



Development of Project Assessment Instruments Based on E-Portfolio to Measure High School Student's Creative Thinking Skills

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Abstract: This study aims to develop an e-portfolio-based project assessment instrument for economics learning that can measure high school students' creative thinking skills. The research employed a Research and Development (R&D) method using a modified 4D development model, consisting of the Define, Design, and Develop stages, followed by field testing. The research instruments included interview guidelines, validation sheets, creative thinking skills assessment rubrics, and response questionnaires. The research subjects consisted of three expert validators and 28 tenth-grade high school students in Jayapura City. The validity of the developed instrument was analyzed using Aiken's V coefficient, resulting in an average value of 0.83, indicating a high level of validity. The field test results showed that students' creative thinking skills were categorized as creative and highly creative. The internal consistency analysis using Cronbach's Alpha produced a reliability coefficient of 0.89, indicating a high reliability level. The practicality evaluation based on student and teacher responses obtained a score of 92.5%, demonstrating that the instrument was practical for implementation. Furthermore, the effectiveness analysis was conducted by comparing pretest and posttest scores using normalized gain (N-Gain) analysis, which resulted in a gain score of 0.57, categorized as moderately effective. Therefore, the developed e-portfolio-based project assessment instrument is considered valid, reliable, practical, and effective for measuring students' creative thinking skills in high school economics learning.

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Introduction

Creativity is a key competency that is crucial for addressing global challenges, technological advancements, and the complexity of social issues in today's world. Education faces the challenge of ensuring that students develop higher-order thinking skills and the ability to generate innovative solutions to prepare them for technological advancements and the dynamic nature of social life. In the current educational context, the performance of Indonesian students, as summarized in the OECD's 2022 PISA report, indicates that their literacy and numeracy skills remain in the "low" category. This report indirectly suggests that students' creative thinking skills remain low due to learning and assessment methods that still rely on traditional models. Meanwhile, the Merdeka Curriculum, with its deep learning practices, emphasizes shifting learning styles and assessments from traditional methods to learning based on HOTS (High Order Thinking Skills) (Kemendikbudristek, 2022).



Therefore, the assessment system needs to be developed to include efficient, valid measures of students' creative thinking skills that are capable of accurately assessing those skills.

Current learning trends indicate that students remain passive recipients. This finding is reinforced by the results of an initial observation at a high school in Jayapura, where learning is still dominated by lecture methods and uses evaluation in the form of written tests, so assessments for higher-order thinking skills such as creative thinking skills have not been well applied in the classroom. Educators also explained that creating assessment instruments that measure creative thinking skills is very complex because it requires clear indicators and adequate validation and reliability testing. These limitations indicate the need to develop valid and reliable assessment instruments, particularly in economics courses, to measure students' creative thinking skills. This phenomenon not only occurs in a local context, but also becomes a global challenge where assessments measuring creativity still face problems of subjective evaluation, implementation efficiency, and limitations in digital technology integration (Rafner et al., 2022). This condition causes students' creative thinking skills to still not be optimally explored because assessments have not been able to capture aspects of originality, flexibility, and fluency objectively and consistently.

Creative thinking skills are the ability to create something new as the ability to see new things from elements that already exist (Purba, 2025). Creative thinking refers to students' ability to generate and develop ideas or alternative solutions (Muthalib et al., 2024). Creativity can be influenced by several factors such as the ability to see problems from different perspectives, knowledge, diversity of thinking patterns, motivation, environmental support, and individual personality towards situations (Putri & Alberida, 2022). Therefore, creative thinking skills need to be measured to determine the extent to which students are able to apply knowledge, particularly economic material, creatively in real life. One relevant technique to measure creative thinking skills is project-based assessment because it allows students to demonstrate the ability to plan, develop, and produce solutions (Afifah & Zhara, 2024). The implementation of e-portfolios in learning is considered effective in increasing student participation, reflective ability, and creativity because students can demonstrate a more complete learning process and work results (Syatriana et al., 2025).

On the other hand, advancements in digital technology provide opportunities to create more authentic and continuous assessment systems through the use of e-portfolios (Chisango, 2024). Thus, learning assessments such as projects can be implemented using digital tools like e-portfolios, thereby supporting the statement in the Merdeka curriculum that learning must be literate in the use of technology. Research conducted by Utama et al., (2021) shows that instruments for creative thinking ability can be considered to have met the requirements with very good and excellent quality if they have gone through expert validation. Research conducted by Hadiana and Muhtadi, (2025) indicates that using project-based e-portfolios can increase student engagement in learning and improve students' creative thinking skills. Previous research has focused more on the effectiveness of creative thinking skills, while the development of project assessment instruments by integrating creative thinking abilities such as fluency, flexibility, originality, and elaboration in the economic learning criteria is still limited. In addition, previous research generally developed project assessment instruments to measure creative thinking skills in other subjects, such as physics, chemistry, and others



(Fardhila & Istiyono, 2019), Meanwhile, in economic learning, the development of project assessment instruments that specifically measure creative thinking skills, particularly on the material of analyzing banking and non-banking financial institutions, has not yet been found.

Various studies have developed project assessment instruments using different development models. Based on the problem findings from observations and the limitations of previous research, this study aims to develop a valid, reliable, and practical e-portfolio-based project assessment instrument to measure high school students' creative thinking skills in economics learning. This product is expected to become an alternative assessment in supporting the development of 21st-century skills and improving the quality of economics learning evaluation in schools.

Research Method

This research is a type of research and development (RnD) which is a research method used to produce a product while simultaneously testing its feasibility, practicality, and effectiveness before trial in the learning process (Yumithasari et al., 2022). Research and development using the 4-D Model design, namely Define, Design, Develop, and Disseminate (Thiagarajan, S. & Semmel, 1974), was modified and limited to the development stage because the research focused on product development and testing. This study involved three validation experts: an educational evaluation expert, a material expert, and an education practitioner. The sources for the interviews were an economics teacher and 28 tenth-grade students at a public high school in Jayapura who were the field test respondents.

The data in this study consisted of qualitative data, namely the results of initial observations, interview results, and suggestions and input from validators. Meanwhile, the quantitative data consisted of the results of creative thinking skills scores, teacher and student response questionnaires, and the results of product effectiveness tests. The instruments used in data collection included interview guidelines, instrument validation sheets, creative thinking assessment instrument sheets, e-portfolio assessment rubrics, and response questionnaires.

The validity of the creative thinking skills instrument was tested through content validity analysis by expert assessment using Aiken's V index to determine the level of suitability of the instrument with the measured indicators. The instrument is considered valid if the Aiken's V coefficient value meets the specified validity criteria (Dewi, 2022). The formula can be seen in this equation:

$$V = \frac{\sum s}{[n(c - 1)]}$$

Description:

- s : distance from r - lo
- r : value from the validator
- lo : lowest value
- n : number of validators
- c : highest value



Furthermore, the criteria for the level of validity can be seen in Table 1 as follows.

Table 1. Validity Level Criteria

Aiken's V Scale	Criteria
(V < 0.7)	Invalid
(V > 0.7)	Valid

(Simamora et al., 2022)

The reliability of the project assessment instrument was determined through an internal consistency analysis using Cronbach's Alpha coefficient with IBM SPSS Statistics 25 software. The guidelines for interpreting the instrument's reliability level are shown in tables as follows:

Table 2. Interpretation of Reliability Levels

Reliability Coefficient	Category
$r < 0,2$	Very low
$0,2 \leq r < 0,4$	Low
$0,40 \leq r < 0,6$	Moderate
$0,6 \leq r < 0,8$	High
$0,8 \leq r \leq 1,0$	Very high

(Rusilowati, 2020, p. 29)

The practicality of the product was obtained from the results of questionnaires from teachers and students regarding the use of project assessment instruments based on e-portfolios. The percentage results were then categorized into very practical, practical, fairly practical, and less practical categories. These two data sets were analyzed using the percentage technique of activity implementation, with the calculation formula as follows:

$$\text{Percentage} = \frac{\text{Percentage of Score Obtained}}{\text{Maximum Score}} \times 100\%$$

The collected data was then analyzed based on the score classification guidelines:

Table 3. Practicality Score Classification Guidelines

Achievement Level	Qualification
80–100%	Very practical
61–80%	Practical
21–40%	Fairly practical
21–40%	Less practical
<20%	Very impractical

(Mufidah, 2023)

The effectiveness of the product is analyzed based on the improvement of students' creative thinking skills before and after the use of project-based e-portfolio assessment instruments using the Normalized Gain (N-Gain) approach. N-Gain is calculated using Hake's (1999) formula. The N-Gain criteria are presented in the following table.

Table 4. The N-Gain criteria

N-Gain Value	Category	Description
$g < 0,30$	Low	Insignificant improvement
$0,30 \leq g < 0,70$	Medium	Fairly significant improvement
$g \geq 0,70$	High	Very significant improvement

(Rahmawati et al., 2024)



Results and Discussion

Instrument Development

The development process of a project assessment instrument based on e-portfolios begins with the define stage, which is the stage of defining learning needs and conditions consisting of student characteristic analysis, curriculum analysis, and concept analysis. Based on the results of an interview with one teacher, the assessment instruments that had been tried in the classroom did not go through a validity process, and the teacher also felt burdened when measuring skills because it was not accompanied by the preparation of a learning plan and well-prepared assessment instruments. On the other hand, students have diverse backgrounds in abilities, speed, and styles of understanding material when learning is conducted with visual aids. Thus, the development of a project assessment instrument based on e-portfolios can serve as a means for students and teachers to engage in technology-based learning with instruments that are valid and reliable. Curriculum analysis at the define stage found that the learning objectives in economic material are that students are able to create concept maps or digital infographics about the interconnections between financial institutions and students are able to present project results in the form of digital presentations or e-portfolios. This becomes the basis for the importance of developing instruments in accordance with the curriculum and effectively assessing students' creative thinking abilities (Kemendikbudristek, 2025).

The Design Stage is the stage of designing project assessment instruments systematically, which includes preparing a blueprint of the instrument, selecting the instrument rubric format, drafting the initial product, and preparing validation for the instrument that has been prepared. With score analysis, (4) means very good, (3) means good, (2) if less active/good, and (1) if the student is not good/not active.

Table 5. Rubric for the Creative Thinking Skills Assessment Instrument

Torrance Indicators	Sub-Indicators	Aspects Assessed	Item No.	Scale
Project Activities	Group Participation	Project group formation	1	1-4
Fluency	Learning initiative, idea development, idea flow	Searching for relevant information and learning resources	3, 4, 5	1-4
Flexibility	Flexibility of thought, relevance to the real world	Viewing economic issues from various perspectives	6, 11	1-4
Originality	Originality of ideas, visual creativity	Generating unique project ideas or solutions.	7,16	1-4
Elaboration	Detailed development of ideas, content relevance, completeness of information.	Developing ideas in detail and systematically	8,9,10	1-4

The development stage is the validation stage prior to testing the instrument on students. Validation was conducted by three validators: an educational assessment expert, a subject matter expert, and a practitioner. The instrument was validated based on the construct of creative thinking using Torrance's dimensions, which include fluency, flexibility, originality, and elaboration. The validation analysis used Aiken's V, and the instrument was deemed valid.



Table 6. Expert Judgment Validation Results

Validation Aspects	Number of Items	Range of Average V Values	Category
Construct	8	0.67–0.89	Highly Valid
Content	4	0.78–0.89	Highly Valid
Language	4	0.71–0.89	Valid
Total	16	0.67–0.89	Valid, suitable for use

Based on the content expert validation results consisting of 16 statement items, the project assessment instrument for measuring creative thinking skills was declared valid with minor revisions. After going through the revision stage, the e-portfolio-based project assessment instrument was tested on 28 tenth-grade students with material on the analysis of banking and non-banking financial institutions. At the trial stage, the learning products produced were in the form of infographics, e-portfolios, and group presentations. The results of students' creative thinking skills scores during the field test showed that the instrument was able to identify variations in students' levels of creativity objectively and systematically.

Table 7. Distribution table of students' creative thinking skill categories

Category	Number of Students	Percentage
Very Creative	10	35.71%
Creative	18	64.29%
Fairly Creative	0	0%
Not Very Creative	0	0%

From the table, it can be seen that the students' creativity scores fall into the creative and very creative categories, indicating that the project-based e-portfolio assessment instrument is effective in facilitating the development and measuring the skills of creative thinking. Item analysis was conducted to determine the tendency of students' abilities based on Torrance's creativity, which includes fluency, flexibility, originality, and elaboration. This analysis is to see which indicators are the highest and require reinforcement in project learning.

Data analysis

Validation of the project assessment instrument in measuring creative thinking skills using Torrance's theory and conducted on the aspects of construct, content, and language. Validation used a 1-4 Likert scale and was analyzed with Aiken's V index, resulting in an average Aiken's V of 0.83 with a high/very good category.

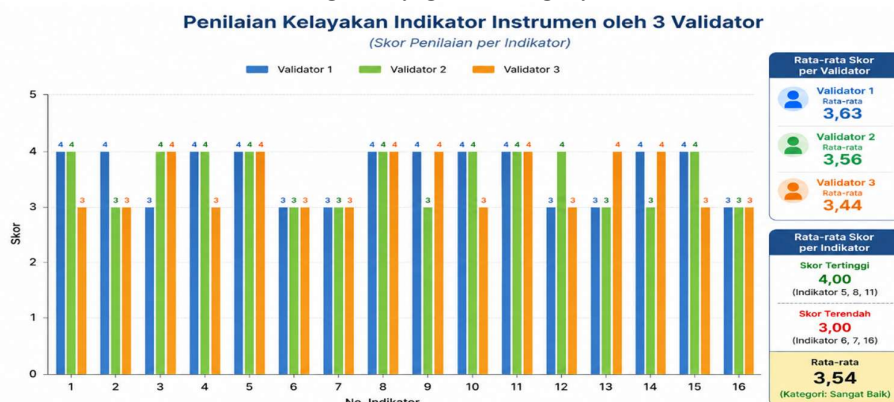


Figure 1. Feasibility Assessment of Instrument Indicators



Overall, the instruments developed have met the aspects of content feasibility, construct, and validity, although some indicators require minor revisions. Notes or minor revisions are found in items 6, 7, and 16 with improvements made without removing the substance of the items in the instrument. The following is a table of items 6, 7, and 16 before and after the revisions.

Table 8. Item Before Revision And After Revision

Item No.	Before Revision	After Revision
6	Students are able to view economic issues from various perspectives	Students are able to analyze economic problems from more than one perspective or consider alternative solutions
7	Students generate unique project ideas or solutions	Students generate project ideas or solutions that differ from most other groups and are appropriate to the context of the problem
16	Instructions for completing and using the instrument are detailed, clear, and systematic	Instructions for completing and using the instrument are accompanied by systematic technical explanations of individual and group scoring

Instrument reliability was assessed to determine whether the assessment instrument produced consistent and stable results when used to evaluate students' creative thinking skills (Rahmawati et al., 2023). The reliability test was conducted on 20 items of the creative thinking skills instrument, which had been pilot-tested on 28 students. This analysis utilized IBM SPSS Statistics 25 with the Cronbach's Alpha technique. The main SPSS output is as follows.

Table 9. Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	0.89
N of Items	20

The e-portfolio-based project assessment instrument is stated to be reliable and feasible to use as a measure of students' creative thinking skills because it obtained a Cronbach's alpha value greater than 0.80. This finding is consistent with instrument validation studies that are stated to be reliable and suitable to be used as a tool to measure students' creative thinking skills (Anggara & Abdillah, 2023).

The practicality analysis was conducted by distributing response questionnaires to teachers and students to determine their responses to the practicality of the project assessment instrument based on e-portfolio. The practicality analysis uses a percentage technique of activity implementation, by calculating the percentage of scores obtained compared to the scores obtained by students. This practicality test was conducted by distributing response sheets to economics subject teachers and students in a statement format with a Likert scale of 1-4. The response sheets were given to 3 teachers and 10 students randomly to provide responses to the product and project-based learning that measures creative thinking skills.

Table 10. Practicality Test Results by Practicing Teachers

Validator	Total Score	Percentage	Category
Teacher 1	37	92.5%	Very Positive
Teacher 2	36	90%	Very Positive
Teacher 3	38	95%	Very Positive
Average	37	92.5%	Very Positive



Based on the responses from 3 teachers, the practicality of the project-based e-portfolio assessment instrument developed has a practicality level of 92.5%, which means this instrument can be used, with clear instructions in each assessment step, is efficient, and can be applied directly. The results of this practicality analysis align with previous development research that reported comparable practicality percentages in the 'very practical' category, such as an interactive learning media instrument that achieved a practicality score of 92.19% (Wardani et al., 2023). Thus, e-portfolio-based assessment is perceived by educators as a practical and appropriate tool for engaging students in reflective and authentic learning processes. Effectiveness testing was conducted to determine whether the developed assessment instrument is truly effective in measuring creative thinking skills. The effectiveness analysis used normalized gain (N-Gain), which was preceded by presenting the frequency diagrams of the pretest and posttest results as follows.

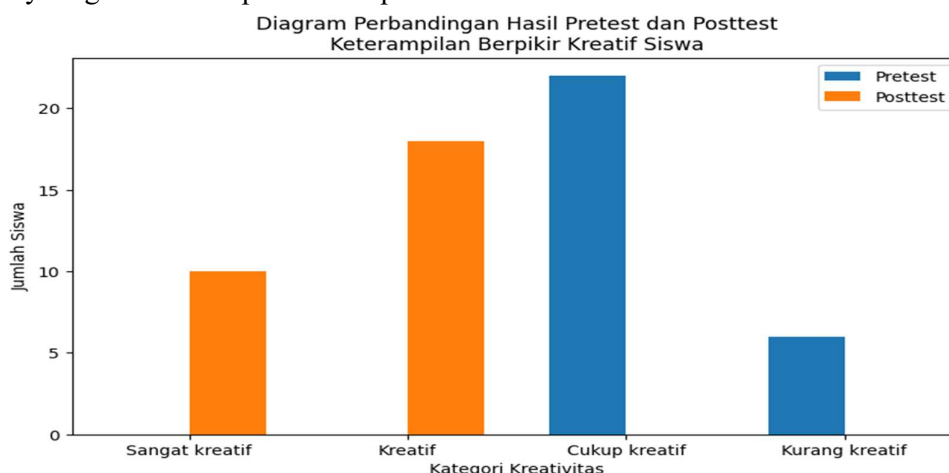


Figure 2. Comparison of Students' Creative Thinking Skills Pretest and Posttest Results

The N-Gain value is calculated using the formula:

$$g = (S_{\text{post}} - S_{\text{pre}}) / (S_{\text{max}} - S_{\text{pre}})$$

(Rahmawati et al., 2023)

Based on the data obtained, the average pretest score for class X was 46.79% and the average posttest score was 77.14% with a maximum score of 100. The result of the N-Gain calculation was $g = 0.57$, which is included in the range of $g \geq 0.70$ with a moderate category. This finding is in line with research by Zahro & Mitarlis, (2021) which concluded that project assessment instruments are able to improve students' creative thinking skills. These results reinforce that authentic project learning assessments based on real contexts develop students' creativity (Aini et al., 2024). Thus, the project assessment instrument is declared effective in measuring students' creative thinking abilities in economics learning, especially in bank and non-bank financial analysis. Conceptually, this study also strengthens the relationship between project-based learning, authentic assessment, and the development of creative thinking abilities.



Conclusion

This study produced a valid and reliable e-portfolio-based project assessment instrument for measuring students' creative thinking skills, particularly in Grade X economics learning with the material on bank and non-bank financial analysis. The developed project assessment instrument can facilitate a more authentic assessment of creative thinking skills through documentation of students' learning processes and outcomes during the implementation of learning. The findings of this study indicate that project-based learning with an assessment of creative thinking skills can provide students with the opportunity to explore ideas, develop ideas, and present project results creatively in the context of meaningful learning. In addition, the assessment instruments produced are feasible for use by teachers because they are able to carry out the assessment of thinking skills systematically, in a structured manner, and in accordance with the characteristics of project-based learning, especially economic learning with the topic of analyzing bank and non-bank financial institutions in grade X.

Thus, this e-portfolio-based project assessment instrument can be used as an alternative evaluation that supports learning with the Merdeka Curriculum, which is oriented towards the development of 21st-century competencies, particularly in developing students' creative thinking skills through project-based learning in economics subjects with the topic of financial analysis of banks and non-banks. For further research, the instrument can be tested with different learning topics to obtain stronger empirical evidence and consistent usage.

Recommendation

It is recommended that future research test the instrument on a larger and more varied sample size to obtain stronger validity and reliability evidence. Moreover, the development of an automated assessment system powered by artificial intelligence could be considered to enhance efficiency and objectivity in assessments. This study's limitations include a small number of respondents and the trial being conducted at just one institution. Furthermore, technical challenges such as internet stability and users' digital literacy levels may potentially affect the results of instrument implementation.

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