

CONTENT VALIDITY ANALYSIS OF A TEACHER NEEDS ASSESSMENT INSTRUMENT IN SCIENCE LEARNING USING AIKEN'S V INDEX

Putri Zuhra^{1*}, Festiyed², Yerimadesi³, Skunda Diliarosta⁴, Febri Yanto⁵, Masringgit Marwiyah Nst⁶

^{1,6}Doctoral Program in Science Education, Universitas Negeri Padang, Padang, Indonesia

^{2,3,4,5}Universitas Negeri Padang, Padang, Indonesia

*Corresponding author email: putri.zuhra01@gmail.com

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ABSTRACT

assessment questionnaire developed to support the development of an ethnoscience-integrated Project-Based Learning (PjBL) model for junior secondary science education. The instrument consisted of 30 items organized into seven variables and was designed to identify teachers' needs regarding project-based learning implementation, the integration of ethnoscience and local wisdom, and the promotion of students' critical and creative thinking skills within the framework of the Merdeka Curriculum Phase D. Content validity was evaluated using Aiken's V index with the involvement of three expert validators, including a science and ethnoscience education expert, an assessment and instrument development expert, and a Merdeka Curriculum expert. The evaluation was conducted using a validation sheet comprising 12 indicators covering content relevance, language clarity, item construction, and the appropriateness of context and rating scales. The findings revealed that all validation indicators achieved Aiken's V values ranging from 0.889 to 1.000, with an overall mean score of 0.944. These values exceeded the minimum acceptable criterion for content validity ($V \geq 0.80$), indicating that the instrument possesses high content validity and is appropriate for identifying teachers' needs during the initial stage of developing an ethnoscience-integrated Project-Based Learning model.

Keywords: content validity; Aiken's V index; teacher needs assessment; Project-Based Learning; ethnoscience.

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LATAR BELAKANG

The transformation of 21st-century education has emphasized critical thinking, creativity, collaboration, and problem-solving as essential competencies that should be fostered through educational processes (Council, 2012; OECD, 2023). In science education, these competencies are closely associated with students' ability to understand natural phenomena scientifically, evaluate information based on evidence, and apply scientific concepts to address real-world challenges (Bybee, 2013; Lederman, 2013). However, the results of the Programme for International Student Assessment (PISA) 2022 revealed that Indonesian students' scientific literacy performance remained below the OECD average, particularly in scientific reasoning and problem-solving domains. This condition highlights the need for innovative instructional approaches capable of creating more active, contextualized, and meaningful learning experiences (OECD, 2023).

One instructional approach that has received considerable attention in addressing these challenges is Project-Based Learning (PjBL). This model actively engages students in inquiry, collaboration, and the completion of authentic projects that require them to investigate and solve real-life problems (Bell, 2010; Thomas, 2000). Through project implementation, students construct knowledge through meaningful experiences while simultaneously developing higher-order thinking and problem-solving skills required in the 21st century (Krajcik & Blumenfeld, 2006). Previous studies have consistently reported that PjBL contributes to improved academic achievement, critical thinking skills, and student engagement in science learning (Bell, 2010; Condliffe et al., 2017).

Nevertheless, the effectiveness of science learning is influenced not only by the instructional model employed but also by its capacity to connect scientific concepts with students' everyday experiences (Aikenhead & Ogawa, 2007; Sudarmin, 2014). In this regard, ethnoscience offers a promising approach by integrating indigenous knowledge, local culture, and community practices into science instruction, enabling students to learn scientific concepts through familiar cultural contexts (Aikenhead & Ogawa, 2007; Snively & Corsiglia, 2001). Recent systematic reviews have demonstrated that ethnoscience integration enhances scientific literacy, conceptual understanding, learning motivation, and higher-order thinking skills by bridging local knowledge systems with modern scientific perspectives (Ali et al., 2025; Hikmah et al., 2025; Jannah et al., 2022). Beyond improving learning outcomes, ethnoscience also promotes the preservation of local wisdom by positioning cultural knowledge as a meaningful learning resource (Hikmah et al., 2025; Sudarmin, 2014).

The integration of ethnoscience into Project-Based Learning has the potential to create richer and more contextualized learning experiences. Through this integration, students not only engage in authentic project work but also explore cultural and environmental phenomena embedded within their local communities (Aikenhead & Ogawa, 2007; Krajcik & Blumenfeld, 2006). Such a combination aligns well with the principles of the Merdeka Curriculum, which emphasizes student-centered learning, competency development, and the utilization of real-life contexts as meaningful learning resources (Kemendikbudristek, 2022).

In educational design and development research, the preliminary phase plays a crucial role in identifying users' needs, learning characteristics, and contextual factors that serve as the foundation for product development (Mckenney & Reeves, 2019; Plomp & Nieveen, 2013). Consequently, the quality of decisions made during the development process depends heavily on the accuracy and representativeness of the data collected at this stage. Therefore, needs assessment instruments must demonstrate adequate validity to ensure that the information obtained accurately reflects the intended constructs and user requirements (Messick, 1995; Retnawati, 2016).

Among various forms of validity evidence, content validity is considered fundamental because it reflects the extent to which instrument items adequately represent the construct being measured (Anastasi & Urbina, 1997; Polit & Beck, 2006). Content validity is commonly evaluated through expert judgment using Aiken's V index, which provides a quantitative estimate of experts' agreement regarding the relevance of instrument indicators (Aiken, 1985). The use of Aiken's V has been widely recommended in educational research because it offers a systematic approach for establishing content validity evidence before an instrument is employed in empirical data collection (Kania et al., 2024).

Numerous studies have reported the development of Project-Based Learning models, ethnoscience-based science instruction, and various educational instruments. However, the validation of teacher needs assessment instruments as an empirical foundation for developing an ethnoscience-integrated Project-Based Learning model has received relatively limited methodological attention. Given that

the quality of needs assessment data substantially influences subsequent development decisions, establishing robust evidence of instrument validity is essential.

Based on this rationale, the present study seeks to obtain evidence of the content validity of a teacher needs assessment questionnaire designed to support the needs analysis phase in the development of an ethnoscience-integrated Project-Based Learning model for junior secondary science education. Content validity was examined using Aiken's V index. The findings are expected to strengthen the methodological quality of instruments employed in educational development research and provide a credible empirical basis for subsequent stages of model development.

RESEARCH METHOD

This study employed a Research and Development (R&D) approach focusing on the content validity analysis of a teacher needs assessment questionnaire developed for the preliminary research phase of an ethnoscience-integrated Project-Based Learning (PjBL) model in junior secondary science education. The study was guided by the Plomp development model, which comprises three phases: preliminary research, prototyping phase, and assessment phase (Plomp & Nieveen, 2013). This article specifically reports the content validity evaluation of the instrument developed during the preliminary research phase. The purpose of this phase is to identify user needs, learning characteristics, and contextual conditions that serve as the foundation for educational product development (Mckenney & Reeves, 2019).

resulting instrument was a teacher needs assessment questionnaire employing a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The structure of the instrument, including its indicators and item distribution, is presented in Table 1. To reduce the potential influence of acquiescence bias and other response-set tendencies, the questionnaire incorporated both favorable and unfavorable statements (Azwar, 2012; Podsakoff et al., 2003).

The instrument development process followed a systematic procedure consisting of construct identification based on literature review and research objectives, determination of variables and indicators, preparation of the instrument blueprint, item development, and content validation through expert judgment (Retnawati, 2016).

Table 1. Distribution of Variables and Items in the Teacher Needs Assessment Questionnaire

No.	Variable	Code	Total Items	Favorable Items (+)	Unfavorable Items (-)
1	Learning Implementation	X1	4	2	2
2	Student Characteristics	X2	4	3	1
3	Learning Media and Resources	X3	4	3	1
4	Learning Process	X4	4	3	1
5	Higher-Order Thinking Skills (HOTS): Critical and Creative Thinking	X5	4	3	1
6	Ethnoscience	X6	5	3	2
7	Needs for Learning Model Development	X7	5	3	2
Total			30	20	10

Source: Developed by the researchers based on a literature review.

Note: (+) = favorable items; (-) = unfavorable items (*reverse-scored items*)

The content validity of the instrument was evaluated by three expert validators consisting of a science and ethnoscience education expert, an expert in educational evaluation and instrument development, and a Merdeka Curriculum specialist. The validators were selected based on their academic expertise and experience in educational research and

development. The evaluation was conducted using a validation sheet containing 12 indicators covering four aspects: content relevance, language clarity, item construction, and the appropriateness of context and rating scales.

The validation sheet employed a four-point rating scale consisting of 1 = Not Appropriate, 2 = Less Appropriate, 3 = Appropriate, and 4 = Highly Appropriate. The use of a four-point scale was intended to eliminate neutral responses and encourage validators to provide more definitive judgments regarding the relevance of each instrument indicator. Content validity assessment in this study focused on the overall quality of the instrument through the 12 validation indicators rather than evaluating each of the 30 questionnaire items individually.

The validation data were analyzed using Aiken's V index to determine the level of agreement among experts regarding the relevance of the instrument indicators (Aiken, 1985). Aiken's V was calculated using the following formula:

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

Where (V) represents the content validity coefficient, ($\sum s$) is the sum of adjusted scores assigned by the validators, ($s = r - l_o$), (r) is the score assigned by a validator, (l_o) is the lowest score on the rating scale, (c) is the number of rating categories, and (n) is the number of validators. In this study, Aiken's V was calculated using four rating categories ((c = 4)) in accordance with the scale employed in the validation sheet.

Aiken's V values range from 0 to 1, with values closer to 1 indicating stronger content validity. The instrument was considered to possess high content validity when the Aiken's V value for each

validation indicator reached or exceeded 0.80 (Azwar, 2012; Retnawati, 2016). The results of the content validity analysis were subsequently used to determine the appropriateness of the instrument before its implementation in the needs analysis stage of developing the ethnoscience-integrated Project-Based Learning model.

RESULTS AND DISCUSSION

Content Validity Analysis Using Aiken's V

Table 2 presents the results of the content validity analysis using Aiken's V coefficient for the 12 validation indicators of the teacher needs assessment questionnaire. The validation indicators were grouped into four aspects: content relevance (A), language clarity (B), item construction (C), and appropriateness of context and rating scale (D).

Tabel 2. Results of Aiken's V Analysis for the Validation Sheet of the Teacher Questionnaire

No	Assessment Aspect	V1	V2	V3	Σ	Aiken's V
1	Item is aligned with the research objectives (A)	4	4	4	9	1,000
2	Item is aligned with the research variables (A)	4	3	4	8	0,889
3	Item is aligned with the measured indicators (A)	4	4	3	8	0,889
4	Language is easily understood by teachers (B)	4	4	4	9	1,000
5	Statement does not create ambiguity (B)	4	3	4	8	0,889
6	Statement is clear and communicative (B)	4	4	3	8	0,889
7	Statement is clear and not confusing (C)	4	4	4	9	1,000
8	Item does not lead to multiple interpretations (C)	3	4	4	8	0,889
9	Item is appropriate for learning conditions (C)	4	4	3	8	0,889
10	Item is appropriate for the context of junior secondary science education (D)	4	4	4	9	1,000
11	The Likert scale is appropriate for use (D)	4	4	4	9	1,000
12	Response options are clearly formulated (D)	4	3	4	8	0,889
	Overall Average					0,944

As presented in Table 2, all validation indicators achieved Aiken's V coefficients ranging from 0.889 to 1.000, with an overall mean value of 0.944. Five

indicators attained the maximum coefficient ($V = 1.000$), including alignment of the items with the research objectives, clarity of language for teachers, clarity and comprehensibility of the statements, appropriateness of the items for science context, and suitability of the Likert scale employed. The remaining seven indicators obtained an Aiken's V value of 0.889.

All coefficients exceeded the recommended minimum threshold for content validity ($V \geq 0.80$), indicating a high degree of agreement among the expert validators regarding the relevance and appropriateness of the instrument. These results suggest that the teacher needs assessment questionnaire adequately represents the intended constructs and fulfills the requirements of content validity. Therefore, the instrument can be considered suitable for use in the needs analysis phase of developing the ethnoscience-integrated Project-Based Learning model.

Summary of Aiken's V Values by Assessment Aspect

Analysis at the assessment-aspect level provides information regarding the consistency of the instrument's content validity across the evaluated dimensions. The Aiken's V values obtained for each validation indicator were grouped and averaged according to four assessment aspects: content relevance, language clarity, item construction, and appropriateness of context and scale. The summary results are presented in Table 3.

Tabel 3. Mean Aiken's V Values Across Assessment Aspects

No	Assessment Aspect	Mean Aiken's V	Category
1	A. Content Relevance	0,926	Valid
2	B. Language Clarity	0,926	Valid
3	C. Item Construction	0,926	Valid
4	D. Appropriateness of Context and Scale	0,963	Valid
	Overall Mean	0,944	Valid

Based on Table 3, all assessment aspects achieved Aiken's V values above 0.90, with an overall mean of 0.944. The aspect of Appropriateness of Context and Scale (D) obtained the highest value (0.963), while Content Relevance (A), Language Clarity (B), and Item Construction (C) each obtained a value of 0.926. The relatively small difference among the aspects (a gap of only 0.037) indicates that the instrument demonstrates a consistent level of content validity across all evaluation dimensions. These findings suggest that the instrument has adequately fulfilled the requirements of content relevance, language clarity, item construction quality, and contextual appropriateness. Therefore, the questionnaire is considered suitable for use in the needs analysis stage of developing the ethnoscience-integrated Project-Based Learning model.

Discussion

The findings indicate that the developed teacher needs assessment questionnaire possesses a high level of content validity, as reflected by the overall Aiken's V coefficient of 0.944. This value exceeds the minimum recommended

threshold of 0.80, indicating that the instrument adequately represents the constructs intended to be measured (Retnawati, 2016). The results suggest that the questionnaire items are relevant to the objectives of the preliminary research and are capable of capturing information required for the development of an ethnoscience-integrated Project-Based Learning model.

The consistently high Aiken's V values across all validation indicators (0.889–1.000) demonstrate substantial agreement among the expert validators. Such consistency indicates that the instrument has been developed with appropriate consideration of content relevance, language clarity, item construction, and contextual suitability. According to (Polit & Beck, 2006), a high degree of expert agreement provides strong evidence that an instrument adequately represents the target construct and is suitable for subsequent empirical use.

Analysis by assessment aspect further revealed that all dimensions achieved mean Aiken's V values above 0.90. The highest value was obtained for the aspect of context and scale appropriateness (0.963), while content relevance, language clarity, and item construction each achieved a mean value of 0.926. The relatively small variation among these aspects indicates that the quality of the instrument is consistently distributed across all evaluated dimensions. This finding suggests that the instrument not only demonstrates strong content relevance but also maintains clarity, structural quality, and contextual appropriateness.

These results support the use of the questionnaire as a valid instrument for collecting needs assessment data during the

preliminary research phase. Establishing content validity at this stage is essential because the quality of needs analysis data directly influences subsequent decisions in educational product development (Mckenney & Reeves, 2019; Messick, 1995). Therefore, the validated instrument provides a credible empirical foundation for the development of an ethnoscience-integrated Project-Based Learning model in junior secondary science education.

CONCLUSION

The results of the content validity analysis using Aiken's V coefficient indicate that the teacher needs assessment questionnaire developed for the preliminary research phase of the ethnoscience-integrated Project-Based Learning (PjBL) model possesses a high level of content validity. All 12 validation indicators achieved Aiken's V values ranging from 0.889 to 1.000, with an overall mean coefficient of 0.944. Since all values exceeded the recommended minimum threshold for content validity ($V \geq 0.80$), the instrument can be considered valid and suitable for use in the needs analysis stage.

The aspect-based analysis further revealed that all assessment dimensions obtained Aiken's V values above 0.90. The highest coefficient was observed in the aspect of appropriateness of context and scale (0.963), while content relevance, language clarity, and item construction each achieved a mean value of 0.926. The relatively small variation among these aspects demonstrates that the instrument exhibits a consistent level of validity across all evaluated dimensions.

These findings provide empirical evidence that the developed instrument meets the requirements of content validity

and can serve as a reliable tool for collecting data during the preliminary stage of educational product development. As the present study focused solely on content validity through expert judgment, future research is recommended to examine the instrument's reliability and construct validity through empirical testing with a larger sample. Furthermore, similar validation procedures may be applied to other research instruments, such as student questionnaires, interview protocols, observation sheets, and higher-order thinking skills assessment instruments, to ensure methodological consistency and strengthen the overall quality of educational research.

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