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Development of Teaching Materials for The Course Evaluation and Curriculum Development with Project-Based Learning for Students of S-1 Educational Technology at UNESA

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Abstract: This study aims to develop interactive teaching materials using a project-based learning approach and examine their effectiveness in enhancing students' learning independence. The study employed a development research design combined with an experimental approach, following the ADDIE model (analysis, design, development, implementation, and evaluation). The participants consisted of 64 undergraduate students in the Educational Technology program at Surabaya State University, divided into an experimental group and a control group using a posttest-only control group design. The developed teaching materials were validated by one media expert and one material expert. The feasibility results indicated that the materials were highly feasible, with a score of 100% from the media expert and 87.17% from the material expert. To test effectiveness, students in the experimental group used the interactive teaching materials for independent learning, while the control group relied on conventional materials. Data were collected using questionnaires measuring students' learning independence and analyzed using an independent samples t-test. The results showed that the experimental group achieved a higher mean score (M = 82.89) compared to the control group (M = 73.51). Statistical analysis revealed a significant difference between the two groups ($p < .001$), indicating that the developed teaching materials had a positive effect on students' learning independence. These findings suggest that interactive teaching materials integrated with project-based learning can effectively support independent learning in higher education contexts and provide a practical solution to enhance student autonomy.

Abstrak: *Penelitian ini bertujuan untuk mengembangkan bahan ajar interaktif berbasis pembelajaran berbasis proyek serta menguji efektivitasnya dalam meningkatkan kemandirian belajar mahasiswa. Penelitian ini menggunakan pendekatan penelitian pengembangan yang dipadukan dengan desain eksperimen, dengan mengacu pada model ADDIE (analysis, design, development, implementation, dan evaluation). Subjek penelitian terdiri atas 64 mahasiswa program studi Teknologi Pendidikan Universitas Negeri Surabaya yang dibagi menjadi kelompok eksperimen dan kelompok kontrol menggunakan desain posttest-only control group. Bahan ajar yang dikembangkan divalidasi oleh satu ahli media dan satu ahli materi. Hasil uji kelayakan menunjukkan bahwa bahan ajar berada pada kategori sangat layak, dengan skor 100% dari ahli media dan 87,17% dari ahli materi. Untuk menguji efektivitas, mahasiswa pada kelompok eksperimen menggunakan bahan ajar interaktif dalam pembelajaran mandiri, sedangkan kelompok kontrol menggunakan bahan ajar konvensional. Data dikumpulkan melalui kuesioner yang mengukur kemandirian belajar mahasiswa dan dianalisis*

menggunakan uji t sampel independen. Hasil penelitian menunjukkan bahwa kelompok eksperimen memperoleh rata-rata skor yang lebih tinggi (M = 82,89) dibandingkan kelompok kontrol (M = 73,51). Analisis statistik menunjukkan adanya perbedaan yang signifikan antara kedua kelompok (p < 0,001), yang menunjukkan bahwa bahan ajar yang dikembangkan berpengaruh positif terhadap kemandirian belajar mahasiswa. Temuan ini menunjukkan bahwa bahan ajar interaktif yang terintegrasi dengan pembelajaran berbasis proyek efektif dalam mendukung pembelajaran mandiri di pendidikan tinggi serta memberikan solusi praktis untuk meningkatkan kemandirian mahasiswa.

INTRODUCTION

Universities play a strategic role in preparing students to become graduates with strong integrity and professional competence in mastering knowledge and skills. Higher education institutions are increasingly required to equip students with competencies relevant to the demands of the 21st-century workforce, including critical thinking, problem-solving, communication, and independence (Donald, 2024; Iqbal & Shaukat, 2021). In this context, the framework of 21st-century learning emphasizes the importance of integrating knowledge, skills, and attitudes to support students' transition into professional environments (Larson & Miller, 2011). Recent studies also highlight that digital and technology-enhanced learning environments further strengthen the development of these competencies in higher education contexts (Hidayat et al., 2022).

Among these competencies, learning independence has become a crucial aspect in higher education. Independent learning enables students to actively construct knowledge, explore learning resources beyond the classroom, and adapt to real-world challenges. It also supports students in developing lifelong learning skills, which are essential for professional success (Al-Ajmy & Al-Mutairi, 2024). Recent research shows that self-directed learning is increasingly supported by digital and mobile technologies, enabling students to regulate their own learning processes more effectively (Lai et al., 2022). Furthermore, students in higher education often face challenges in regulating their own learning despite having access to various digital resources (van Harsel et al., 2022).

Teaching materials, in particular, play a significant role in supporting independent learning. Well-designed materials can enhance student engagement, improve comprehension, and facilitate self-directed learning processes (Oregon Department of Education, 2023). In addition, the integration of interactive and multimedia elements in teaching materials has been shown to increase student motivation and understanding, especially in digital learning environments. Studies indicate that technology-based instructional materials and task-centered learning approaches significantly improve students' problem-solving skills and engagement in higher education (Argelagós et al., 2022). Moreover, the development of innovative teaching materials is essential to meet diverse student needs, particularly in digital learning contexts (Ishartiwi et al., 2022).

Despite these expectations, preliminary observations in the Educational Technology undergraduate program at Surabaya State University indicate that students still experience difficulties in conducting independent learning. Students tend to struggle when completing independent study tasks and show low engagement when learning outside the classroom without direct supervision from lecturers. This finding is consistent with previous studies indicating that students often encounter difficulties in maintaining independence during project-based or self-directed learning activities (Whyatt et al., 2023). In addition, learning environments that do not adequately support self-regulated learning may hinder students' ability to become independent learners (Lahdenperä et al., 2022).

Previous studies have highlighted the importance of teaching materials and independent learning; however, there is still a limited number of studies that specifically integrate the development of interactive teaching materials with a project-based learning approach to enhance student independence in higher education contexts. Existing research tends to focus separately on self-directed learning strategies or instructional design without fully combining both aspects in a

structured pedagogical model (Zhu & Bonk, 2025). This indicates a research gap in designing and empirically testing teaching materials that not only meet content requirements but also actively promote independent learning through structured instructional models.

Based on this gap, this study aims to develop interactive teaching materials for the course Evaluation and Curriculum Development using a project-based learning approach and to examine their effectiveness in enhancing students' learning independence. The developed materials are expected to provide an engaging, flexible, and accessible learning experience that supports students in conducting independent study both inside and outside the classroom.

METHOD

This research is a development research aimed at creating teaching materials, followed by an experiment to assess student independence. The research development procedure follows the ADDIE model, which includes five stages: analyze, design, develop, implement, and evaluate (Branch, 2009). The experimental design employs a control group posttest-only design (Creswell & Creswell, 2018). The data collection instrument for this research is a questionnaire used to gather expert eligibility data and measure student learning independence. Indicators of independence, as defined by Albert Bandura, encompass self-belief, self-regulation, resilience, responsible decision-making, initiative in action, emotional processing ability, intrinsic motivation, and independent learning ability (Bandura, 1977, 1985, 1994, 2006).

The participants in this study included experts and students. The expert group comprised 2 individuals selected to evaluate media and materials for curriculum development. The student group consisted of 64 students from the S1 Educational Technology program at the Faculty of Education, Surabaya State University, divided into two classes. The first experimental class, with 32 students, received interactive module teaching materials for independent study. The second class, also with 32 students, studied independently without interactive module teaching materials. Data analysis involved using PSA to assess the teaching material feasibility test results and independent samples t-test for analyzing student independence values.

RESULTS AND DISCUSSION

Development of Teaching Materials

1. Analysis

The first stage is to identify learning objectives and determine the characteristics of the material that students must learn and improve. These skills encompass areas that require development or enhancement. Specify the particular skills students need to attain, conduct a topic analysis to identify and clarify lecture content. This analysis is performed to establish the topics that will be used for subsequent learning. The outcomes of the analysis stage take the form of a draft outlining the design requirements for teaching materials.

2. Design

After conducting analysis and determining the needs of teaching materials, the next step is to design the teaching materials. The design stage includes formulating learning objectives needed to achieve learning outcomes. These objectives describe the abilities or competencies that students will achieve. The objectives determined contain activities. Additionally, creating a description of the module layout, developing a text arrangement design for teaching materials, planning the assets needed to provide images and audio that will be included in the teaching materials. The results of this design stage are blueprints and drafts of teaching materials that will be developed.

3. Develop

In the third stage, namely development, the teaching materials' content is created. Assets collected from the blueprint are combined according to the teaching materials' design. The material content is integrated into the teaching module, including images and audio, to complete

the development process. The outcome of this stage is an interactive teaching module prepared for testing and evaluation.

4. Implementation

After the interactive teaching module has been successfully developed, at this stage an assessment is carried out first. The assessment is conducted by teaching material experts who evaluate the teaching materials in terms of media and materials. The experts' assessment is utilized to enhance the quality and feasibility of the teaching materials before they are implemented with students. Once the assessment is completed and the teaching module is prepared for use, it is then introduced to students. The teaching module is provided to students in the experimental class for independent learning.

5. Evaluation

The evaluation stage consists of assessing 4 levels: perception, learning, behavior, and results. Perception evaluates students' thoughts and feelings about the teaching materials. Learning measures the knowledge and skills acquired from using the teaching materials. Behavior assesses the behavioral changes observed after using the teaching materials. Results refer to the impacts observed after students use the teaching materials.

Results

The developed teaching materials were evaluated for feasibility by experts in Educational Technology, focusing on both media and material aspects. The assessment employed a Likert scale ranging from 1 (not appropriate) to 4 (very appropriate), and the results were analyzed using percentage techniques.

Media Feasibility Results

Table 1. Media Expert Evaluation Results

Aspect	Variabel	Indikator	Score
Educative	Providing learning opportunities	Media can be utilized for learning at any time	4
		Media can be utilized for learning anywhere	4
Educational aspect score.			**8**
Technical quality	Quality of presentation	Media captures attention	4
		Module cover design is displayed	4
		Module content layout design is displayed	4
		Module layout design and display quality	4
	Relevance of module content	Relevance of sub-chapters to chapter content	4
		Quality and attractiveness of module content	4
	Quality of media packaging	Media is easily portable	4
		Media maintenance is straightforward.	4
		Technical quality aspect score	**32**
		Overall score.	40
		Ideal score.	40
		Percentage of all aspects.	100%

The results indicate that the developed teaching materials achieved a perfect score (100%), categorizing them as **very feasible** for implementation.

Material Feasibility Results

Table 2. Material Expert Eligibility Results

Sub variable	Sub-sub variable	Indicator	Score
Educative	Tailored to its intended use	Materials aligned with the learning objectives.	4
	The convenience inherent in the material content	Clarity of language for comprehension by students	4
		Appropriateness of language for student characteristics	4
		Alignment of language with student cognitive abilities	3
		Relevance of supporting images for the content	4
	According to the student's ability level.	Accessibility of the material for students	4
		Appropriateness of the material for students' skill level	4
	Avoid using complex vocabulary.	Use of straightforward vocabulary	4
		Absence of ambiguous terms	3
		Educational aspect score.	
		Overall score.	34
		Ideal score.	36
		Percentage of all aspects.	87,17%

The material expert evaluation shows a percentage of **87.17%**, indicating that the teaching materials are also **very feasible** for use in learning.

Normality Test Results

Table 3. Normality Test (Kolmogorov-Smirnov)

Test of Normality				
	Group	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Self Regulated	Experiment	.115	32	.200*
	Control	.114	32	.200*

The significance values for both groups are greater than .05, indicating that the data are normally distributed.

Homogenity Results

Table 4. Data Homogeneity Test (Levene Test)

Test of Homogeneity of Variances			
Self Regulated			
Levene Statistic	df1	df2	Sig.
.592	1	62	.445

The result shows that the data are homogeneous since the significance value is greater than .05.

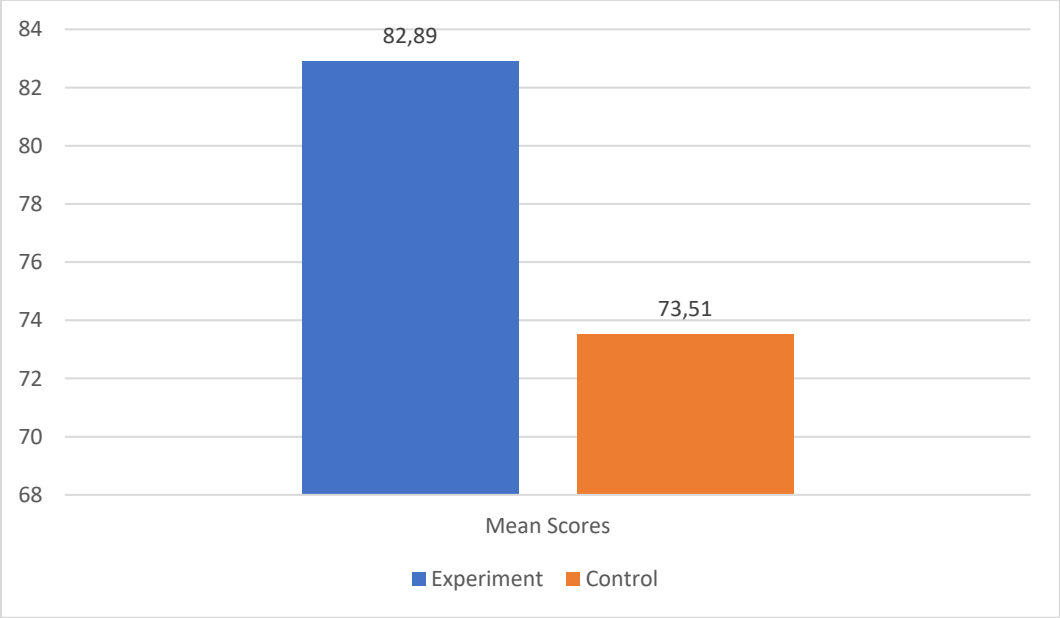
Mean Score of Student Independence

Table 5. Mean Scores of Student Independence

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Independent	Experiment	32	82.8906	7.21528	1.27549
	Control	32	73.5156	7.82519	1.38331

Graphical Representation

Figure 1. Comparison of Student Independence Scores



The experimental group shows a higher mean score compared to the control group.

t-Test Results

Table 6. Independent Samples t-Test Results

		F	Sig.	t	df	p	MD	Std. Error Difference
Self Regulated	Equal variances assumed	.592	.445	4.982	62	.000	9.37500	1.88160
	Equal variances not assumed			4.982	61.596	.000	9.37500	1.88160

The t-test result indicates a statistically significant difference between the experimental and control groups.

Interpretation of Results

Based on the results, the developed teaching materials are highly feasible according to both media and material experts. Furthermore, statistical analysis demonstrates that students who used the developed teaching materials achieved significantly higher levels of learning independence compared to those who did not. The experimental group outperformed the control group, with a mean difference of approximately 9.38 points. These findings indicate that the implementation of interactive teaching materials contributes positively to enhancing student learning independence.

Discussion

The findings of this study indicate that students initially demonstrated a low level of learning independence, as evidenced by repeated observations of their inability to effectively complete independent learning tasks. This condition suggests that the existing learning environment and instructional support were not sufficiently facilitating self-directed learning. Previous studies have similarly reported that students often struggle to regulate their own learning when instructional support and learning resources are not aligned with their needs (Al-Ajmy & Al-Mutairi, 2024).

The results of the questionnaire further revealed that the primary issue did not lie in lecturer performance or instructional strategies, but rather in the teaching materials used. Students reported difficulties in utilizing printed books for independent learning due to their static nature and lack of accessibility. This finding is consistent with prior research indicating that traditional teaching materials tend to be less effective in supporting independent learning, particularly in digital-era learners who prefer flexible and interactive resources (Anwar et al., 2023; Murni et al., 2024).

In contrast, students showed a strong preference for digital and interactive learning resources accessed through electronic devices. However, reliance on open internet sources such as video platforms presents challenges related to the credibility and reliability of information. This aligns with findings from previous studies, which highlight that although digital resources increase accessibility, they may also lead to difficulties in identifying valid academic sources (Isa, 2023). Therefore, there is a need for structured and credible teaching materials that combine the advantages of interactivity with academic reliability.

The development of interactive teaching materials using the ADDIE model in this study successfully addressed these challenges. The high feasibility ratings from both media and material experts indicate that the developed materials meet the required standards for instructional quality. These results are in line with previous studies showing that systematically designed instructional materials can enhance both the quality of learning and student engagement (Budiarto & Jazuli, 2021).

Furthermore, the statistical results demonstrate that students who used the interactive teaching materials achieved significantly higher levels of learning independence compared to those who relied on conventional materials. The experimental group showed a higher mean score, with a statistically significant difference ($p < .001$). This finding supports earlier research indicating that interactive and technology-enhanced learning materials can foster self-directed learning and improve student autonomy (Sipayung et al., 2021).

From a theoretical perspective, this result can be explained through the relationship between motivation and learning independence. Interactive teaching materials not only provide content but also stimulate student engagement and motivation through visual and auditory elements. Increased motivation encourages students to take initiative in their learning, which in turn enhances their independence. This is consistent with studies demonstrating a strong relationship between learning motivation and independence, where motivated learners are more likely to engage in self-directed learning activities (Isa, 2023). Recent studies further support this finding, showing that digital and interactive learning environments significantly enhance students' intrinsic motivation and self-regulated learning behaviors (Hafiz et al., 2025; Rahmawati & Mukhibat, 2026; Ubben et al., 2023). These studies emphasize that technology-supported learning not only improves engagement but also fosters autonomy by allowing students to control the pace and depth of their learning.

Compared to previous studies, this research offers a more integrated approach by combining the development of interactive teaching materials with a structured instructional model. While earlier research has often examined either learning independence or instructional media separately, this study demonstrates how both aspects can be synergistically integrated to produce a measurable impact on student independence. Similar findings were reported by (Ubben et al., 2023), who highlighted that interactive digital modules significantly improve learner

autonomy, although their study did not incorporate a systematic instructional design model. Likewise, Hafiz et al. (2025) found that multimedia-based learning enhances student engagement but did not explicitly measure independence as an outcome variable. In contrast, Rahmawati & Mukhibat (2026) demonstrated that integrating instructional design models with digital learning tools leads to more structured and effective independent learning. Therefore, the present study extends prior research by explicitly linking interactive teaching materials with the ADDIE model, providing a more comprehensive framework for promoting independent learning in higher education.

Overall, the findings suggest that interactive teaching materials designed based on student needs and supported by appropriate instructional models can significantly enhance learning independence. These results highlight the importance of aligning teaching materials with student characteristics and learning preferences, particularly in the context of digital-era education.

Limitation and Future Research

This study has several limitations that should be acknowledged. First, the sample size was limited to 64 undergraduate students from a single study program at Surabaya State University, which may restrict the generalizability of the findings to broader educational contexts. Second, the duration of the intervention was relatively short, as students used the developed teaching materials for only one week, which may not fully capture the long-term impact on learning independence. Third, the measurement of student independence relied on self-reported questionnaire data, which may be subject to response bias.

In addition, this study focused primarily on the effectiveness of interactive teaching materials in enhancing learning independence, without examining other related variables such as academic achievement, critical thinking skills, or long-term retention of knowledge.

Future research is recommended to involve a larger and more diverse sample across different institutions and disciplines to improve the generalizability of the findings. Longer intervention periods should also be considered to examine the sustained impact of interactive teaching materials on student independence. Furthermore, future studies may integrate additional variables, such as learning outcomes, motivation, and self-regulated learning, to provide a more comprehensive understanding of the effectiveness of interactive teaching materials. Finally, experimental designs incorporating mixed methods approaches could offer deeper insights into students' learning experiences and behaviors.

CONCLUSION

Based on the results of this study, it is concluded that interactive teaching materials have been successfully developed using the ADDIE development procedure within a highly feasible category. The teaching materials that have been developed are applied to students for independent learning. Through the development of these teaching materials, there is a notable improvement in student independence. The achievement of student independence scores for those who learn using interactive teaching materials is higher compared to students who solely rely on printed books. Interactive teaching materials have a positive impact on student independence.

After the development of interactive teaching materials to enhance student independence in the evaluation of courses and curriculum development, a positive impact has been observed. Teaching materials should be further developed to cater to the needs of students in various other courses. This initiative is aimed at enhancing student independence across all courses.

REFERENCES

Al-Ajmy, S. S., & Al-Mutairi, M. A. (2024). The Impact and Future of Student's Independent Learning. *MECSJ*.

Anwar, A., Hasan, S., & Haerani, E. (2023). Increasing Student Learning Enthusiasm Through Multimedia-Based Learning. *AL-ISHLAH: Jurnal Pendidikan*, *15*(3), 3210–3217. https://doi.org/10.35445/alishlah.v15i3.3430

Argelagós, E., Garcia, C., Privado, J., & Wopereis, I. (2022). Fostering information problem solving skills through online task-centred instruction in higher education. *Computers & Education*, *180*, 104433. https://doi.org/https://doi.org/10.1016/j.compedu.2022.104433

Bandura, A. (1977). *Social Learning Theory*. Pretice Hall.

Bandura, A. (1985). *Prentice-Hall series in social learning theory. Social foundations of thought and action: A social cognitive theory*. Prentice-Hall, Inc.

Bandura, A. (1994). *Self-Efficacy*. John Wiley & Sons, Inc.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In *Self-efficacy beliefs of adolescents* (pp. 307–337). Information Age Publishing.

Branch, R. M. (2009). Instructional Design. In *Encyclopedia of Evolutionary Psychological Science*. Springer. https://doi.org/10.1007/978-3-319-19650-3_2438

Budiarto, F., & Jazuli, A. (2021). Interactive Learning Multimedia Improving Learning Motivation Elementary School Students. *ICONESS*. https://doi.org/10.4108/eai.19-7-2021.2312497

Creswell, W. J., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative adn Mixed Methods Approaches. In *Journal of Chemical Information and Modeling* (Vol. 53, Issue 9). file:///C:/Users/Harrison/Downloads/John W. Creswell & J. David Creswell - Research Design_ Qualitative, Quantitative, and Mixed Methods Approaches (2018).pdf%0Afile:///C:/Users/Harrison/AppData/Local/Mendeley Ltd./Mendeley Desktop/Downloaded/Creswell, Cr

Donald, W. E. (2024). Preparing Students for the University-to-Work Transition. In *Strategic Opportunities for Bridging the University-Employer Divide* (Vol. 49, Issue 9, pp. 144–170). https://doi.org/10.1108/PR-01-2019-0026

Hafiz, M., Agustini, K., & Suartama, I. K. (2025). Blended Learning and its Impact on 21st Century Student Learning: Blended Learning dan Dampaknya terhadap Pembelajaran Siswa Abad 21. *Indonesian Journal of Innovation Studies*, *26*. https://doi.org/10.21070/ijins.v26i3.1449

Hidayat, D. N., Lee, J. Y., Mason, J., & Khaerudin, T. (2022). Digital technology supporting English learning among Indonesian university students. *Research and Practice in Technology Enhanced Learning*, *17*(1), 23. https://doi.org/10.1186/s41039-022-00198-8

Iqbal, J., & Shaukat, S. (2021). The Role of University Preparation for Developing Students' Employability and Professional Competencies. *Pakistan Business Review*, *23*(1). https://doi.org/10.22555/pbr.v23i1.535

Isa, A. (2023). The Relationship between Learning Independence and Learning Motivation with Student Academic Achievement. *Journal of Education Method and Learning Strategy*, *1*(01), 1–8. https://doi.org/10.59653/jemls.v1i01.11

Ishartiwi, Handoyo, R. R., Prabawati, W., & Suseno, A. (2022). Alternative Teaching Materials For Distance Learning For Student With Special Needs. *Jurnal Kependidikan Penelitian Inovasi Pembelajaran*, *6*(2), 129–142. https://doi.org/10.21831/jk.v6i2.49858

Lahdenperä, J., Rämö, J., & Postareff, L. (2022). Student-Centred Learning Environments Supporting Undergraduate Mathematics Students To Apply Regulated Learning: A Mixed-Methods Approach. *The Journal of Mathematical Behavior*, *66*, 100949. https://doi.org/https://doi.org/10.1016/j.jmathb.2022.100949

Lai, Y., Saab, N., & Admiraal, W. (2022). Learning Strategies in Self-directed Language Learning Using Mobile Technology in Higher Education: A Systematic Scoping Review. *Education and Information Technologies*, *27*(6), 7749–7780. https://doi.org/10.1007/s10639-022-10945-5

Larson, L. C., & Miller, T. N. (2011). 21st Century Skills: Prepare Students for the Future. *Kappa Delta Pi Record*, *47*(3), 121–123. https://doi.org/10.1080/00228958.2011.10516575

Murni, D., Siagian, S., & Tanjung, S. (2024). E-Modul Tematik Interaktif : Membuat Pembelajaran Lebih Menyenangkan dengan Canva di SD. *Elementary School Journal*, *14*(1), 119–135.

Oregon Department of Education. (2023). Importance of High-Quality Instructional Materials. *Oregon Department of Education*. http://k12education.gatesfoundation.org/blog/high-quality-

Rahmawati, M., & Mukhibat, M. (2026). DIGITAL LITERACY AS A MEDIATOR OF THE EFFECT OF THE INDEPENDENT CURRICULUM AND LEARNING MOTIVATION ON ACADEMIC ACHIEVEMENT: A PLS-SEM ANALYSIS. *Isagoge - Journal of Humanities and Social Sciences*, *6*, 169–189. https://doi.org/10.59079/isagoge.v6i1.297

Sipayung, T. N., Imelda, I., Siswono, T. Y. E., & Masriyah, M. (2021). The significant relationship between independent and student's motivation on online-based mathematics learning. *Malikussaleh Journal of Mathematics Learning (MJML)*, *4*(2), 137. https://doi.org/10.29103/mjml.v4i2.5608

Ubben, M. S., Kremer, F. E., Heinicke, S., Marohn, A., & Heusler, S. (2023). Smartphone Usage in Science Education: A Systematic Literature Review. In *Education Sciences* (Vol. 13, Issue 4, p. 345). https://doi.org/10.3390/educsci13040345

van Harsel, M., Hoogerheide, V., Janssen, E., Verkoeijen, P., & van Gog, T. (2022). How do higher education students regulate their learning with video modeling examples, worked examples, and practice problems? *Instructional Science*, *50*(5), 703–728. https://doi.org/10.1007/s11251-022-09589-2

Whyatt, D., Davies, G., & Clark, G. (2023). Going Solo: Students' Strategies For Coping With An Independent Gis Project. *Journal of Geography in Higher Education*, *47*(3), 381–398. https://doi.org/10.1080/03098265.2022.2065668

Zhu, M., & Bonk, C. J. (2025). Guidelines and strategies for fostering and enhancing self-directed online learning. *Open Learning: The Journal of Open, Distance and e-Learning*, *40*(4), 382–398. https://doi.org/10.1080/02680513.2022.2141105