria as follows:

Table 1. Criteria for choice in the questionnaire

Response	Choice Criteria	Score
Positive	SS / Strongly Agree	4
	S / Agree	3
Negative	KS / Disagree	2
	TS / Disagree	1

The next stage is the implementation stage. The implementation phase is carried out to test the feasibility of the media which will be carried out by material experts, media experts, and respondents.

3. RESULTS

The media was tested for feasibility by material experts, media experts, and respondents. The results of the media feasibility trial and the respondent's trial are as follows:

Table 2. Processing of the results of the product feasibility test of material experts

Mean	Median	Modus	Percentage
3,8	4	4	95%

From the analysis of the material expert's assessment, the total percentage is 95%. And get a positive response percentage of 100%, with details of the percentage of SS responses (Strongly Agree) 81.25%, the percentage of responses S (Agree) 18.75 %. Then get a

negative response of 0%, with details of the percentage of responses from KS (Disagree) 0%, and the percentage of responses from TS (Disagree) 0% so that it can be concluded that the digital module media learning materials are suitable for use as learning media.

Table 3. Data processing of the results of the media expert's product feasibility test

Mean	Median	Modus	Percentage
3,7	4	4	97%

From the analysis of the media expert's assessment, the total percentage was 97%. And get a positive response percentage of 100%, with details of the percentage of SS responses (Strongly Agree) 88.3%, the percentage of responses S (Agree) 11.7%. Then get a negative response of 0%, with details of the percentage of responses from KS (Disagree) 0%, and the percentage of responses from TS (Disagree) 0% so that it can be concluded that the digital module media learning materials are suitable for use as learning media.

Table 4. Data processing of respondents' test results

Mean	Median	Modus	Percentage
3,4	4	4	89%

The digital module media field trial involved 30 students. From the analysis of the student response assessment, the total percentage was 89%. And get a positive response percentage of 97%, with details of the percentage of SS responses (Strongly Agree) 60.4%, the percentage of responses S (Agree) 36.6%. Then get a negative response of 3%, with details of the percentage of responses from KS (Disagree) 3%, and the percentage of responses from TS (Disagree) 0% so that it can be concluded that the digital module media learning materials are suitable for use as learning media.



Figure 2. Student learning style responses

The picture above shows a diagram of student interest in choosing the format for presenting the material. Based on the picture above, it shows that 28 students prefer to learn using material that is presented in the form of video as evidenced by the percentage of 93.3%, 7 students prefer to learn to use material that is presented in audio form as evidenced by the percentage of 23.3% and 10 students prefer to learn using the material whose presentation is in the form of text as evidenced by the percentage of 33.3%. From the results of the data above, it can be concluded that the digital media module of learning materials can accommodate diverse student learning styles.

4. DISCUSSION

In the learning process, learning media is a component of learning resources whose use is to convey messages (Ena 2001). Accuracy in the use of learning media can help lecturers and students in making concrete concepts of learning materials (Muhson 2010).

Modules are learning media that are printed and used for independent study, the material presented is planned and arranged systematically (Rokhayah 2019). With the development of technology, a combination of computer technology and printing technology appears so that the form of the module changes in its presentation, which is presented electronically or can be called an e-module. (Erdi, Nurhalimah and Padwa 2021). Digital modules are learning materials that are presented in a digital format whose materials are systematically arranged and adapted to the needs of students (Sugiharni 2017). The digital module was developed to be an intermediary for communication between lecturers and students and also to make it easier for students to learn independently. The development of a digital module using the redundancy principle has passed the feasibility test stages consisting of a material expert test, a media expert test, and a respondent trial, namely 30 students majoring in Education Technology.

From the results of testing the digital module to material experts, developers get advice from material experts, namely it is necessary to add material about textbooks, modules, worksheets, and handouts (because they are often used in educational institutions). And from the results of testing digital modules to media experts, developers get suggestions for further development to reapply visual or audio principles (podcasts) in presenting the information contained in the module. For example, applying Mayer's multimedia principles to the presentation of text, layout, color, or how to use scaffolding and assessment in a module.

The advantages of developing digital module learning media by applying the principle of redundancy are:

1. The material presented in the digital module of learning materials varies (audio, video, and text) so that students can study in the format of the material as they wish. This is in accordance with the adaptive learning theory, which is a learning process where the material or content can adjust the response from the user (Oxman and Wong 2014).
2. Digital modules of learning materials can be accessed easily. Can be accessed anytime and anywhere. Can be accessed using a laptop, computer or smartphone. E-modules have the advantage that they can be accessed anywhere and can contain a variety of content that can help students understand the lesson. (Nurhidayati dkk., 2018).

5. CONCLUSION

The research that has been carried out has resulted in learning media in the form of digital modules that have criteria suitable for use as learning media in the learning process in the course of developing learning materials majoring in Educational Technology, State University of Malang. Digital learning materials modules can accommodate the different learning styles of students.

REFERENCES

- [1] Asyar, R. 2012. "Pengertian Media Pembelajaran Menurut Para Ahli Dan Secara Umum." *ZonaReferensi. Com*.
- [2] Ena, O. T. 2001. "Membuat Media Pembelajaran Interaktif Dengan Piranti Lunak Presentasi." *Yogyakarta: Universitas Sanata Dharma Yogyakarta*.
- [3] Erdi, Putri Nurhalimah, and Tivsi Rizqi Padwa. 2021. "Penggunaan E-Modul Dengan Sistem Project Based Learning." *JAVIT: Jurnal Vokasi Informatika* 1(1):21–25.
- [4] Halim, Adriani, Agustinna Yosanny, and Andreas Soegandi. 2012. "Efektifitas Prinsip Redundansi Dalam Presentasi Perkuliahan." *ComTech: Computer, Mathematics and Engineering Applications* 3(9):901–7.
- [5] Hidayat, Nandang, and Husnul Khotimah. 2019. "Pemanfaatan Teknologi Digital Dalam Kegiatan Pembelajaran." *JPPGuseda | Jurnal Pendidikan & Pengajaran Guru Sekolah Dasar* 2(1):10–15.
- [6] Jaenudin, Ahmad, Prof Baedhowi, and Tri Murwaningsih. 2017. "The Effectiveness of the E-Module of Economics Learning on Problem-Based Learning Used to Improve Students' Learning Outcomes." *158(Ictte):30–36*.
- [7] Karo-karo, I., and R. Rohana. 2018. "Manfaat Media Dalam Pembelajaran." *AXIOM : Jurnal Pendidikan*

- Dan Matematika* 7:91–96.
- [8] Lee, W., and D. Owens. 2004. *Multimedia Based Instructional Design: Second Edition*. Second Edi. San Francisco: Pfeiffer.
- [9] Mayer, R. E. 2001. “Multimedia Learning. Terj: Teguh W.” *Utomo. Yogyakarta: Pustaka Pelajar*.
- [10] Muhson, Ali. 2010. “Pengembangan Media Pembelajaran Berbasis Teknologi Informasi.” *Jurnal Pendidikan Akuntansi Indonesia* 8(2).
- [11] Nurhidayati, Alipah, Setiadi Cahyono Putro, and Triyanna Widiyaningtyas. 2018. “Penerapan Model Pbl Berbantuan E-Modul Berbasis Flipbook Dibandingkan Berbantuan Bahan Ajar Cetak Pengaruhnya Terhadap Hasil Belajar Pemrograman Siswa Smk.” *Teknologi Dan Kejuruan: Jurnal Teknologi, Kejuruan, Dan Pengajarannya* 41(2):130–38.
- [12] Oxman, S., and W. Wong. 2014. “White Paper: Adaptive Learning Systems, DeVry Education Group and Integrated Education Solutions.”
- [13] Prasasti, Tri Indah, Mutsyuhito Solin, and Wisman Hadi. 2019. “The Effectiveness of Learning Media Folklore Text of North Sumatera Based on Blended Learning by 10th Grade Students of Vocational High School Harapan Mekar-1 Medan.” *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal* 2(4):480–90.
- [14] Purnomo, Agus, Nurul Ratnawati, and Nevy Farista Aristin. 2016. “Pengembangan Pembelajaran Blended Learning Pada Generasi Z.” *Jurnal Teori Dan Praksis Pembelajaran IPS* 1(1):70–76.
- [15] Rahmawati, Sholichatun Aisyah. 2016. “Pengembangan Modul Digital Berbasis Visul Basic for Application Powerpoint Pada Mata Pelajaran Teknologi Informasi Dan Komunikasi Materi Coreldraw X3 Di Kelas VII SMP Kebon Dalem Semarang.” 90.
- [16] Rokhayah, Lilis. 2019. “Desain Modul Pembelajaran Matematika Dengan Instruksi Dan Soal Sesuaivariasi Individu Siswa Pada Materi Sistem Persamaan Linear.” *Pasundan Journal of Research in Mathematics Learning and Education* 4:1–15.
- [17] Selwyn, Neil. 2011. “Digitally Distanced Learning: A Study of International Distance Learners’ (Non)Use of Technology.” *Distance Education* 32(1):85–99.
- [18] Suarsana, I. M., and G. A. Mahayukti. 2013. “Pengembangan E-Modul Berorientasi Pemecahan Masalah Untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa.” *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)* 2(3):193.
- [19] Sudiby, L. (2013). Peranan dan Dampak Teknologi Informasi dalam Dunia Pendidikan di Indonesia. *Widyatama*, 20(2).
- [20] Sugiharni, Gusti Ayu Dessy. 2017. “Validitas Isi Instrumen Pengujian Modul Digital Matematika Diskrit Berbasis Open Source Di STIKOM Bali.” *E-Proceedings KNS&I STIKOM Bali* 678–84.
- [21] Sugiyono, D. 2010. “Metode Penelitian Kuantitatif Dan R&D.” *Bandung: Alfabeta*.