Journal of Smart Education and Emerging Technology
E-ISSN: 3110-6900
https://journal.lontaradigitech.com/JSEET

Multimedia-Based Learning Module Development for a Special Topics in Multimedia Course: A Four-D Research and Development Study

Riska[1*], Muhammad Yahya[2], Muhammad Riska[3]
[1,2,3] *Universitas Negeri Makassar, Indonesia*

Corresponding e-mail : riskaaptw@gmail.com

ARTICLE INFO

Keywords:

Four-D;
Modul;
Multimedia;
Research & Development;

Article History

Received: October 16, 2025
Revised : December 26. 2025
Accepted : January 25, 2026

ABSTRACT

Background/Context: The development of information and communication technology has promoted the use of multimedia-based learning in higher education to improve student engagement and independent learning. However, instructional materials for the Special Topics in Multimedia course were unsystematically organized, fragmented, and lacked structured learning modules, making it difficult for students to understand the content independently.
Objective/Purpose: This study aimed to develop a systematically designed multimedia-based learning module for the Special Topics in Multimedia course to support structured learning and enhance student understanding.
Method: This study employed a Research and Development approach using a four-D (4D) development model consisting of Define, Design, Develop, and Disseminate. The module was validated by material and media experts and tested through small and large group trials with students.
Results: The developed module was evaluated as highly feasible by both material and media experts. Student trials indicated very positive responses, showing that the module was practical, easy to use, and supported effective independent learning.
Conclusion: The multimedia-based learning module was proven to be valid, practical, and well-accepted by students. It successfully provides structured instructional materials and enhances independent learning, making it suitable for use in higher education.

To cite this article : Riska et al. (2026). Title. Journal of Smart Education and Emerging Technology (JSEET), 1(2), 43-51. Doi. xxxx

INTRODUCTION

The development of information and communication technology has driven changes in learning strategies in higher education through the implementation of multimedia-based learning media that enhance student engagement, skills, and understanding. The integration of multimedia components such as text, images, audio, video, and interactive elements positively influences learning experiences and learning outcomes when designed in accordance with appropriate pedagogical strategies and instructional design principles (Openg et al., 2024). Previous studies have also indicated that the use of multimedia in higher education strengthens student engagement, motivation, and the achievement of competencies such as digital literacy and independent learning (Said, 2023; Stanevičienė & Žekienė, 2025).

In the context of instructional materials, learning modules are systematically and comprehensively designed resources intended to facilitate self-instructional learning. Modules provide a structured sequence of content that allows students to learn at their own pace and evaluate their mastery of material progressively, thereby enhancing cognitive engagement in independent learning (Albana & Sujarwo, 2021). Interactive multimedia-based modules have also been proven effective in improving student

engagement, motivation, and learning outcomes through the inclusion of visualisations, instructional videos, content summaries, and evaluation exercises. Furthermore, such modules demonstrate high levels of validity, practicality, and effectiveness in higher education contexts (Nurhikmah et al., 2021; Due et al., 2023; Mahendri et al., 2023; Musfirah et al., 2024).

Nevertheless, evaluations of digital instructional materials indicate that a major challenge in higher education learning lies in the lack of systematic content organisation, multimedia integration, and user-friendly design of developed modules (Utami et al., 2025). Many instructional materials remain fragmented, derived from multiple sources without a clear instructional structure, which leads to difficulties for students in following learning sequences independently and effectively.

This condition is also evident in the Informatics and Computer Education Study Programme at Universitas Negeri Makassar (UNM), particularly in the course Special Topics in Multimedia. Based on interviews with course instructors, learning activities are primarily supported by the Semester Learning Plan (RPS) and PowerPoint presentations, without the availability of systematically structured learning modules aligned with learning objectives. The instructional content is sourced from various references and has not been organised coherently, resulting in students experiencing difficulties in independently understanding the material.

These field findings highlight a gap between learning needs and the availability of structured and accessible instructional materials. In fact, numerous studies have demonstrated that systematically designed multimedia-based learning modules significantly enhance student engagement, comprehension, and learning independence (Ayunda et al., 2024; Maulinda et al., 2024; Sape et al., 2024). However, most previous research has predominantly focused on the general development of digital modules, without specifically addressing the lack of structured learning modules for particular courses based on the authentic needs of lecturers and students (Pramesti et al., 2024; Talitha et al., 2025). Moreover, limited research has explored the development of multimedia-based learning modules aimed at organising previously scattered materials from various sources into a single systematic and easily comprehensible instructional resource.

Based on the literature review and field conditions, a research gap can therefore be identified, namely the limited number of development studies that specifically design structured multimedia learning modules for particular courses to address unsystematic instructional materials and insufficient support for independent learning in higher education.

Accordingly, this study focuses on the development of a systematically designed multimedia-based learning module for the course Special Topics in Multimedia using the 4D development model (Define, Design, Develop, Disseminate). The developed module is expected to demonstrate high levels of validity, practicality, and effectiveness, as well as support students in understanding learning materials in a structured and independent manner.

METHOD

The research method used in this study is Research and Development (R&D). According to (Sugiyono (2019), the R&D research method is a type of research used to develop a specific product through systematic stages, starting from design, testing, to product refinement so that it is suitable for use in a learning context. This study aims to produce and refine a learning product that can be used effectively and is scientifically accountable. The product developed in this study is a learning module for the Special Topics in Multimedia course, designed to support students' understanding of the material presented and improve the quality of the learning process.

In its implementation, this development research adopted the 4D development model. According to the four-D (4D) model in (Thiagarajan (1974), the development process consists of four main stages, namely Define, Design, Develop, and Disseminate. The definition stage aims to analyse learning needs, learner characteristics, and problems encountered in the learning process. The design stage is carried out to develop a learning product design that includes material structure, learning objectives, and content delivery strategies. The development stage covers the process of product creation, validation by experts, and revision based on the feedback received. The dissemination stage is carried out to distribute learning products that have been declared suitable for use in learning activities.

This research was conducted at the Department of Informatics and Computer Engineering, Faculty of Engineering, Makassar State University, located at Jalan Dg Tata Parang Tambung, Makassar City. The selection of the research location was based on the suitability of the learning context with the product being developed and the availability of research subjects relevant to the research objectives.

The research subjects consisted of expert validators and product test subjects. The expert validators included two media validators, one material validator, and two instrument validators who were lecturers in the Department of Informatics and Computer Engineering. This validation aims to assess the feasibility of the learning module in terms of material, media display, and assessment instruments used. Product testing was conducted in two stages, namely small group testing involving five students and large group testing involving fifteen active students who had programmed the Multimedia Special Topics course.

RESULTS AND DISCUSSION

The results of this study are in the form of learning modules for the Special Topics in Multimedia course in the Department of Informatics and Computer Engineering, Faculty of Engineering, Makassar State University. The modules were developed using the 4D model, which consists of four stages: Define, Design, Develop, and Disseminate.

The development process began with the definition stage, which involved gathering various information related to the product to be developed and identifying learning issues that underlie the importance of developing a Special Topic Multimedia Course module in the Department of Informatics and Computer Engineering. At this stage, five types of analysis are carried out, namely preliminary analysis, student analysis, concept analysis, task analysis, and learning objective analysis.

Based on the results of interviews at the definition stage with Mr Ir. Muhammad Riska, S.Pd., M.Pd., as the lecturer in charge of the Special Topics in Multimedia course, it was found that learning in this course was not supported by structured learning modules in line with the learning objectives. In addition, lecturers still use teaching materials sourced from various references, so the material used is not yet systematically organised. Therefore, one of the proposed solutions to overcome this problem is to develop a structured learning module for the Special Topics in Multimedia course that is in line with learning needs.

The next stage is the design stage, which includes several steps, namely module framework development, media selection, format selection, and learning module design. Module framework development is carried out to plan the structure and systematics of the module to be developed. Media selection aims to determine the applications used in the module design process. The media used in this study were the Canva application, which was used to design the cover and supporting images in the module, and the Microsoft Word 2019 application, which was used to compile the manuscript or draft of the learning module.

The results of the development of the Special Topic Multimedia Course learning module in this study are presented in the form of a visualisation of the module display, which includes the front and back covers of the module.

1. Front and Back Covers

   The front cover of the module consists of the institutional logo, the module title, supporting images, institutional information, and the author's name. Meanwhile, the back cover contains the institutional logo and a brief description of the module content. The visual presentation of the front and back covers is illustrated in Figure 1.

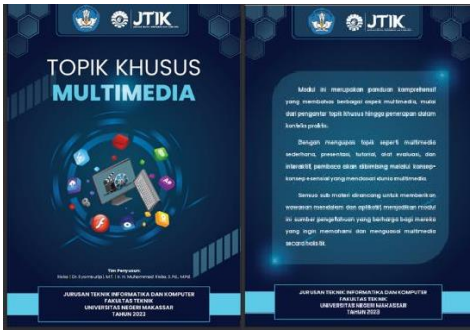


Figure 1. Front and Back Covers of the Module

2. Foreword, Instructions for use and Table of contents
   The introduction page includes a foreword, instructions for use, and a table of contents intended for lecturers and students. The introduction page is shown in Figures 2, 3, and 4.

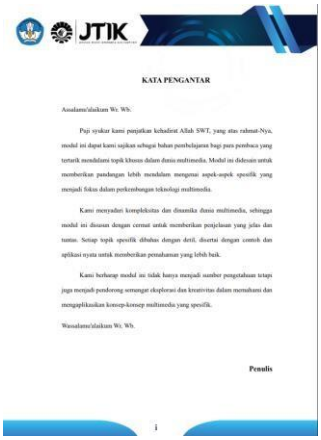


Figure 2. Foreword Display

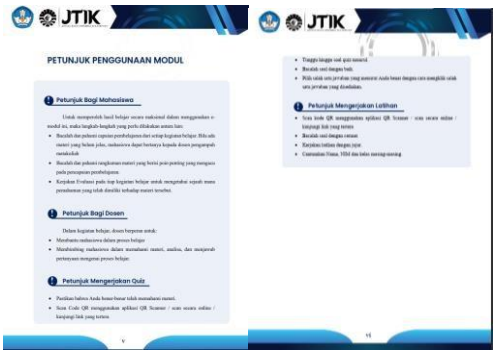
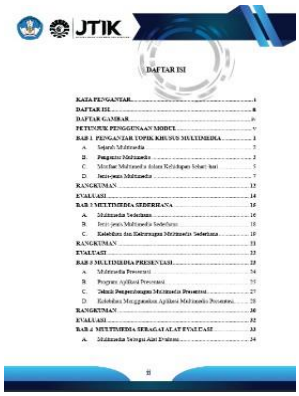


Figure 3 Display of Instructions for Use



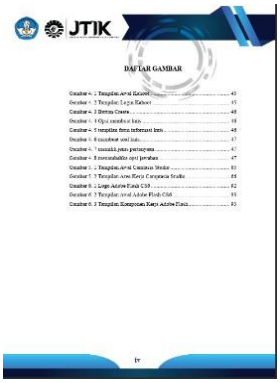


Figure 4 Module Table of Contents Display

3. Content of the Module
   The module contents include chapter covers and material descriptions, with visualisations presented in Figure 5.

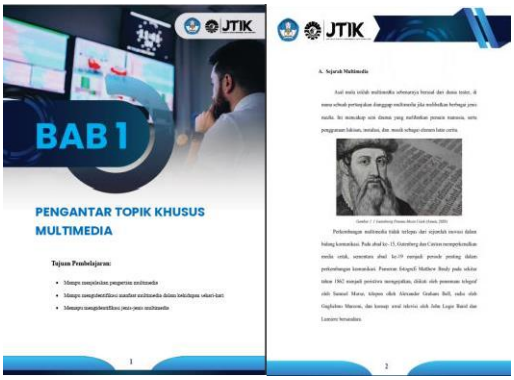


Figure 5 Module Contents Display

4. Summary Display
   The summary contains a description of the material that has been studied in the module and has been summarised. The visualisation of the image is presented in Figure 6.

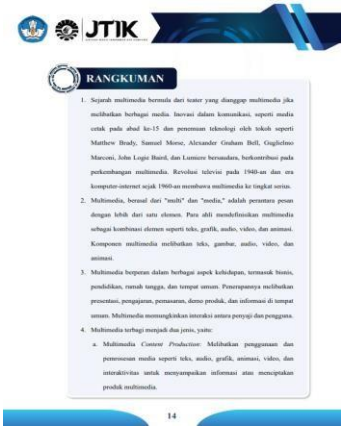


Figure 6 Summary Display

5. Learning Video Display
   The learning videos use YouTube as the platform for displaying each material, with visualisations presented in Figure 7.

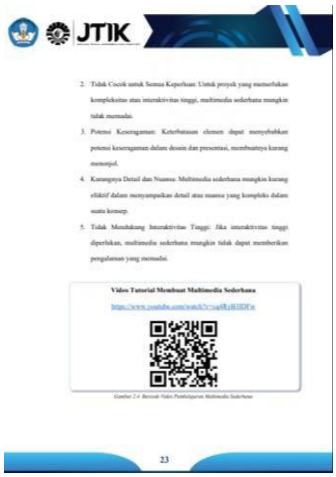


Figure 7 Learning Video Display

6. Practical Display and Quiz
   The display is designed to measure students' understanding of the learning material presented in the module. The visualisation of the images is presented in Figure 8.

Figure 8 Quiz Display

The next stage is the development stage. This stage aims to develop specialised multimedia topic modules that are valid and suitable for use. The steps taken by researchers in this stage are expert validation, product revision and product testing. Validation is carried out to determine the assessment level of specialised multimedia topics by two subject matter experts and two media experts. Meanwhile, product revision is carried out based on suggestions, comments, and validation results of the specialised multimedia topic module by subject matter experts and media experts with the aim of refining and improving the product. After the revision stage is complete, the module is tested on students. Testing is carried out to determine student responses or feedback on the specialised multimedia topic module that has been developed.

The data obtained from the material expert validation, which assessed several aspects of the module feasibility including *self-instruction*, *self-contained*, *stand-alone*, *adaptive*, and *user-friendly*, are presented in Table 1 below.

Table 1 Results of Subject Matter Expert Validation

No	Aspek	Skor Ahli Materi	Jumlah Skor
1	***Self Instruction***	**84**	**84**
2	***Self Contained***	**5**	**5**
3	***Stand Alone***	**10**	**10**
4	***Adaptive***	**5**	**5**
5	***UserFriendly***	**9**	**9**
Skor Total			**113**
Jumlah Skor yang diharapkan			**115**
Persentase Penilaian			**98,26%**
Kategori : Sangat Layak			

Source: Data processing results

Based on the recapitulation of the expert material validation test results, the total score for the self-instructional, self-contained, stand-alone, adaptive, and user-friendly aspects was 113, while the expected score based on the number of statements in the questionnaire was 115. Therefore, the percentage of the total score for all aspects is 98.26% of the maximum percentage of 100%, which falls into the "Highly Suitable" category.

The data from the validation conducted by media experts is presented in Table 2 below.

Table 2 Media Expert Validation Results

No	Aspek	Skor Ahli Media		Jumlah Skor
		Ahli Media Pertama	Ahli Media Kedua	
1	Format	9	10	19
2	Organisasi	12	15	27
3	Daya Tarik	33	35	68
4	Bentuk dan UkuranHuruf	12	15	27
5	Ruang (Spasi Kosong)	9	10	19
6	Konsistensi	11	15	26
Skor Total				**186**
Jumlah skor yang diharapkan				**200**
Persentase Penilaian				**93,00%**
Kategori : Sangat Layak				

Source: Data processing results

Based on the recapitulation of the results of the media expert validation test, the total score for the aspects of format, organisation, appeal, font size and style, spacing, and consistency is 186, while the expected score based on the number of statements in the questionnaire is 200. Therefore, the percentage of the total statement item score from all aspects is = 93.00% of the maximum percentage of 100%, which falls into the "Very Good" category.

After undergoing validation and being declared highly feasible, the multimedia special topic learning module proceeded to the implementation stage through limited trials and extensive trials. This stage aimed to obtain empirical data on student responses, acceptance levels, and feedback on the developed module, as recommended in research on multimedia-based teaching material development.

A small group trial involving five students from the Informatics and Computer Engineering Study Programme showed a very positive response. The score obtained was 353 out of a maximum score of 375, with an average percentage of 94.13% and was classified as "Very Good". These findings indicate that the module has fulfilled the aspects of material clarity, display quality, and ease of use, and is in line with research stating that multimedia learning modules that have undergone expert validation and initial trials tend to receive high levels of acceptance, are considered practical, and are effective for independent learning (Vagg et al., 2020; Nurhikmah et al., 2021; Pratama et al., 2023).

Furthermore, a large-scale trial involving 15 students also showed consistent results. From 15 assessment statements, a total score of 1102 out of a maximum score of 1125 was obtained, with an average percentage of 97.96% and again falling into the "Very Good" category. This achievement indicates that the module was not only well received, but also capable of increasing student engagement, satisfaction, and perception of learning effectiveness. Analytically, the high level of student acceptance and engagement can be understood as the result of the integration of multimedia elements that support visual, interactive, and independent learning in line with student characteristics. These findings reinforce previous research results which reported that the use of interactive multimedia modules has a positive impact on learning satisfaction, student engagement, and improved learning outcomes based on differences in pre-test and post-test scores (Zakiyah & Dwiningsih, 2022; Mardiros et al., 2023). Conceptually, the effectiveness of multimedia-based digital modules has also been reported to increase participation, motivation, and learning activity compared to conventional printed modules (Sahamudin et al., 2022).

The consistency of results between small group trials and large group trials demonstrates the stability of the quality of the developed modules. These findings are in line with research stating that the development of e-modules based on learning design produces valid, feasible products that receive positive responses from students in the context of higher education (Dimyati et al., 2024).

Based on these overall results, it can be concluded that the special topic module on multimedia is in the "Very Good" category and is suitable for use as teaching material. The final stage of the research,

in the form of publication and dissemination limited to lecturers teaching the course, was carried out as an initial step towards institutional implementation prior to wider application.

CONCLUSIONS

Based on the results of the research and discussion concerning the development of the Special Topics in Multimedia course module, it can be concluded that this study successfully produced a learning module for the Informatics and Computer Engineering Education Programme developed using the 4D development model and deemed appropriate for use. The validation results from material experts and media experts indicated that the developed module achieved an average percentage score of 95.63%, which falls within the category of "Very Feasible", thereby meeting the criteria as a high-quality learning medium. Furthermore, users' responses to the developed module were categorised as "Very Good". The small group trial involving five students showed a positive response percentage of 94.13%, while the large group trial involving fifteen students achieved a percentage of 97.96%. Overall, the module obtained an average user response percentage of 96.10%, which falls within the "Very Good" category, indicating that the module was highly well received by the students.

In relation to these findings, several recommendations can be proposed to support the utilisation and further development of the module. Lecturers are encouraged to implement the Special Topics in Multimedia module as an alternative teaching material in the learning process within the Department of Informatics and Computer Engineering. Students are also expected to utilise the module optimally as a means of independent learning to enhance their understanding of the material. Moreover, future researchers are advised to further refine the developed module in terms of both content and presentation. As this study has not yet reached the stage of testing the effectiveness of the module, subsequent research is recommended to examine the impact of the module on students learning outcomes.

AKNOWLEDGMENT

The authors would like to express their sincere gratitude to the lecturers of the Department of Informatics and Computer Engineering, particularly the supervisors and examiners, for their valuable guidance, suggestions, and support throughout the completion of this research. Appreciation is also extended to the students who participated in the validation and trial stages of the module development.

REFERENCES

Albana, L. F. A. N. F., & Sujarwo, S. (2021). Pengembangan E-Modul Interaktif untuk Meningkatkan Kemandirian Belajar Dasar Desain Grafis. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran*, *5*(2), 223–236. https://doi.org/10.21831/jk.v5i2.33278

Ayunda, A. D., Hasanah, H., & Ariyanti, N. A. (2024). Development of a Flipped Classroom-Based E-Module to Improve Problem-Solving Abilities and Learning Independence of High School Students. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(2), 453–466. https://doi.org/10.22219/jpbi.v10i2.32183

Dimyati, A., Fatra, M., & Hafiz, M. (2024). Pengembangan E-Modul Media & Teknologi Pendidikan Berbasis Self Organized Learning Environment Berorientasi Pada Literasi Digital. *Jurnal Riset Dan Inovasi Pembelajaran*, *4*(3), 1801–1818. https://doi.org/10.51574/jrip.v4i3.2161

Due, L. R. D., Siswanto, & Imran, A. F. (2023). Development of E-Modules Based on Articulate Storyline 3 to Improve Accounting Cycle Learning Outcomes. *JPI (Jurnal Pendidikan Indonesia)*, *12*(3), 490–499. https://doi.org/10.23887/jpiundiksha.v12i3.59688

Mahendri, R. P., Amanda, M., Latifah, U., & Rawas, S. (2023). Development of Interactive Flipbook-Based E-Module for Teaching Algorithms and Basic Programming in Higher Education. *Journal of Hypermedia & Technology-Enhanced Learning*, *1*(1), 1–17. https://doi.org/10.58536/j-hytel.v1i1.18

Mardiros, L., Mahmood, F., Colantonio, S., & Bose, R. (2023). Skin of Colour Dermatoses Self-Learning Module: Assessing Student Comprehension. *Journal of Cutaneous Medicine and Surgery*, *27*(3), 214–218. https://doi.org/10.1177/12034754231163543

Maulinda, T. N., Megawati, E., & Rafidah, F. (2024). Efektivitas Pengembangan E-Modul Interaktif Bahasa Indonesia Materi Teks Prosedur Berbasis Canva. *SAP (Susunan Artikel Pendidikan)*, *8*(3), 386–393. https://doi.org/10.30998/sap.v8i3.19323

Musfirah, I. M., Nurhikmah, H., & Febriati, F. (2024). Pengembangan Modul Digital Multimedia Pembelajaran pada Mahasiswa Teknologi Pendidikan Fakultas Ilmu Pendidikan Universitas Negeri Makassar. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, *10*(1), 1221–1234. https://doi.org/10.36989/didaktik.v10i1.2694

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

Openg, F. S., Aran, A. M., & Kwen, K. M. (2024). Pengaruh Media Pembelajaran Multimedia Interaktif terhadap Motivasi dan Keaktifan Belajar Siswa. *JAPB: Jurnal Agama, Pendidikan Dan Budaya*, *5*(2), 122–132. https://doi.org/10.56358/japb.v5i2.342

Pramesti, R. F., Hanjani, T. A., Pratama, G. B., & Purba, E. E. (2024). Pengembangan E-Modul Interaktif pada Mata Kuliah Praktikum Pajak Penghasilan: Development of Interactive E-Modules in Income Tax Practicum Courses. *Edu Cendikia: Jurnal Ilmiah Kependidikan*, *4*(03), 1340–1350. https://doi.org/10.47709/educendikia.v4i03.5221

Pratama, Muh. P., Ruruk, S., & Karuru, P. (2023). Validity of Interactive Learning Media in Computer Basics Course. *Jurnal Inovasi Teknologi Pendidikan*, *10*(4), 353–362. https://doi.org/10.21831/jitp.v10i4.60376

Sahamudin, B. S., Bachri, B. S., & Arianto, F. (2022). Pengembangan Modul Pembelajaran Konsep Kewargaan Digital Untuk Meningkatkan Kemandirian Belajar Dan Hasil Belajar Siswa Kelas X Di SMK Pembangunan Surabaya. *Jurnal Ilmiah Mandala Education (JIME)*, *8*(2), 1553–1565. https://doi.org/10.58258/jime.v8i2.3254

Said, S. (2023). Peran Teknologi Digital sebagai Media Pembelajaran di Era Abad 21. *Jurnal PenKoMi : Kajian Pendidikan Dan Ekonomi*, *6*(2), 194–202. https://doi.org/10.33627/pk.62.1300

Sape, H., Lukman, & Sambara, P. M. (2024). Penggunaan E-Modul Interaktif dalam Meningkatkan Kemampuan Literasi Siswa. *Jurnal Pendidikan Dan Pembelajaran*, *4*(2), 101–106. https://doi.org/10.62388/jpdp.v4i2.522

Stanevičienė, E., & Žekienė, G. (2025). The Use of Multimedia in the Teaching and Learning Process of Higher Education: A Systematic Review. *Sustainability*, *17*(19), 8859. https://doi.org/10.3390/su17198859

Sugiyono. (2019). *Metode Penelitian dan Pengembangan (Research and Development)*. Alfabeta.

Talitha, S., Budiana, S., Nurjaman, A., & Fadillah, V. (2025). Pengembangan E-Modul Pembelajaran Menulis Teks Negosiasi Kelas X SMK. *Prosiding Konferensi Linguistik Tahunan Atma Jaya (KOLITA) 23*, *23*(23). https://doi.org/10.25170/kolita.v23i23.7178

Thiagarajan, S. (1974). *Instructional Development for Training Teachers of Exceptional Children: A Sourcebook*. Indiana University.

Utami, R. A., Ernawati, Nelmira, W., & Hafidza, H. (2025). Digital Learning Modules: Perspectives On Usability, Content Quality, And Effectiveness. *Jurnal Teknologi Pendidikan : Jurnal Penelitian Dan Pengembangan Pembelajaran*, *10*(4), 639–646. https://doi.org/10.33394/jtp.v10i4.17561

Vagg, T., Balta, J. Y., Bolger, A., & Lone, M. (2020). Multimedia in Education: What do the Students Think? *Health Professions Education*, *6*(3), 325–333. https://doi.org/10.1016/j.hpe.2020.04.011

Zakiyah, W. I., & Dwiningsih, K. (2022). The Effectivity of Interactive E-Module to Increase the Students' Visual-Spatial Intelligence on Ionic. *Jurnal Inovasi Teknologi Pendidikan*, *9*(1), 91–100. https://doi.org/10.21831/jitp.v9i1.46561