

Didakta: International Journal of Social Sciences, Language, and Education
Vol 1 No 4 October 2026, Hal 86-102
ISSN: 3124-3894 (Print) ISSN: 3124-3886(Electronic)
Open Access: https://researchfrontiers.id/didakta/index

Development of an Interactive Economics Learning Medium Using the STAD Model (Interec-Stad) to Enhance Students' Critical and Collaborative Thinking Skills

Meivira Dinda Maulidiya Rizqi[1*], Endang Mulyani[2]
[1-2] Yogyakarta State University, Indonesia
email: meiviradinda.2024@student.uny.ac.id[1]

Article Info :
Received:
01-10-2025
Revised:
16-10-2025
Accepted:
21-10-2026

Abstract

This study developed Interec-STAD interactive economics learning media and evaluated its feasibility, practicality, and effectiveness in supporting students' critical thinking and collaborative skills. Research and development followed the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, integrating Lumio by SMART with Student Teams Achievement Divisions (STAD) for Grade XI fiscal policy instruction. A limited trial involved 36 students, followed by a quasi-experimental pretest–posttest comparison involving 72 students in experimental and control classes. Data were obtained through interviews, expert validation, questionnaires, and pretests and posttests. Feasibility and practicality were assessed using descriptive analyses, while effectiveness was evaluated through multivariate analysis of variance (MANOVA) and normalized gain (N-Gain) calculations using SPSS. Expert validation produced a mean score of 3.51 (highly feasible), and teacher–student practicality assessment yielded 3.37 (practical). The limited trial averaged 3.49 (very good). Posttest MANOVA identified a significant multivariate difference between groups (Wilks' lambda = 0.225; $p < 0.001$; partial eta squared = 0.775). Experimental-class N-Gain values were 0.5895 for critical thinking and 0.5204 for collaboration (moderate), compared with 0.2790 and 0.0302 in the control class (low). Interec-STAD was feasible and practical and was associated with stronger learning outcomes, although baseline differences and the single-school quasi-experimental design limit causal interpretation.

Keywords: *Collaborative Skills, Critical Thinking, Economics Education, Fiscal Policy, Interec-STAD.*

©2026 Authors.. This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.
(https://creativecommons.org/licenses/by-nc/4.0/)

INTRODUCTION

Economics education at the secondary-school level increasingly requires students to interpret economic information, evaluate competing explanations, and formulate reasoned judgments rather than merely reproduce theoretical concepts. These requirements correspond to the growing emphasis on critical thinking and collaboration as interconnected competencies in contemporary education (Thornhill-Miller et al., 2023). The expansion of digital learning technologies has created opportunities to reorganize classroom instruction through interactive activities that encourage students to examine information and participate in problem-solving. Research on Nearpod-assisted economics instruction has demonstrated the relevance of interactive learning media to the development of economic literacy among senior high school students (Hasan et al., 2024). Similarly, the application of Google Sites-based learning media has been investigated as an approach to strengthening students' conceptual understanding in economics education (Mustapa & Santoso, 2025). Nevertheless, the instructional challenge extends beyond introducing digital platforms, as economics learning also requires pedagogical arrangements that connect individual reasoning, meaningful interaction, and shared responsibility for completing academic tasks.

Recent educational research has examined technology-supported instruction and cooperative learning as complementary approaches to developing students' cognitive and interpersonal competencies. Web-based interactive learning media have been investigated for their contribution to critical thinking, although the available evidence includes educational settings that differ from senior high school economics classrooms (Saputra et al., 2025). Research incorporating technological pedagogical content knowledge has similarly addressed the development of collaboration skills through the integration of instructional technology and pedagogical strategies (Lutfiana et al., 2023).

Cooperative learning represents a related research direction because structured peer interaction has been associated with opportunities to strengthen critical thinking and academic performance (Harianto, 2024). The relationship between cooperative learning and student engagement has also received attention, particularly regarding the instructional conditions that encourage active participation in learning activities (Nguyen & Oanh, 2025). These research directions share an emphasis on student involvement but differ in their instructional mechanisms, outcome indicators, and the relative importance assigned to digital interaction and cooperative organization. Their synthesis suggests that the pedagogical effectiveness of interactive media should be examined alongside the organization of collaborative tasks and individual learning responsibilities.

The Student Teams Achievement Divisions (STAD) model provides a relevant cooperative structure for organizing learning activities, although existing applications have emphasized different educational outcomes and disciplinary settings. Research comparing STAD and Teams Games Tournament approaches in economics education has addressed achievement motivation and learning outcomes, without specifically establishing the effectiveness of an integrated digital medium for developing critical thinking and collaboration simultaneously (Butar-Butar et al., 2022). The development of STAD-based cooperative learning has also been examined through mathematical reasoning and communication skills in higher education, indicating a different disciplinary setting and target population (Nasution et al., 2024). Research involving collaborative-individual learning among secondary-school students has addressed critical thinking development, but its instructional arrangement does not directly establish the outcomes of integrating STAD with interactive economics learning media (Viado & Espiritu, 2023). Taken together, these studies provide relevant evidence concerning cooperative structures and cognitive development, while the selected literature does not directly explain how interactive digital activities can be systematically aligned with STAD stages to address critical and collaborative thinking as concurrent outcomes in secondary economics instruction. The resulting research gap concerns the design and evaluation of an integrated learning medium rather than the isolated application of cooperative learning or digital instructional technology.

The significance of this gap becomes more apparent when students are expected to analyze economic problems independently while participating productively in collective learning activities. Preliminary interviews with an economics teacher at SMA Negeri 6 Yogyakarta indicated difficulties in students' ability to interpret information, analyze problems systematically, formulate conclusions, and communicate logical reasoning. The preliminary account also identified uneven participation, limited individual contributions, and weaknesses in group communication, although these observations do not constitute a quantified assessment of student competencies. Contemporary research emphasizes that critical thinking and collaboration require deliberate instructional development and appropriate assessment rather than reliance on incidental classroom interaction (Thornhill-Miller et al., 2023). Cooperative learning provides a relevant pedagogical basis because structured learning activities can create opportunities for students to examine ideas, exchange arguments, and strengthen their reasoning processes (Harianto, 2024). Research addressing cooperative learning and student engagement further supports examining how learning arrangements influence opportunities for active student participation (Nguyen & Oanh, 2025). Without a coherent instructional design connecting digital activities, individual accountability, and collaborative problem-solving, the difficulties identified in the preliminary observations may remain insufficiently addressed despite the availability of interactive learning technologies.

The present study positions Interec-STAD as an interactive economics learning medium that integrates Lumio by SMART with the instructional stages of the STAD cooperative learning model. Existing research on digital economics instruction has established a relevant foundation for using interactive learning media to support economic literacy, but the cited investigation does not specifically evaluate the proposed integration of Lumio-based activities and STAD stages (Hasan et al., 2024). Research on STAD in economics education has addressed cooperative learning and academic achievement, whereas the present development focuses on connecting the model with interactive digital activities and assessing two distinct student competencies (Butar-Butar et al., 2022). The integration of technology and pedagogical strategies to support collaboration also provides a relevant conceptual reference, although previous work using the TPACK approach differs from the product-development orientation adopted in this study (Lutfiana et al., 2023). Research concerning web-based interactive media and critical thinking provides a further rationale for investigating cognitive outcomes, but its

educational setting and intervention structure differ from those proposed for Interec-STAD (Saputra et al., 2025). The proposed novelty lies in the purposeful integration of interactive economic content, collaborative problem analysis, team discussion, individual quizzes, and team recognition into a single instructional medium, with feasibility, practicality, critical thinking, and collaborative skills serving as explicit dimensions of its evaluation, as conceptually illustrated in Figure 1.

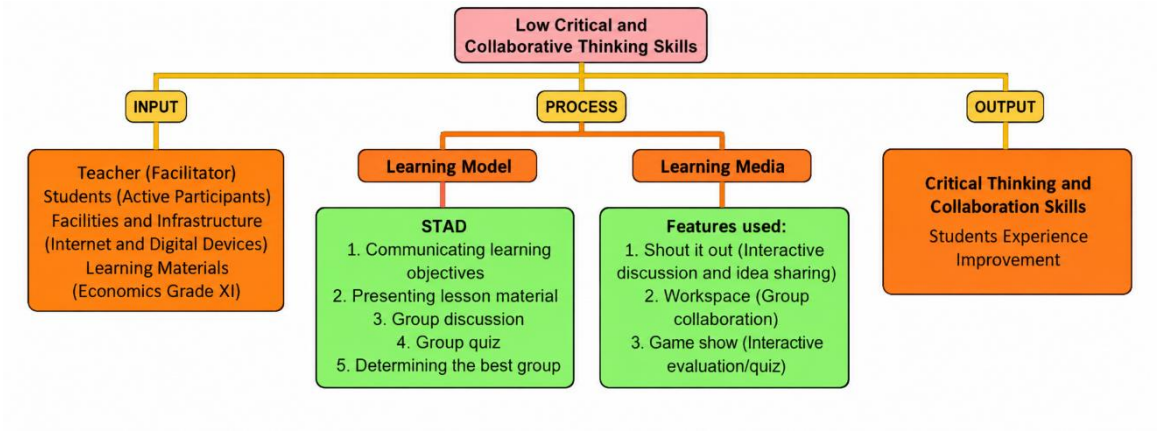


Figure 1. Conceptual Framework for the Development of Interec-STAD

This study aims to develop Interec-STAD as an interactive economics learning medium using Lumio by SMART and the STAD cooperative learning model for senior high school students. The developed medium is designed to integrate economic content presentation, collaborative problem analysis, group discussion, individual assessment, and team recognition into a coherent instructional sequence. The first objective is to determine the feasibility of Interec-STAD through an appropriate validation process. The second objective is to evaluate the practicality of the developed medium for implementation in economics instruction. The third objective is to examine its effectiveness in enhancing students' critical thinking and collaborative skills. The study is expected to contribute to instructional development by specifying the integration of digital learning activities and cooperative learning structures within a medium directed toward cognitive and interpersonal competency development. Its practical contribution concerns the provision of a learning medium and corresponding evaluation evidence that may inform the implementation of interactive and cooperative approaches in secondary-school economics education.

RESEARCH METHODS

This study employed a research and development (R&D) approach to develop and evaluate Interec-STAD, an interactive economics learning medium designed for Grade XI fiscal policy instruction (Sugiyono, 2023). The development process followed the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, which provided the procedural framework for producing and evaluating the instructional medium, as illustrated in Figure 2. Lumio by SMART served as the digital platform for integrating interactive learning content and student participation into the developed medium (Saatiah et al., 2025). The instructional component incorporated the Student Teams Achievement Divisions (STAD) cooperative learning model, which structured learning objectives, content presentation, group discussion, quizzes, and team recognition (Nasution et al., 2024). These instructional activities were integrated with the interactive features of Lumio by SMART to support individual engagement and collaborative learning during economics instruction. The development and evaluation components addressed three principal dimensions: product feasibility, instructional practicality, and effectiveness in enhancing students' critical thinking and collaborative skills.

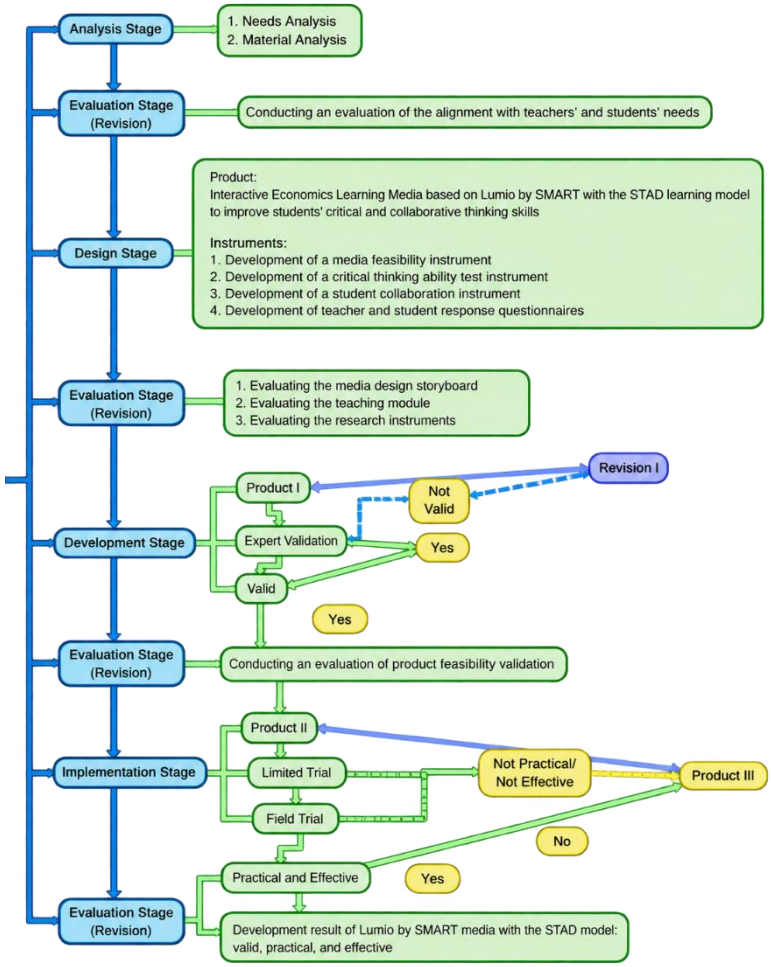


Figure 2. Development Process of Lumio by SMART Interactive Media

The study involved 108 Grade XI students distributed across a limited trial, an experimental class, and a control class. The effectiveness evaluation employed a quasi-experimental pretest–posttest control-group design to examine learning outcomes associated with STAD-based economics instruction (Butar-Butar et al., 2022). Data were collected through interviews, questionnaires, and tests to obtain qualitative and quantitative information relevant to product development, evaluation, and student learning outcomes. Critical thinking was examined as a distinct outcome variable, consistent with research investigating the contribution of web-based interactive learning media to students' reasoning abilities (Saputra et al., 2025). Collaborative skills constituted the second outcome variable, reflecting the role of collaborative learning activities in developing students' participation and critical thinking (Viado & Espiritu, 2023). Qualitative and quantitative analyses were applied to assess product feasibility and practicality, while multivariate analysis of variance (MANOVA) and normalized gain (N-Gain) calculations using SPSS were employed to evaluate critical thinking and collaborative learning outcomes.

RESULTS AND DISCUSSION

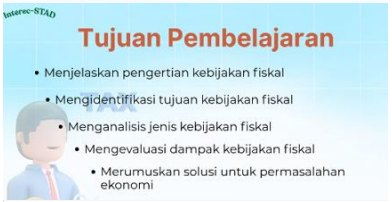
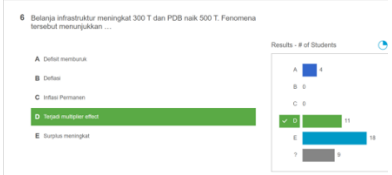
Development and Expert Validation of Interec-STAD Learning Media

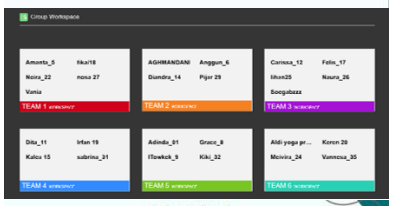
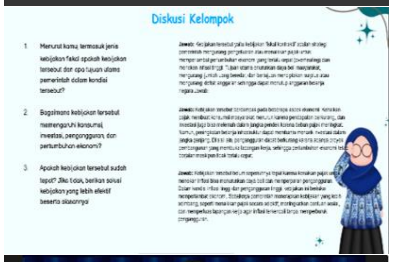
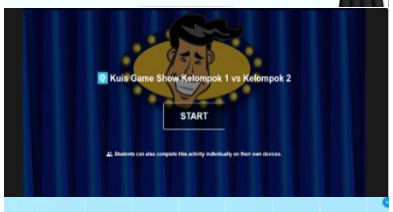
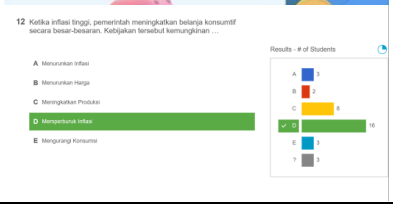
The development of Interec-STAD followed the analysis, design, development, implementation, and evaluation stages of the ADDIE framework to produce interactive learning media for Grade XI fiscal policy instruction. The preliminary analysis drew on classroom observations and interviews conducted at SMA Negeri 6 Yogyakarta. These activities identified continued dependence on lectures and PowerPoint presentations, which provided limited opportunities for active student participation, critical reasoning, and collaborative problem-solving. The documented instructional conditions were treated as development needs rather than as measured effects of conventional teaching.

Research on digital learning in economics indicates the relevance of instructional media that facilitate students' engagement with economic content (Syata et al., 2024). Based on these needs, the developed product combined Lumio by SMART with the Student Teams Achievement Divisions (STAD) cooperative learning model, retaining fiscal policy as its principal subject matter.

The design stage translated the identified instructional needs into a sequence of interactive activities covering the introduction of fiscal policy, learning objectives, initial assessment, content exploration, teamwork, and final assessment. The product incorporated an instructional video on taxation and the Shout It Out prompt asking what would happen to development if citizens did not pay taxes. Students were subsequently directed to the main instructional material and organized into teams through Group Workspace. The group activities required students to discuss assigned problems, while Game Show supported a competitive quiz intended to identify the highest-scoring team. A pretest and posttest were included to document students' understanding before and after instruction. Similar investigations of interactive economics media have described their relevance to students' economic literacy, although such evidence does not independently establish the effectiveness of Interec-STAD (Hasan et al., 2024). The media interfaces and their intended instructional functions are documented in Table 1.

Table 1. Interec-STAD Learning Media Interface and Functions

Media Interface	Function
	Introduces the learning topic, Fiscal Policy.
	Displays the learning objectives.
	Students complete the pretest to establish their initial understanding.
	Embeds a YouTube instructional video about taxation to stimulate students' views.
	Uses Shout It Out to ask: "What would happen to development if people did not pay taxes?"

	Presents the main instructional content on fiscal policy.
	After the presentation, students form teams using Group Workspace.
	Each team discusses the problems presented; members collaborate using Group Workspace.
	Groups complete a Game Show quiz to determine the highest-scoring team.
	Closes the lesson.
	Students complete a posttest to assess their understanding after the lesson.

The developed product was submitted to four validators consisting of university lecturers and educational practitioners for an assessment of content and media quality. The assessment addressed the suitability of instructional material and the presentation characteristics of the digital medium. Table 2 reproduces the mean assessment scores recorded for each validation aspect. Content validation produced a mean of 3.42, whereas media validation reached 3.60. The combined mean was 3.51, with all reported results classified as highly feasible according to the criteria used in the original assessment. Product validation and subsequent revision constitute relevant procedures within educational research and development, particularly when instructional products require evaluation before classroom implementation (Sugiyono, 2023).

Table 2. Validation Results for Interec-STAD Learning Media

Assessment Aspect	Mean Score	Category
Content validation	3.42	Highly feasible
Media validation	3.60	Highly feasible
Overall mean	**3.51**	**Highly feasible**

Source: Primary data, 2026.

The feasibility results were used as a basis for product refinement rather than as evidence of improved student learning outcomes. The first validator identified the need to expand the fiscal policy material beyond the initial presentation of policy instruments. Recommended additions included trade-offs, potential risks of expansionary and contractionary fiscal policy, and a simple aggregate demand formula. These revisions increased the range of issues that students could examine when interpreting the consequences of fiscal policy decisions. The changes were particularly relevant to a learning medium intended to develop analytical reasoning rather than merely facilitate factual recall. Previous research on economics learning media has examined improvements in conceptual understanding, providing a relevant basis for considering the instructional clarity of such content (Mustapa & Santoso, 2025). Figure 3 presents the before-and-after material documentation associated with the first validator's recommendations.



Figure 3. Revisions to Interec-STAD Based on Validator Feedback

The second validator recommended incorporating more current data and examples into the fiscal policy material. The researchers revised the instructional content by adding recent examples intended to connect the presented concepts with observable economic conditions. This revision addressed the contextual relevance of the learning material without modifying the underlying STAD instructional sequence. Attention to contemporary economic information was relevant because the interpretation of fiscal policy requires consideration of the conditions under which particular policy instruments are implemented. Research on interactive economics learning media has similarly examined digital instruction as a means of strengthening students' engagement with economic concepts (Hasan et al., 2024). The documented content revisions are identified in Figure 4, while the complete instructional material is referenced in Appendix 4 of the original study.



Figure 4. Instructional Content Revisions Suggested by Validator 2

The third validator focused on the presentation of relationships among fiscal policy concepts rather than the quantity of instructional content alone. A mind map was subsequently incorporated to represent the conceptual sequence and connections between the policy elements addressed in the lesson.

This revision provided students with an additional visual reference for examining conceptual relationships before discussing economic problems within their respective teams. The function of the mind map within Interec-STAD was primarily organizational, and the available validation data did not isolate its independent contribution to students' learning outcomes. Research on digital mind maps in cooperative learning has examined their relationship with critical thinking development, making visual conceptual organization a relevant pedagogical consideration (Deviani et al., 2025). Within the developed medium, the mind map complemented the existing verbal explanations, prompting questions, and collaborative learning activities. Figure 5 documents the instructional content revision proposed by the third validator.



Figure 5. Instructional Content Revisions Suggested by Validator 3

The fourth validator recommended improving the correspondence between the stated learning objectives and the instructional material presented through Interec-STAD. The researchers subsequently revised the objectives by incorporating the designated Learning Outcomes (CP) and Learning Objectives Sequence (ATP), making the intended instructional progression more focused and consistent with the curriculum. This adjustment addressed curriculum alignment without changing the principal learning outcomes evaluated in the study. Separate evaluations of the media interface identified font type and size as presentation characteristics requiring refinement. Following recommendations from the first and third validators, the original Montserrat font was replaced with Arial to improve consistency, legibility, and readability, reflecting the importance of appropriate visual presentation in interactive learning media development (Annajati & Wikarya, 2023). The revisions concerning curriculum alignment and typography are documented in Figures 5 and 6, respectively.

Learning Materials Before Revision

A. CAPAIAN PEMBELANJARAN

Di akhir fase ini, siswa diharapkan mampu memahami konsep kebijakan fiskal serta dapat menganalisis peran kebijakan fiskal dalam mengatasi permasalahan ekonomi.

B. TUJUAN PEMBELAJARAN

1. Peserta didik diharapkan mampu memahami konsep kebijakan fiskal yaitu pengertian, jenis, dan tujuannya.
2. Peserta didik diharapkan mampu menganalisis hubungan kebijakan fiskal dengan APBN, pajak, investasi, dan pertumbuhan ekonomi.
3. Peserta didik diharapkan mampu memahami dampak kebijakan fiskal terhadap kondisi ekonomi
4. Peserta didik diharapkan mampu menemukan solusi kebijakan fiskal terhadap permasalahan ekonomi

Learning Materials After Revision

A. CAPAIAN PEMBELANJARAN

Pada akhir fase ini, peserta didik mampu memahami dan menjelaskan berbagai konsep dasar ekonomi. Peserta didik memahami peranan akuntansi sebagai alat bantu dalam pengambilan keputusan keuangan dan ekonomi. Peserta didik mengidentifikasi berbagai permasalahan ekonomi yang terjadi di lingkungan sekitar serta mampu menjelaskan dampak dari permasalahan ekonomi yang sedang terjadi berdasarkan konsep yang sudah dipelajari. Konsep-konsep yang diharapkan dipahami peserta didik pada fase ini yaitu Badan Usaha dalam konteks perekonomian di Indonesia (BUMN, BUMS, BUMD, Koperasi, dan Manajemen Badan Usaha), Akuntansi Keuangan Dasar dalam konteks penerapannya pada salah satu bentuk badan usaha di Indonesia (Transaksi Bisnis Perusahaan, Persamaan Dasar Akuntansi, dan Siklus Akuntansi), Pendapatan Nasional dalam konteks mengidentifikasi masalah kesenjangan ekonomi serta solusi untuk mengatasinya, Pertumbuhan dan Pembangunan Ekonomi, Ketenagakerjaan dalam konteks mengidentifikasi berbagai masalah pengangguran dan pengupahan serta solusi untuk mengatasinya, Teori Uang, Indeks Harga dan Inflasi, Pasar Uang dan Ekonomi Digital, Kebijakan Moneter dan Kebijakan Fiskal (Anggaran Negara dan Anggaran Daerah), Perpajakan, dan Ekonomi Internasional.

B. ALUR TUJUAN PEMBELAJARAN

1. Peserta didik memahami konsep dasar kebijakan fiskal, APBN, pajak, dan belanja negara.
2. Peserta didik menganalisis peran kebijakan fiskal dalam menjaga stabilitas ekonomi nasional.
3. Peserta didik menginterpretasikan data APBN untuk memahami kondisi perekonomian.
4. Peserta didik mengevaluasi dampak kebijakan fiskal terhadap masyarakat dan ekonomi.

Figure 6. Revisions to Learning Outcomes (CP) and Learning Objectives Sequence (ATP)



Figure 7. Font Revisions Based on Validator Feedback

The fourth validator also recommended incorporating an instructional video relevant to fiscal policy to support the explanation of concepts presented in the lesson. The researchers included the video within the digital medium, extending the available formats for presenting instructional content. This addition was intended to provide students with another means of examining fiscal policy concepts before participating in structured team discussions and collaborative activities. Research on Lumio-based interactive learning media has addressed the role of multimedia presentation in supporting students' learning motivation, providing a relevant reference for the integration of instructional videos into digital learning activities (Saatiah et al., 2025). Figure 9 documents the addition of the instructional video, with supplementary information identified in Appendix 8 of the original study. The sequence of expert-recommended revisions addressed conceptual completeness, currency of economic information, curriculum alignment, visual readability, and variation in instructional presentation. Following these revisions, the developed product proceeded toward classroom trials, while evidence concerning its practicality and effectiveness was obtained through subsequent evaluation activities.



Figure 8. Addition of an Instructional Video

Practicality of Interec-STAD Learning Media

The practicality assessment examined the extent to which Interec-STAD could be implemented and used by teachers and students during Grade XI fiscal policy instruction. A limited product trial was conducted with 36 students from Class XI-F3 at SMA Negeri 6 Yogyakarta. The trial produced a mean assessment score of 3.49, classified as very good according to the criteria applied in the original study. The evaluation considered students' responses to the interactive interface, instructional content, navigation, and opportunities for participation in learning activities. Previous research has identified student interest and motivation as relevant considerations in evaluating the implementation of interactive digital learning media (Ali et al., 2025). The reported trial findings provided preliminary evidence of product acceptance and usability, although favorable responses to instructional media should not be interpreted as direct evidence of improved learning outcomes.

Students' responses indicated favorable perceptions of the visual presentation and ease of navigation provided by Interec-STAD. The organization of fiscal policy materials was considered understandable because instructional content was presented through a structured sequence of explanations, interactive activities, and assessments. Clear instructions facilitated students' access to learning activities without requiring extensive adjustments to the instructional sequence. Shout It Out enabled students to submit their responses and examine opinions contributed by their classmates during

discussions. Group Workspace provided a shared digital environment in which students could exchange ideas and participate in collaborative assignments. Research examining Lumio-based interactive multimedia has similarly emphasized student engagement as an important consideration in evaluating digital learning environments (Noprianty & Jasiah, 2025). These characteristics suggest that the perceived practicality of Interec-STAD was associated with both interface accessibility and the instructional functions supporting student participation.

Practicality was subsequently evaluated through assessments completed by teachers and students to examine the usability of the developed medium in classroom instruction. The teacher assessment produced a mean score of 3.34, categorized as practical according to the assessment criteria. Student assessments yielded a slightly higher mean score of 3.43, which was also classified as practical. The reported combined practicality score was 3.37, indicating that Interec-STAD met the established practical category, as presented in Table 3. Research on digital learning platforms has emphasized the relevance of instructional accessibility and collaborative functionality when examining the application of technology-supported learning environments (Febrian & Nasution, 2024). These assessment results provide a basis for evaluating user acceptance of the developed medium without assuming that practicality ratings directly represent improvements in critical thinking or collaborative skills.

Table 3. Practicality Assessment Results for Interec-STAD

Evaluator	Mean Score	Category
Teacher	3.34	Practical
Students	3.43	Practical
Overall mean	**3.37**	**Practical**

Source: Primary data, 2026.

The results presented in Table 3 indicate that teachers and students assigned Interec-STAD practicality scores within the same assessment category. Student evaluations were numerically higher than teacher evaluations, although the available results do not identify the specific questionnaire items responsible for this difference. The distinction is relevant because instructional media must accommodate the operational requirements of teachers and the learning experiences of students. The reported teacher rating suggests that the product was considered usable for classroom instruction, while student ratings indicate favorable acceptance among the participating learners. Studies of technology-supported economics instruction have examined the contribution of interactive platforms to students' conceptual understanding, demonstrating the relevance of evaluating digital media within subject-specific instructional activities (Mustapa & Santoso, 2025). Nevertheless, the practical classification obtained in this study establishes perceived usability under the reported implementation conditions rather than universal suitability across different schools. The consistency of the assessment categories provides supporting evidence for the product's classroom applicability, while the differences between evaluator scores warrant consideration when interpreting its practical performance.

The limited trial provided additional information concerning students' evaluations of individual aspects of the learning medium. The reported assessment scores ranged from 3.27 to 3.65, with an overall mean of 3.49, indicating a very good classification. As illustrated in Figure 9, most student ratings exceeded 3.4, reflecting generally favorable evaluations of the interactive learning experience. Students particularly appreciated the visual interface, clear instructions, straightforward navigation, and contextual presentation of fiscal policy materials. Previous research on interactive learning media has examined the relationship between digital instructional features and students' learning motivation, supporting the relevance of user responses in evaluating classroom media (Munawir et al., 2024). However, the variation in recorded scores cannot independently establish the contribution of each media component to students' assessments because the available summary does not provide an item-level analysis of these relationships.

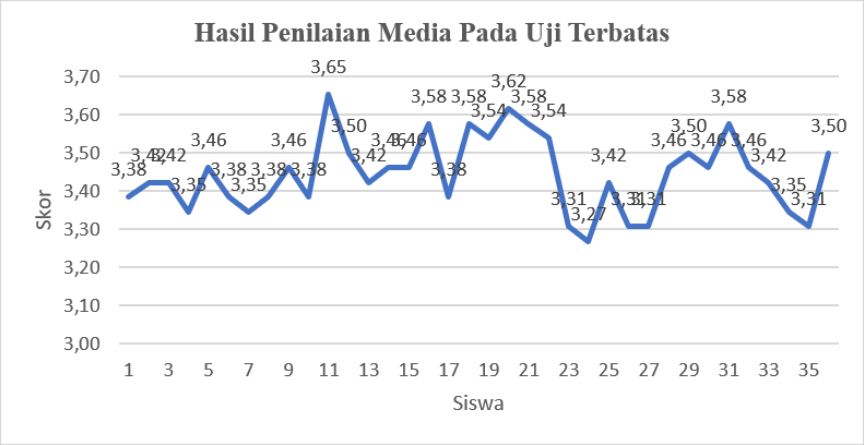


Figure 9. Results of the Limited Trial of Interec-STAD
Source: Primary data, 2026.

The practical value of Interec-STAD was particularly associated with interactive functions that supported student communication and the completion of collaborative assignments. Shout It Out enabled students to contribute individual responses to discussion prompts, allowing their ideas to become accessible to other learners during classroom activities. Group Workspace facilitated the exchange of information and contributions among students working on shared learning tasks. Research on digital tools in secondary education has identified their relevance to collaborative learning activities, particularly when instructional technologies provide opportunities for interaction among learners (Oskarita & Arasy, 2024). Nevertheless, the availability of collaborative features does not independently establish the quality of student interaction, as meaningful collaboration also depends on the organization and characteristics of assigned activities (Ransanz Reyes et al., 2025). The favorable responses obtained during the limited trial indicate that students considered these interactive functions useful for participating in learning activities. Such evidence supports the product's practicality while remaining distinct from direct measurements of collaborative performance.

The favorable practicality assessments should also be considered alongside the technological and instructional conditions required for implementation. As a website-based learning medium, Interec-STAD depends on internet connectivity and access to digital devices during classroom activities. The integration of content presentation, group discussion, interactive questions, and assessment activities also requires coordination within the STAD instructional sequence. Research on digitalization in education has identified technological adaptation and instructional innovation as interconnected considerations in implementing digital learning resources (Indrasari et al., 2024). Although the participating teachers and students assigned favorable practicality ratings, the available findings do not establish whether the same evaluations would be obtained under different infrastructure conditions. The assessment was conducted within a single school, limiting the extent to which its practicality findings can be generalized to institutions with different technological resources or instructional arrangements.

Evidence from the limited trial and teacher-student assessments indicates that Interec-STAD received favorable evaluations regarding its use in fiscal policy instruction. The limited-trial mean of 3.49 was categorized as very good, while the reported overall practicality mean of 3.37 was categorized as practical. Positive student responses concerned the clarity of instructional materials, interface accessibility, and opportunities to participate through Shout It Out and Group Workspace. These features provided instructional arrangements through which students could communicate their responses and participate in team-based learning activities. Research examining cooperative learning has emphasized the relationship between structured student participation and engagement, providing a relevant basis for interpreting the instructional significance of such interactive functions (Nguyen & Oanh, 2025). However, perceived practicality should remain analytically distinct from evidence of effectiveness because favorable user experiences do not necessarily establish statistically significant improvements in learning competencies. The effectiveness of Interec-STAD in enhancing critical thinking and collaborative skills is therefore examined through the pretest–posttest comparisons, multivariate analysis, and normalized gain calculations presented in the following section.

Effectiveness of Interec-STAD in Enhancing Critical Thinking and Collaborative Skills

The field evaluation examined the effectiveness of Interec-STAD in supporting critical thinking and collaborative skills among Grade XI students studying fiscal policy. Two classes at SMA Negeri 6 Yogyakarta participated in the evaluation, comprising 36 students in the experimental class and 36 students in the control class. The experimental class received STAD instruction supported by Interec-STAD, whereas the control class received STAD instruction without the interactive learning medium. Instruction was conducted over three meetings, with pretest and posttest assessments used to examine changes in both learning outcomes. This comparison was designed to evaluate the additional contribution associated with interactive digital media within a shared cooperative learning structure rather than compare STAD with conventional instruction. Previous research on STAD in economics education has examined achievement-related outcomes, providing a relevant foundation for investigating the model's application to critical thinking and collaborative competencies (Butar-Butar et al., 2022).

The descriptive results indicated differences in students' critical thinking and collaborative skills between the experimental and control classes before and after instruction. The experimental class recorded a mean critical thinking pretest score of 69.25, which increased to 87.19 following the implementation of Interec-STAD. In comparison, the control class obtained a mean pretest score of 67.66 and a posttest score of 76.61 for the same competency. Collaborative skills in the experimental class increased from a mean score of 54.61 to 70.13, while the control class recorded an increase from 55.77 to 60.33. These results indicate that both classes experienced improvements, although the experimental class demonstrated larger observed increases in the two assessed competencies. The descriptive comparisons are presented in Table 4, which documents the initial and final mean scores for each group. Research examining critical thinking in economics education has emphasized the importance of understanding the conditions associated with students' reasoning abilities, supporting the relevance of evaluating changes in these competencies through instructional assessment (Suciono et al., 2021).

Table 4. Mean Pretest and Posttest Scores in Experimental and Control Classes

Outcome	Group	Pretest	Posttest
Critical thinking	Experimental	69.25	87.19
	Control	67.66	76.61
Collaborative skills	Experimental	54.61	70.13
	Control	55.77	60.33

Source: Primary data, 2026.

The results in Table 4 show that the experimental class achieved higher posttest scores than the control class for both critical thinking and collaborative skills. Nevertheless, differences in initial performance require consideration because the experimental class began with a higher critical thinking mean, whereas the control class had a slightly higher collaborative skills mean. The multivariate pretest comparison produced Pillai's trace of 0.057 with a significance value of 0.134, indicating no statistically significant overall multivariate difference between the classes before instruction. However, the univariate analysis of initial critical thinking scores yielded a significance value of 0.048, identifying a statistically significant baseline difference for this particular outcome. The absence of a significant multivariate difference cannot be interpreted as evidence that the two classes were equivalent across all measured competencies, particularly when an individual outcome exhibited a detectable initial difference. Research investigating the factors associated with students' critical thinking abilities further indicates the relevance of considering differences in learner characteristics when interpreting educational outcomes (Huda et al., 2024).

Assumption testing was conducted before interpreting the multivariate analysis of variance used to compare the experimental and control classes. The Shapiro–Wilk normality tests produced significance values greater than 0.05 for the pretest and posttest data in both groups, indicating that the reported tests did not identify statistically significant departures from normality. Box's M tests yielded significance values of 0.121 for the pretest and 0.638 for the posttest, providing no statistically

significant evidence against homogeneity of covariance matrices at the conventional 0.05 level. However, Levene's test for the collaborative skills pretest produced a significance value of 0.018, indicating that the homogeneity of variance assumption was not satisfied for this variable. The MANOVA results presented in Table 5 show a nonsignificant multivariate difference at pretest and a statistically significant difference at posttest. Specifically, the posttest analysis produced Wilks' lambda of 0.225 with $p < 0.001$ and partial eta squared of 0.775, representing a large multivariate effect-size estimate rather than a direct measure of percentage improvement attributable to the intervention. Evaluating critical thinking and collaboration as distinct but related learning outcomes is consistent with contemporary educational research emphasizing the assessment of multiple competencies beyond conventional academic achievement (Thornhill-Miller et al., 2023).

Table 5. Summary of MANOVA Results

Comparison	Statistic	Value	p value
Between-group pretest	Pillai's trace	0.057	0.134
Between-group posttest	Wilks' lambda	0.225	< 0.001
Between-group posttest	Partial eta squared	0.775	—

Source: Primary data, 2026.

The posttest MANOVA findings indicate that the experimental and control classes differed significantly when critical thinking and collaborative skills were analyzed simultaneously. Subsequent univariate analyses identified statistically significant posttest differences in critical thinking, with $F = 206.875$ and $p < 0.001$, and collaborative skills, with $F = 24.141$ and $p < 0.001$. These results were consistent with the descriptive differences reported in Table 4, where students receiving Interec-STAD obtained higher final mean scores for both competencies. The findings suggest an association between the use of interactive learning media and stronger measured outcomes when the medium was implemented alongside the STAD cooperative learning model. Nevertheless, the quasi-experimental design and the significant initial difference in critical thinking restrict the extent to which the observed outcomes can be attributed exclusively to Interec-STAD without further adjustment for baseline differences. Research examining digital tools in secondary education provides a relevant pedagogical comparison by identifying technology-supported interaction as an instructional consideration in the development of collaborative learning opportunities (Oskarita & Arasy, 2024).

Normalized gain analysis was used to assess changes in critical thinking and collaborative skills relative to the maximum improvement attainable from students' initial scores. For critical thinking, the experimental class obtained a mean N-Gain of 0.5895, categorized as moderate, whereas the control class recorded 0.2790, categorized as low. In collaborative skills, the experimental class achieved a mean N-Gain of 0.5204, also classified as moderate, while the control class obtained 0.0302, categorized as low. These reported results, summarized in Table 6, indicate greater normalized score improvement in the experimental class for both measured outcomes. The differences between groups were particularly evident in collaborative skills, where the reported N-Gain for the experimental class exceeded that of the control class despite the latter having a slightly higher mean pretest score. Nevertheless, normalized gain provides a descriptive measure of relative improvement and does not independently account for possible group-selection effects or differences in initial competencies. Research on web-based interactive learning media and critical thinking offers a relevant point of comparison for interpreting improvement in reasoning performance while recognizing that the contribution of individual instructional features requires separate evaluation (Saputra et al., 2025).

Table 6. Mean N-Gain for Critical Thinking and Collaborative Skills

Outcome	Experimental	Category	Control
Critical thinking	0.5895	Moderate	0.2790
Collaborative skills	0.5204	Moderate	0.0302

Source: Primary data, 2026.

The differences in measured outcomes can be considered in relation to the instructional activities integrated into Interec-STAD, although the evaluation did not isolate the independent effects of individual media features. Shout It Out provided opportunities for students to formulate responses to fiscal policy questions, examine classmates' opinions, and participate in exchanges concerning economic problems. Group Workspace supported team-based discussion and the completion of collaborative assignments, connecting the interactive medium with the cooperative structure established through STAD. Game Show introduced an assessment activity through which groups could review instructional content and participate in a competitive learning exercise. These features distinguished the experimental class from the control class by providing additional digital mechanisms for participating in activities organized around the same cooperative learning model. Research on collaborative activity design in technology-supported education similarly emphasizes the relevance of task organization, interaction opportunities, and participation structures to the quality of collaborative learning experiences (Ransanz Reyes et al., 2025).

The reported findings indicate that Interec-STAD was associated with higher final scores and greater normalized gains in critical thinking and collaborative skills compared with STAD instruction without the interactive medium. The significant multivariate and univariate posttest results provide statistical support for differences between the two instructional conditions, while the N-Gain findings describe the relative magnitude of improvement reported for each group. These results extend the product evaluation beyond feasibility and practicality by examining learning outcomes following classroom implementation. However, the study was conducted in one school, involved two classes, and covered three instructional meetings, limiting the generalizability of the findings to other educational settings and implementation periods. The initial difference in critical thinking, the nonrandomized instructional comparison, and the variance-homogeneity issue identified for the collaborative skills pretest also require caution when interpreting the magnitude and causal meaning of the observed differences. Research examining interactive multimedia technologies and the development of twenty-first-century competencies supports continued investigation of cognitive and collaborative outcomes across different instructional environments (Buriyeva, 2025). Further evaluations involving additional schools, larger samples, longer instructional periods, and analytical procedures accounting for initial group differences would provide a stronger basis for determining the consistency and transferability of Interec-STAD's effectiveness.

CONCLUSION

The development of Lumio by SMART-based Interec-STAD using the ADDIE model produced interactive fiscal policy learning media integrated with the Student Teams Achievement Divisions (STAD) cooperative learning model. The developed medium incorporated instructional videos, contextual economic materials, Shout It Out, Group Workspace, interactive quizzes, and individual assessments to support structured cooperative learning activities. Expert validation yielded a mean score of 3.51, classified as highly feasible, indicating that the instructional content and media design satisfied the established feasibility criteria. Teacher and student practicality assessments produced an overall mean score of 3.37, categorized as practical, reflecting favorable evaluations of the medium's classroom usability. The limited trial involving 36 students also produced a mean score of 3.49, classified as very good, with positive responses concerning navigation, instructional clarity, and interactive learning features. These findings establish the feasibility and perceived practicality of Interec-STAD for Grade XI fiscal policy instruction, while distinguishing product quality assessments from evidence of improvements in students' learning competencies.

The effectiveness evaluation showed moderate N-Gain values in the experimental class for critical thinking (0.5895) and collaborative skills (0.5204), compared with low gains in the control class (0.2790 and 0.0302, respectively). The posttest MANOVA indicated a statistically significant multivariate difference between groups (Wilks' lambda = 0.225, $p < 0.001$; partial eta squared = 0.775), with higher final mean scores observed in the experimental class for both competencies. These results suggest that integrating interactive digital media with STAD instruction was associated with stronger critical thinking and collaborative performance than implementing STAD without the developed medium. Nevertheless, the initial difference in critical thinking, nonrandomized group allocation, and limited instructional duration restrict the extent to which these differences can be attributed exclusively to Interec-STAD. The involvement of only two classes from a single school and the focus on fiscal

policy instruction further limit the generalizability of the findings to other educational settings and economics topics. Future research should examine Interec-STAD across broader student populations, different instructional materials, and longer implementation periods while applying analytical procedures that account for baseline differences between comparison groups.

REFERENCES

Ali, A., Venica, S. D., Aini, W., & Hidayat, A. F. (2025). Efektivitas media pembelajaran interaktif dalam meningkatkan minat dan motivasi belajar siswa sekolah dasar. *Journal of Information System and Education Development, 3*(1), 1–6. https://doi.org/10.62386/jised.v3i1.115

Annajati, S., & Wikarya, Y. (2023). Pengembangan media pembelajaran pembelajaran interaktif berbasis Google Slide pada materi seni rupa tiga dimensi kelas X SMA Negeri 8 Mukomuko. *Jurnal Pendidikan Tambusai, 7*(1), 1181–1188. https://doi.org/10.31004/jptam.v7i1.5405

Buriyeva, K. E. (2025). Interactive multimedia technologies as a means of developing 4C skills in literary education. *Jurnal Pendidikan Multimedia (Edsence), 7*(1), 73–82. https://doi.org/10.17509/edsence.v7i1.81595

Butar-Butar, N. D., Mursid, R., & Tanjung, S. (2022). The effect of STAD type cooperative learning model with TGT type and achievement motivation on economic learning outcomes. In *Proceedings of the 7th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2022)*. European Alliance for Innovation. https://doi.org/10.4108/eai.20-9-2022.2324807

Choir, R. A., Maryani, M., & Ernasari, E. (2025). The impact of discovery learning model with Lumio by SMART on high school students' engagement and learning outcomes in static fluids. *KONSTAN: Jurnal Fisika dan Pendidikan Fisika, 9*(2), 180–193. https://doi.org/10.20414/konstan.v9i02.643

Deviani, I., Gumilar, G., & Sadiah, A. (2025). Peningkatan kemampuan berpikir kritis siswa melalui penerapan model pembelajaran kooperatif tipe Group Investigation berbantuan digital mind map. *COSMOS: Jurnal Ilmu Pendidikan, Ekonomi dan Teknologi, 2*(3), 616–626. https://garuda.kemdiktisaintek.go.id/documents/detail/5067028

Febrian, M. A., & Nasution, M. I. P. (2024). Efektivitas penggunaan Google Sites sebagai media pembelajaran kolaboratif: Perspektif teoritis dan praktis. *Al-I'tibar: Jurnal Pendidikan Islam, 11*(2), 152–159. https://doi.org/10.30599/jpia.v11i2.3590

Fitrianto, I., & Hidayat, A. M. (2024). Critical reasoning skills: Designing an education curriculum relevant to social and economic needs. *International Journal of Post Axial: Futuristic Teaching and Learning, 2*(4), 245–258. https://doi.org/10.59944/postaxial.v2i4.393

Harianto, B. B. (2024). Embracing cooperative learning for critical thinking and enhanced learning outcomes. *East Asian Journal of Multidisciplinary Research, 3*(5), 1709–1720. https://doi.org/10.55927/eajmr.v3i5.9325

Hasan, M., Anugrawati, A., Nurjannah, Ampa, A. T., & Ahmad, M. I. S. (2024). Interactive learning media through Nearpod to increase the economic literacy of students at the high school level. *Jurnal Edutech Undiksha, 12*(1), 75–88. https://doi.org/10.23887/jeu.v12i1.76712

Hendi, A., Caswita, C., & Haenilah, E. Y. (2020). Pengembangan media pembelajaran interaktif berbasis strategi metakognitif untuk meningkatkan kemampuan berpikir kritis siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 4*(2), 823–834. https://doi.org/10.31004/cendekia.v4i2.310

Huda, N., Watung, S. R., Faresi, G. M. F., Laratmase, A. J., & Patty, J. (2024). Pengaruh self-efficacy dan metakognitif self-regulation terhadap kemampuan berpikir kritis siswa SMA Negeri 10 Malang. *Cetta: Jurnal Ilmu Pendidikan, 7*(4), 143–152. https://doi.org/10.37329/cetta.v7i4.3518

Indrasari, M., Wajdi, M. B. N., Prasnowo, M. A., Pamuji, E., Winarko, B., & Fatadona, H. (2024). The digitalization policy in the education sector: Innovation and adaptation. *Journal of Social Political Sciences, 5*(3), 236–251. https://doi.org/10.52166/jsps.v5i3.241

Junita, J., & Wardani, K. W. (2020). Efektivitas model pembelajaran STAD dan CIRC terhadap peningkatan keterampilan kolaborasi siswa kelas V SD Gugus Joko Tingkir pada mata pelajaran tematik. *JPDI (Jurnal Pendidikan Dasar Indonesia), 5*(1), 11–17. https://doi.org/10.26737/jpdi.v5i1.1688

Latifah, A., & Kartika, I. (2023). Collaborative learning in the digital era: Strategies to prepare primary school students to face the challenges of the 21st century. *Sunan Kalijaga International Journal on Islamic Educational Research, 7*(1), 67–76. https://doi.org/10.14421/skijier.2023.71.07

Lutfiana, R. F., Zuriah, N., & Saputri, D. K. N. (2023). The TPACK approach improves student collaboration skills in 21st-century learning. *Jurnal Pedagogi dan Pembelajaran, 6*(2), 274–282. https://doi.org/10.23887/jp2.v6i2.52845

Muawiyah, S. N. (2024). Fostering creative and critical thinking skills through collaborative learning: A theoretical approach. *International Student Conference on Business, Education, Economics, Accounting, and Management (ISC-BEAM), 1*(1), 612–620. https://doi.org/10.21009/ISC-BEAM.011.43

Mubarrok, A., Waluyo, S. B., Dewi, N. R., Zaenuri, Z., Walid, W., Agoestanto, A., & Sugiman, S. (2025). Peran media pembelajaran interaktif terhadap kemampuan berpikir kritis siswa. *PRISMA, Prosiding Seminar Nasional Matematika, 8*, 51–63. https://proceedings.unnes.ac.id/prisma/article/view/4299

Mulyani, A. Y. (2022). Pengembangan critical thinking dalam peningkatan mutu pendidikan di Indonesia. *DIAJAR: Jurnal Pendidikan dan Pembelajaran, 1*(1), 100–105. https://doi.org/10.54259/diajar.v1i1.226

Munawir, M., Rofiqoh, A., & Khairani, I. (2024). Peran media interaktif dalam meningkatkan motivasi belajar siswa pada mata pelajaran SKI di Madrasah Ibtidaiyah. *Jurnal Al-Azhar Indonesia Seri Humaniora, 9*(1), 63–71. https://doi.org/10.36722/sh.v9i1.2828

Mustapa, A., & Santoso, J. T. B. (2025). Efektivitas media pembelajaran berbasis Google Sites dalam meningkatkan pemahaman konsep siswa kelas X. *Jurnal Pendidikan Ekonomi (JUPE), 13*(3), 259–272. https://doi.org/10.26740/jupe.v13n3.p259-272

Nasution, M., Rusdi, R., & Nasution, A. (2024). Development of the STAD cooperative learning model: Enhancing mathematical reasoning and communication skills in higher education. *Jurnal Kependidikan, 10*(1), 325–337. https://doi.org/10.33394/jk.v10i1.10784

Nguyen, T. N. T., & Oanh, D. T. K. (2025). Cooperative learning and its influences on student engagement. *Cogent Education, 12*(1), Article 2513414. https://doi.org/10.1080/2331186X.2025.2513414

Noprianty, A., & Jasiah. (2025). Multimedia interaktif berbasis web LUMIO by Smart sebagai metode alternatif dalam meningkatkan keterlibatan santri pada pembelajaran PAI. *At-Tarbiyah: Jurnal Penelitian dan Pendidikan Agama Islam, 2*(2), 119–126. https://journal.staittd.ac.id/index.php/at/article/view/278

Oskarita, E., & Arasy, H. N. (2024). The role of digital tools in enhancing collaborative learning in secondary education. *International Journal of Educational Research, 1*(1), 26–32. https://doi.org/10.62951/ijer.v1i1.15

Rahayu, I. M. P., Nasution, N., & Mustaji, M. (2023). Development of digital student worksheets with the discovery learning model to improve collaboration skills and results for elementary school students: Literature review. *International Journal of Emerging Research and Review, 1*(4), Article 000054. https://doi.org/10.56707/ijoerar.v1i4.54

Ransanz Reyes, E., Arana-Cuenca, A., & Manzanal Martínez, A. I. (2025). Recommendations for designing collaborative activities in online higher education: A systematic review. *Journal of Technology and Science Education, 15*(1), 4–17. https://doi.org/10.3926/jotse.2818

Saatiah, S., Ahyar, A., & Fitrianingsih, N. (2025). Pengembangan media pembelajaran interaktif berbasis Lumio untuk meningkatkan motivasi belajar siswa. *Jurnal Pendidikan Teknologi Informasi dan Vokasional, 7*(1), 57–68. https://doi.org/10.23960/jptiv.v7i1.30067

Saputra, A. R., Murti, R. C., & Hastuti, W. S. (2025). The effect of web-based interactive learning media on critical thinking skills of elementary school students. *Jurnal Prima Edukasia, 13*(1), 159–168. https://doi.org/10.21831/jpe.v13i1.75228

Schunk, D. H. (2012). *Learning theories: An educational perspective* (6th ed.). Pearson Education.

Sidi, P. (2020). DiscoBlog untuk meningkatkan keterampilan kolaborasi dan prestasi belajar ekonomi bisnis siswa kelas X AKL 2 SMK N 1 Sukoharjo. *Jurnal Pendidikan Ilmu Sosial, 30*(2), 141–150. https://doi.org/10.23917/jpis.v30i2.11011

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice* (2nd ed.). Allyn & Bacon.

Suciono, W., Rasto, R., & Ahman, E. (2021). Analisis faktor-faktor yang mempengaruhi keterampilan berpikir kritis siswa dalam pembelajaran ekonomi era revolusi 4.0. *SOCIA: Jurnal Ilmu-Ilmu Sosial, 17*(1), 48–56. https://doi.org/10.21831/socia.v17i1.32254

Sugiyono. (2023). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Alfabeta.

Syata, W. M., Sabillah, B. M., Damayanti, D., Subur, H., & Lewa, M. J. (2024). Optimalisasi media digital dalam pembelajaran ekonomi. *Jurnal Pendidikan Dasar dan Keguruan, 9*(2), 22–27. https://doi.org/10.47435/jpdk.v9i02.3175

Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J.-M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: Assessment, certification, and promotion of 21st century skills for the future of work and education. *Journal of Intelligence, 11*(3), Article 54. https://doi.org/10.3390/jintelligence11030054

Viado, A. L., & Espiritu, J. A. (2023). The collaborative-individual learning in improving the critical thinking skills of secondary students in the Philippines. *International Journal of Multidisciplinary: Applied Business and Education Research, 4*(7), 2592–2600. https://doi.org/10.11594/ijmaber.04.07.35

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Yuliana, D., Baijuri, A., Suparto, A. A., Seituni, S., & Syukria, S. (2023). Pemanfaatan aplikasi Canva sebagai media video pembelajaran kreatif, inovatif, dan kolaboratif. *Jurnal Pendidikan Teknologi Informasi (JUKANTI), 6*(2), 247–257. https://doi.org/10.37792/jukanti.v6i2.1025

Zou, Y., Kuek, F., Feng, W., & Cheng, X. (2025). Digital learning in the 21st century: Trends, challenges, and innovations in technology integration. *Frontiers in Education, 10*, Article 1562391. https://doi.org/10.3389/feduc.2025.1562391