

Development and Content Validity of an E-Portfolio Assessment in a Chemistry Learning Media Development Course for Prospective Chemistry Teachers' Creativity

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ABSTRACT

This study developed and examined the content validity of an e-portfolio assessment instrument for measuring prospective chemistry teachers' creativity in a Chemistry Learning Media Development course. It addresses the limited availability of validated rubrics that assess both creative processes and final media products in chemistry teacher education. Using a Research and Development approach with the ADDIE model, this study was limited to the Analysis, Design, and Development stages. The instrument comprised five digital rubrics: Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. Data were obtained from three expert validators using a 30-item validation sheet and analyzed using Aiken's V. The overall Aiken's V value of 0.91 indicated high content validity. The instrument is feasible for use with minor revisions, while further implementation is needed to examine practicality, inter-rater reliability, and classroom effectiveness.

INTRODUCTION

Twenty-first-century higher education requires prospective teachers to possess higher-order thinking skills, including creativity, in addition to mastery of chemistry content (Ekaputra et al., 2024; Maslulah & Afifah, 2022). In chemistry education, the ability to develop innovative learning media is crucial because chemistry involves abstract and microscopic concepts that are difficult for learners to understand directly (Dwiningsih et al., 2018; Wibowo & Ariyatun, 2018). The Chemistry Learning Media Development course plays an important role in fostering prospective chemistry teachers' creativity in designing applicable media products that are relevant to learning needs (Ekaputra et al., 2024).

Conventional assessment practices tend to focus on final products, making it difficult to evaluate the creative process comprehensively (Maslulah & Afifah, 2022; Mawaddah et al., 2024). In fact, creativity develops through a series of stages, including needs analysis, media design, prototype development, revision, and reflection (Runco & Acar, 2012). Assessment that only emphasizes the final product cannot adequately capture prospective chemistry teachers' ability to select appropriate technology, organize media flow, or adjust media design to learners' characteristics.

E-portfolio emerges as an innovative assessment solution. It can record prospective chemistry teachers' digital traces from initial idea generation, prototype design, and product development to final media refinement (Fiqri et al., 2026; Maslulah & Afifah, 2022). The integration of rubrics and assessment instruments enables the creative process and divergent thinking to be evaluated more objectively and comprehensively.

Recent studies have demonstrated the effectiveness of e-portfolios in chemistry learning. Aini et al. (2024) developed an e-portfolio to assess conceptual mastery and creative thinking skills in project-based acid-base concepts. Rahmawati et al. (2024) used an e-portfolio to improve creative thinking skills in chemical reaction equation materials. Yuliaturosida et al. (2025) developed a project-based e-portfolio to foster critical and creative thinking skills. These studies indicate that e-portfolios are useful for documenting learning evidence and supporting higher-order thinking skills in chemistry-related learning contexts.

However, most previous studies have focused on e-portfolios for specific chemistry topics or on students' creative thinking outcomes. Limited attention has been given to the development of a structured e-portfolio assessment instrument specifically designed to measure prospective chemistry teachers' creativity in developing chemistry learning media. In particular, previous studies have not sufficiently integrated the assessment of the creative process and the final media product through a set of digital rubrics that represent the stages of media development. This gap is important because prospective chemistry teachers' creativity cannot be adequately captured only through the final product; it also needs to be assessed through their ability to analyse learning needs, design media, communicate ideas, revise products, and reflect on the development process.

Based on this gap, the present study develops a digital e-portfolio assessment instrument consisting of five specific rubrics: Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. The instrument is designed to assess prospective chemistry teachers' creativity more comprehensively by documenting both process and product during the Chemistry Learning Media Development course. In this way, the study contributes to the field of chemistry teacher education by providing an assessment instrument that is more aligned with authentic, project-based, and digital learning practices.

Content validity is an essential requirement before the instrument is implemented. Aiken's V is used to evaluate expert agreement on the relevance of instrument items (Aiken, 1985). Content validity ensures that each rubric indicator is relevant to the construct of prospective chemistry teachers' creativity and can be measured objectively. A valid instrument provides a sound basis for assessing both process and product in an e-portfolio, thereby supporting more authentic assessment.

Therefore, this study aims to develop and examine the content validity of an e-portfolio assessment instrument for assessing prospective chemistry teachers' creativity in the Chemistry Learning Media Development course. The instrument consists of five analytic rubrics covering Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. The development process follows the ADDIE model but is limited to the Analysis, Design, and Development stages. The focus of this article is to determine the content feasibility of the instrument through expert judgment using Aiken's V before it is implemented in classroom practice.

THEORETICAL REVIEW

Creativity of Prospective Chemistry Teachers in Learning Media Development

Creativity of prospective chemistry teachers is the main focus of this study. Creativity is not only defined as the ability to produce new products, but also as the ability to generate relevant, flexible, original, elaborated, and problem-oriented ideas. In the context of chemistry learning media development, creativity is reflected in prospective chemistry teachers' ability to identify learning needs, select appropriate media formats, design media flow, utilize technology, visualize chemistry concepts, and produce attractive and usable learning media.

Prospective chemistry teachers' creativity needs to be developed because chemistry content is often abstract, particularly at the macroscopic, sub microscopic, and symbolic levels. This condition requires prospective chemistry teachers to transform difficult-to-observe concepts into visual representations, simulations, animations, videos, or interactive media. Permatasari et al. (2022) showed that multiple representations help students understand abstract chemistry concepts more meaningfully. Yamtinah et al. (2023) also emphasized that augmented reality-based media can support the visualization of chemistry concepts in a more concrete form.

Creativity in learning media development is also related to the integration of content, pedagogy, and technology. Shulman (1986) emphasized that teachers

need to transform subject matter into forms that are easier for students to understand. Mishra & Koehler (2006) extended this idea through technological pedagogical content knowledge, which refers to the ability to integrate technology, pedagogy, and content. In this context, creativity indicators include fluency, flexibility, originality, and elaboration, as described by Torrance (1974), namely the ability to generate ideas, view alternatives flexibly, produce original ideas, and develop ideas in detail.

E-Portfolio as Authentic Digital Assessment

An e-portfolio is a digital assessment system that enables prospective chemistry teachers to collect, organize, and present learning evidence continuously. It does not only function as a task repository, but also as a space for process documentation, reflection, feedback, and performance assessment. Maslulah & Afifah (2022) stated that e-portfolios are relevant as assessment instruments in the digital era because they can record learning evidence flexibly. (Lu, 2021) also showed that e-portfolios in higher education support the documentation of learning achievements, reflection, and professional development. In addition, e-portfolios are aligned with the principles of authentic assessment and project-based learning because they assess work processes, problem solving, collaboration, and products rather than merely final outcomes (Guo et al., 2020; Wiggins, 1990).

In this study, developing chemistry learning media is considered an authentic task because prospective chemistry teachers are required to analyse students' needs, design media, develop products, present ideas, and reflect on the development process. Recent studies also support the relevance of e-portfolios in chemistry and science education. Aini et al. (2024) developed an e-portfolio to assess conceptual mastery and creative thinking in project-based acid-base concepts. Rahmawati et al. (2024) developed an e-portfolio assessment instrument to improve creative thinking skills in chemical reaction equation materials. Yuliaturosida et al. (2025) showed that project-based e-portfolios can support critical and creative thinking. Therefore, this study uses e-portfolios to assess prospective chemistry teachers' creativity through five rubrics: Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video.

Rubric-Based Assessment for E-Portfolio

Rubrics are essential components of e-portfolio assessment because they provide clear assessment criteria. Rubrics help assessors determine performance quality based on measurable indicators and help prospective chemistry teachers understand the expected performance standards. (Brookhart, 2013) explained that a good rubric contains clear criteria and performance-level descriptions, ranging from the lowest to the highest score. Panadero et al. (2023) also showed that rubrics can support academic performance, self-regulation, and self-efficacy. In chemistry learning media development, rubrics help prospective chemistry teachers identify aspects that need improvement, such as conceptual accuracy, visualization, interactivity, and innovation in presentation.

The rubrics in this study are analytical because they break down complex skills into several aspects and indicators. The Initial Analysis rubric assesses the ability to understand learning needs. The Learning Media Design rubric assesses the ability to design media before production. The Presentation rubric assesses the ability to communicate and defend ideas scientifically. The Chemistry Learning Media Product rubric assesses the quality of the final artifact, including conceptual accuracy, design, interactivity, and creativity. The Media Development Progress Video rubric assesses the documentation of the process, revision, and reflection. Rubrics also strengthen the formative function of e-portfolios because scores and assessor comments help prospective chemistry teachers identify strengths and areas for improvement. Hu et al. (2025) emphasized that digital technology in authentic assessment can support feedback, process tracking, and evidence-based assessment. Therefore, e-portfolio rubrics need to be designed for easy use on digital platforms such as Google Sites, Google Forms, and Google Sheets.

Based on these theoretical perspectives, creativity in chemistry learning media development can be assessed more comprehensively when the assessment captures both process and product. Therefore, an e-portfolio supported by analytic rubrics is considered appropriate because it enables prospective chemistry teachers to document their ideas, design decisions, media development process, final product, and reflection in a structured digital format.

ADDIE as a Development Framework

The ADDIE model is used as the development framework in this study because it provides a systematic procedure for designing educational products. ADDIE consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). However, this article only discusses the first three stages, namely Analysis, Design, and Development. The Analysis stage is used to identify assessment needs in the Chemistry Learning Media Development course, particularly those related to task characteristics, creative process assessment, and digital documentation. The Design stage is used to design the structure of the e-portfolio instrument, including rubric components, assessment indicators, scoring scales, and usage format. The Development stage is used to develop the instrument prototype and examine its content validity through expert judgment. This limitation keeps the article focused on the content feasibility of the instrument before implementation; therefore, the effectiveness of the instrument and its classroom reliability are not discussed.

Content Validity and Aiken's V

Content validity is an essential basis in instrument development because it ensures that items, indicators, and rubrics are aligned with the construct being measured, namely prospective chemistry teachers' creativity in developing chemistry learning media. Aiken's V is used to examine the level of expert agreement on the relevance of instrument items (Aiken, 1985). A higher V value indicates stronger content validity. Expert validation is necessary because e-portfolios assess diverse artifacts, including media designs, presentations,

chemistry learning media products, and progress videos. Therefore, each rubric must contain indicators that are appropriate to the object being assessed before the instrument is used in the course.

The theoretical framework of this study positions prospective chemistry teachers' creativity as the construct assessed through e-portfolio assessment. This creativity emerges throughout the process of developing chemistry learning media, starting from needs analysis, followed by media design, idea presentation, product development, and progress documentation. Conceptually, this framework is presented in Figure 1.

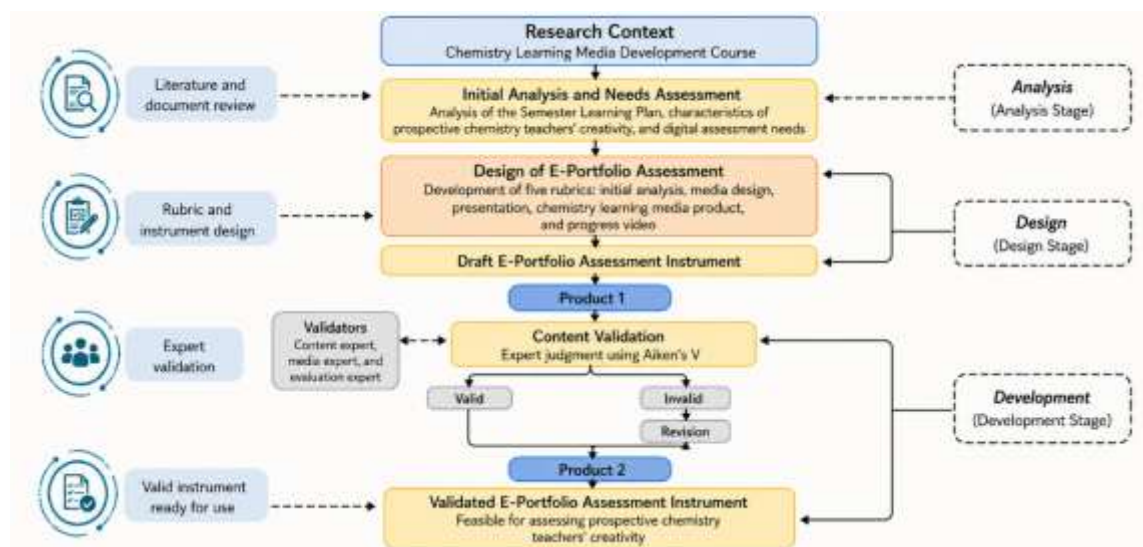


Figure 1. Theoretical Framework

This framework shows that the e-portfolio functions as a documentation and assessment system, while the rubric functions as the assessment tool. Both components complement each other. The e-portfolio provides digital evidence, while the rubric provides assessment criteria. Aiken's V is used to determine whether these criteria have adequate content validity before the instrument is used in the implementation stage.

METHODOLOGY

Research Design

This study employed a Research and Development approach to produce an e-portfolio assessment instrument for measuring prospective chemistry teachers' creativity in the Chemistry Learning Media Development course. The development framework used in this study was the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). However, this article reports only the first three stages, namely Analysis, Design, and Development, because the main focus of the study was to develop the instrument prototype and examine its content validity before classroom implementation.

This study did not involve classroom implementation, student respondents, or hypothesis testing because the product was still at the expert validation stage. Therefore, the main units of analysis were the e-portfolio assessment

instruments, rubric indicators, scoring descriptors, and validation items. The content validity of the instrument was examined through expert judgment using Aiken's V.

Research Procedure

The research procedure followed the first three stages of the ADDIE model: Analysis, Design, and Development. These stages were used to produce an e-portfolio assessment instrument with adequate content validity before implementation.

In the Analysis stage, the researchers examined the Semester Learning Plan of the Chemistry Learning Media Development course to identify learning outcomes, sub-learning outcomes, task characteristics, assessment forms, and digital artifacts that could be used as evidence of prospective chemistry teachers' creativity. The analysis showed that the course required students to analyse chemistry learning problems, identify learning needs, design ICT-based learning media, develop media products, conduct validation and practicality related activities, revise products, and present academic outputs. Based on these characteristics, the assessment instrument needed to capture both the creative process and the final product.

In the Design stage, the researchers designed the structure of the e-portfolio assessment instrument based on the results of the needs analysis. The instrument was organized into five assessment components: Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. These components were selected because they represent the main stages of chemistry learning media development, from identifying learning needs to documenting the development process. Each component consisted of assessment objectives, indicators, scoring guidelines, assessment sheets, a four-point scoring scale, and analytic rubric descriptors.

The scoring scale ranged from 1 to 4. A score of 4 represented very good or highly appropriate performance, a score of 3 represented good or appropriate performance, a score of 2 represented fair performance, and a score of 1 represented poor or inappropriate performance. The rubric descriptors were designed to make each performance level observable and assessable. At this stage, the researchers also developed an expert validation sheet consisting of 30 validation items covering six aspects: content, construction, rubric quality, format, language, and digital usability.

In the Development stage, the researchers produced a prototype of the e-portfolio assessment instrument based on the design stage. The prototype was then submitted to expert validators for content validation. The validators assessed the relevance, clarity, construction, rubric quality, format, language, and digital usability of the instrument. Their quantitative scores were used to calculate Aiken's V, while their qualitative comments were used to revise the instrument. The revisions focused on improving the mapping of creativity indicators, the measurability of rubric indicators, the distinction between scoring levels, consistency of format, clarity of language, and the mechanism for providing formative feedback in digital platforms.

Validation Subjects

The validation subjects consisted of three expert validators selected through purposive sampling. The validators were chosen based on the relevance of their expertise to the developed instrument. They represented three areas of expertise: learning evaluation, learning media, and chemistry education. Their involvement was considered necessary because the e-portfolio assessment instrument integrates assessment principles, digital learning media development, and chemistry education content. Since this study focused on content validation, the validators served as expert judges rather than research participants in an implementation trial. Each validator assessed the instrument using a four-point rating scale and provided qualitative comments and suggestions for revision.

Instrument and Data Collection Technique

The data in this study were obtained from three main sources: the Semester Learning Plan of the Chemistry Learning Media Development course, the e-portfolio assessment instrument prototype, and the expert validation sheet. The Semester Learning Plan was used to map learning outcomes, project tasks, digital artifacts, and assessment needs. The instrument prototype consisted of five rubrics designed to assess the stages of chemistry learning media development. The expert validation sheet was used to collect validators' scores, comments, revision notes, and feasibility conclusions.

Data were collected through documentation and expert validation. Documentation was used to analyse the course structure, learning outcomes, and task characteristics. Expert validation was conducted by asking the validators to review the instrument and rate each validation item using a scale of 1 to 4. The quantitative data consisted of the scores given by the validators, while the qualitative data consisted of comments and suggestions for improving the instrument.

Data Analysis Technique

The quantitative data were analysed using Aiken's V to determine the level of expert agreement on the relevance of each validation item. Aiken's V was selected because it is appropriate for examining content validity based on expert judgment using a rating scale (Aiken, 1985). The Aiken's V formula is as follows:

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

where V represents the content validity index, s represents the score assigned by each validator minus the lowest score in the rating scale, n represents the number of validators, and c represents the number of rating categories. The interpretation criteria for Aiken's V are presented in Table 1. The qualitative data from validators' comments were analysed descriptively and used as the basis for revising the instrument.

Table 1. Criteria for interpreting Aiken's V

Aiken's V Interval	Validity Category	Decision
$V \geq 0.80$	Highly valid	Feasible for use without revision or with very minor revision
$0.60 \leq V < 0.80$	Valid	Feasible for use with minor revision
$0.40 \leq V < 0.60$	Moderately valid	Feasible for use with moderate revision
$0.20 \leq V < 0.40$	Less valid	Requires major revision
$V < 0.20$	Invalid	Not yet feasible for use

RESULTS

Results of the Analysis Stage

The Analysis stage produced a mapping of assessment needs based on the Semester Learning Plan of the Chemistry Learning Media Development course. The Semester Learning Plan indicates that this course requires prospective chemistry teachers to analyse chemistry learning needs, design ICT-based learning media, develop media systematically, conduct validation and practicality testing, and produce academic outputs. The course assignments are non-test and project-based, including problem analysis reports, needs analysis reports, conceptual designs, instructional designs, storyboards, flowcharts, media products, validation results, and practicality test reports. Therefore, the developed assessment needs to document both process and product in stages, starting from problem identification, needs analysis, design, product development, validation, revision, readability testing, and reflection. Accordingly, the e-portfolio assessment instrument was designed so that each stage of prospective chemistry teachers' work could be assessed through digital artifacts.

Results of the Design Stage

The Design stage produced five e-portfolio assessment instruments representing the stages of chemistry learning media development. These instruments include Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. Each instrument was designed to assess different digital artifacts, ranging from initial analysis reports, design documents, presentations, and media products to progress videos. Thus, the assessment of prospective chemistry teachers' creativity does not only focus on the final product but also covers the processes of analysis, design, idea communication, product development, and reflection. The five instruments were subsequently validated using an expert validation sheet.

1. Initial Analysis Instrument. This instrument assesses the basis of prospective chemistry teachers' decision-making in determining learning media needs through an initial analysis report. The assessed aspects include learning problem analysis, learning needs, student characteristics, chemistry content,

- and the basis for selecting media. This instrument consists of 14 indicators with a maximum score of 56.
2. Learning Media Design Instrument. This instrument assesses the quality of media design before production through design documents, storyboards, media flow, or media drafts. The assessed aspects include technology utilization, design creativity, and design suitability with the results of needs analysis. This instrument consists of 9 indicators with a maximum score of 36.
 3. Presentation Instrument. This instrument assesses prospective chemistry teachers' ability to communicate the results of analysis and media design systematically, communicatively, and scientifically. The assessed aspects include presentation materials, clarity of delivery, communication, language use, mastery of content, presentation structure, use of digital media, accuracy of chemistry concepts, and ability to answer questions. This instrument consists of 10 indicators with a maximum score of 40.
 4. Chemistry Learning Media Product Instrument. This instrument assesses the quality of the final ICT-based chemistry learning media product. The assessed aspects include design suitability, learning needs, accuracy of chemistry concepts, technical quality, interactivity, ease of use, completeness of components, uniqueness, and innovation in presentation. This instrument consists of 14 indicators with a maximum score of 56.
 5. Media Development Progress Video Instrument. This instrument assesses the digital record of the media development process, including analysis, design, development, validation, revision, readability testing, and reflection. This instrument consists of 17 indicators with a maximum score of 68.

Results of the Development Stage

The Development stage produced a prototype of the e-portfolio assessment instrument, which was validated by three expert validators. The validation involved 30 items covering six aspects: content, construction, rubric quality, format, language, and digital usability. The validators were asked to assess each item using a scale of 1 to 4, provide revision notes, and conclude the feasibility of the instrument as the basis for revision.

Expert validation was conducted to determine the content feasibility of the e-portfolio assessment instrument based on each validator's judgment. The results show that all three validators rated the instrument in the highly valid category, as presented in Table 2.

Table 2. Expert Validation Results by Validator

Validator	Score Obtained	Percentage (%)	Aiken's V	Category
Validator 1	113	94.17	0.92	Highly valid
Validator 2	110	91.67	0.89	Highly valid
Validator 3	112	93.33	0.91	Highly valid
Average	111.67	93.06	0.91	Highly valid

Table 2 shows a high level of consistency in the assessments provided by the three validators. All Aiken's V values for each validator were above 0.80,

indicating that the e-portfolio assessment instrument prototype was feasible for use with minor revisions.

The analysis was then continued by examining Aiken's V values for each validation aspect. This recapitulation was used to identify the instrument aspects with the strongest validity level and those requiring refinement. The content validity results by aspect are presented in Table 3.

Table 3. Content Validity Results by Aspect

Validation Aspect	Number of Items	Total Score	Aiken's V	Category
Content	6	70	0.96	Highly valid
Construction	5	57	0.93	Highly valid
Rubric Quality	5	52	0.82	Highly valid
Format	4	42	0.83	Highly valid
Language	4	46	0.94	Highly valid
Digital Usability	6	68	0.93	Highly valid
Total	30	335	0.91	Highly valid

The overall Aiken's V value of 0.91 indicates that the e-portfolio assessment instrument was in the highly valid category. The content aspect obtained the highest value of 0.96, while the construction and digital usability aspects each obtained a value of 0.93. These results indicate that the instrument was appropriate in terms of content, clearly structured, and feasible for assessing prospective chemistry teachers' digital artifacts. The indicator-level recapitulation shows that 22 indicators were categorized as highly valid and 8 indicators were categorized as valid. No indicators were categorized as moderately valid, less valid, or invalid, as shown in Table 4.

Table 4. Validity Category by Indicator

Validity Category	Number of Items	Percentage (%)
Sangat valid	22	73.33
Valid	8	26.67
Cukup valid	0	0.00
Kurang valid	0	0.00

Table 4 shows that all indicators were feasible to retain. Indicators categorized as valid could still be used but required minor revisions based on the validators' comments.

The qualitative comments from the validators supported the quantitative results. Validator 1 suggested revisions related to the mapping of creativity elements, measurability of indicators, clarity of distinctions between scoring levels, table layout, format consistency, and the mechanism for digital formative feedback. Validator 2 emphasized improvements in the clarity of scoring criteria, consistency of rubric descriptions, table layout, and digital feedback mechanism. Validator 3 suggested revisions related to the clarity of distinctions between

rubric levels, consistency of wording, sentence simplification, technical adaptation to Google Forms, and explanation of the digital formative feedback mechanism.

Based on the Development stage, the e-portfolio assessment instrument obtained an overall Aiken's *V* value of 0.91, categorized as highly valid. All validation aspects were also categorized as highly valid, with values ranging from 0.82 to 0.96. The indicator-level recapitulation showed that 22 indicators were highly valid and 8 indicators were valid. Therefore, the e-portfolio assessment instrument is feasible for use with minor revisions related to creativity mapping, operationalization of indicators, clarity of distinctions between scoring levels, format consistency, and the digital formative feedback mechanism.

DISCUSSION

The findings of this study indicate that the developed e-portfolio assessment instrument has strong content validity. The overall Aiken's *V* value of 0.91 reflects a high level of agreement among the three expert validators regarding the relevance and feasibility of the instrument. This result suggests that the five developed rubrics are appropriate for assessing prospective chemistry teachers' creativity in the Chemistry Learning Media Development course. More importantly, the instrument captures not only the final media product but also the creative process through digital artifacts produced at different stages of media development.

The content aspect achieved the highest Aiken's *V* value of 0.96, indicating that the indicators in the instrument are well aligned with the construct being measured. This is crucial because creativity in learning media development is multi-dimensional, involving the ability to analyze learning problems, generate ideas, design media flow, select appropriate technology, visualize chemistry concepts, revise products, and communicate development progress. Therefore, the high content validity demonstrates that the instrument has a strong conceptual basis for assessing creativity as both a process- and product-oriented construct.

The construction and digital usability aspects obtained values of 0.93, indicating that the instrument has a clear structure and is suitable for use on digital platforms such as Google Sites, Google Forms, and Google Sheets. This is particularly relevant because e-portfolio assessment depends on the organized collection of digital evidence, including reports, design documents, presentation files, media products, and progress videos. A clear structure ensures that lecturers can evaluate student work consistently, while good digital usability supports practical implementation.

Although all validation aspects were categorized as highly valid, the rubric quality and format aspects were relatively lower, with Aiken's *V* values of 0.82 and 0.83. These findings suggest the need for refinement at the operational level. In particular, distinction between scoring levels should be clearer, descriptors should be more measurable, and rubric format should be standardized across the five instruments. Clear rubric quality is essential for scoring consistency; ambiguous descriptors could lead to different interpretations by different assessors.

The qualitative comments from validators supported these interpretations. They recommended revisions regarding the mapping of creativity elements, measurability of indicators, clarity of scoring levels, table layout, consistency of wording, adaptation to digital platforms, and the digital formative feedback mechanism. Addressing these suggestions ensures that the e-portfolio functions not merely as a repository of assignments, but as a structured assessment system that supports feedback, reflection, and staged creativity development.

These findings align with prior research on e-portfolios as authentic assessment tools. Guo et al. (2020) emphasized that project-based learning in higher education requires assessment that evaluates both process and product. Similarly, Aini et al. (2024) demonstrated that e-portfolios can assess conceptual mastery and creative thinking in project-based chemistry learning, while Rahmawati et al. (2024) showed that e-portfolio assessment instruments can support the development of creative thinking skills in chemical reaction topics. Yuliaturosida et al. (2025) confirmed that project-based e-portfolios enhance critical and creative thinking skills. This study extends these findings to the context of prospective chemistry teachers in the Chemistry Learning Media Development course, focusing specifically on creativity in media design and development.

The novelty of this study lies in the structure of the five rubrics that cover the stages of analysis, design, idea communication, product development, documentation, and reflection. Unlike previous studies that focused on specific chemistry topics or final outcomes, this instrument enables comprehensive assessment of both process and product, providing a more authentic evaluation of students' creativity in teacher education.

Practically, the instrument allows lecturers to assess prospective chemistry teachers' creativity systematically and transparently. It guides evaluation not only of the products but also of the processes through clear performance indicators, scoring rubrics, and formative feedback on digital artifacts. For students, the instrument provides structured guidance to reflect on design decisions, evaluate technology use, and improve their media products, thereby supporting incremental development of creativity.

However, the findings should be interpreted within the scope of content validity. While the high Aiken's V values indicate that the instrument is feasible based on expert judgment, they do not provide evidence regarding classroom effectiveness, inter-rater reliability, practical usability, or student responses. Future studies should implement the instrument in real classroom settings to assess scoring consistency, practicality, and its impact on creativity development.

Overall, the e-portfolio assessment instrument is feasible for use with minor revisions. Its high content validity provides a solid foundation for assessing prospective chemistry teachers' creativity through digital evidence, ranging from initial analysis and design to presentation, product, and progress documentation. Minor refinements should focus on rubric descriptors, format consistency, and digital feedback mechanisms to enhance usability and effectiveness in classroom practice.

CONCLUSIONS AND RECOMMENDATIONS

This study developed an e-portfolio assessment instrument for assessing prospective chemistry teachers' creativity in the Chemistry Learning Media Development course. The instrument consists of five components: Initial Analysis, Learning Media Design, Presentation, Chemistry Learning Media Product, and Media Development Progress Video. The content validation results showed an overall Aiken's V value of 0.91, categorized as highly valid, indicating that the instrument is feasible for use with minor revisions. The instrument has a strong content validity basis for assessing both the creative process and the final product through digital artifacts. However, this finding should be interpreted within the scope of expert judgment. The high Aiken's V value does not yet provide evidence of the instrument's effectiveness, practicality, or scoring consistency in real classroom implementation. Therefore, minor revisions are recommended, particularly in clarifying creativity indicators, distinguishing scoring levels, improving format consistency, and strengthening the digital feedback mechanism.

FURTHER STUDY

This study was limited to the Analysis, Design, and Development stages of the ADDIE model. Future studies should continue to the Implementation and Evaluation stages by applying the instrument in an actual course setting. Further research is also needed to examine inter-rater reliability, practicality on digital platforms, prospective chemistry teachers' responses, and the impact of the e-portfolio assessment on creativity development in designing chemistry learning media.

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