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Cultural Tourism Contexts into Digital Numeracy Assessment: Development of a Quizizz-Based Instrument

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Abstract

This study aims to develop a numeracy test instrument based on the context of Kuningan cultural tourism using the Quizizz platform. This valid, reliable, and practical tool is used in the numeracy assessment of the Independent Curriculum (Curriculum Merdeka). This research is developmental research using the Plomp model, which includes preliminary research, design, and evaluation. The trial subjects involved 30 junior high school students in Kuningan Regency. Content validation was conducted by three experts in mathematics education, assessment, and local culture, and analyzed using the Aiken's V coefficient. Empirical testing included analysis of item validity, reliability, discrimination power, and difficulty index using classical test theory. The results showed that the Aiken's V value ranged from 0.83 to 0.94, with an average of 0.89, indicating high content validity. The instrument's reliability value of $\alpha = 0.79$ is in the high category. Most of the test items had good discrimination power ($0.40 \leq D < 0.70$) and a moderate difficulty index ($0.30 \leq p \leq 0.80$). These findings indicate that the developed instrument is suitable for use as a contextual numeracy assessment tool. Integrating Kuningan's cultural context, such as the Linggarjati Museum and Cibulan Pond, with the Quizizz platform has been shown to increase student engagement and provide a meaningful and enjoyable digital assessment. This research contributes to strengthening local culture-based numeracy literacy and supports the implementation of the Pancasila Student Profile through technology-based assessment.

Keywords: *numeracy, ethnomathematics, local culture, Quizizz, instrument development*

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INTRODUCTION

Numeracy skills are a crucial aspect of mathematics learning, requiring students to think logically, analytically, and contextually (Kemendikbudristek, 2023). However, various studies show that the results of the Minimum Competency Assessment (AKM) still show low (Sumarni, et.al., 2024), (Stanggo & Susanto, 2025) and PISA still show low mathematics skills of Indonesian students (OECD, 2022). One cause is the lack of local cultural context in the assessment process (Fitriyani & Setiawan, 2022).

The integration of culture into mathematics learning is known as the ethnomathematics approach (D'Ambrosio, 1985), which emphasizes that cultural practices can provide meaningful contexts for understanding mathematical concepts (Rosa & Orey, 2016). Kuningan has rich cultural potential, such as the Seren Taun ceremony, ngalokat cai, brass metal crafts, and the Linggarjati traditional market, which can be integrated into the numeracy context (Komara, Yudikusyadi, Meliyani, 2023).

Research shows that Seren Taun has pedagogical and ethnopedagogical value in education, so it can be used as a contextual learning resource in various subjects including numeracy and mathematics (Komara, Yudikusyadi, Meliyani, 2023). Ngalokat cai or Kawin Cai is a traditional ceremony in Kuningan (Sunda) that has strong cultural elements and is often included in cultural teaching materials in schools because of its values in social and cultural life (Pitradi & Ropiah, 2024). There has been no specific study that directly links Seren Taun, ngalokat cai, metal crafts, and the Linggarjati traditional market with numeracy, based on cultural and ethnopedagogical literature, all of these traditional cultural phenomena contain quantitative elements, patterns, space, size, scale, and economic value so that they are relevant for integration in contextual mathematics learning based on local culture.

The ethnomathematics approach has significant potential in mathematics education because it can link mathematical concepts to cultural practices, social experiences, and students' daily lives, making learning more contextual and meaningful (D'Ambrosio, 1985). Through ethnomathematics, mathematics is understood as the result of human activities that develop within a specific cultural context, not merely as a collection of abstract concepts (D'Ambrosio, 2001). Several studies have shown that the application of this approach can improve conceptual understanding, mathematical literacy, and student learning motivation because students learn mathematics through real situations close to their environment and culture (Rosa & Orey, 2011; Suhartini & Wahyuni, 2019). In addition, the ethnomathematics approach also contributes to fostering an appreciative attitude towards local culture and supports inclusive and equitable learning, making it relevant to the demands of 21st-century education and the Sustainable Development Goals (Rosa & Orey, 2016).

Furthermore, the use of digital technology in assessment is increasingly relevant (Mauladaniyati, 2025). The Quizizz application allows for interactive problem presentation with gamification elements that can increase student motivation and participation (Bashith & Amin, 2020; Haryati et al., 2023). Numeracy and digital-based assessment have been extensively researched, particularly regarding increasing learning motivation through the use of Quizizz, Kahoot, or Google Forms. For example, research by Bashith & Amin (2020) showed that Quizizz can increase students' motivation to learn mathematics. Similarly, Haryati et al. (2023) reported that using Quizizz makes the assessment process more engaging and interactive. However, these studies focused more on media and learning motivation, rather than on developing valid and reliable numeracy instruments.

On the other hand, research on ethnomathematics and numeracy based on local culture has also developed. D'Ambrosio (1985) and Rosa & Orey (2016) emphasized that cultural context can enhance the meaning of mathematics learning. Fitriyani & Setiawan (2022) also developed a local culture-based numeracy assessment, but the cultural context used was still general and did not utilize the specific cultural heritage of certain regions, such as Kuningan. In other words, there is still a research gap in developing numeracy instruments that simultaneously integrate local culture and interactive digital technology.

Furthermore, research combining an ethnomathematics approach (cultural context) with a game-based digital platform like Quizizz is still very limited, especially in the numeracy context of the Independent Curriculum. Most previous research has focused on learning, rather than on developing validated, practical, and reliable culture-based numeracy assessment instruments (see also Kemendikbudristek, 2023; OECD, 2022).

This research aims to fill this gap by developing a valid, practical, and reliable Kuningan culture-based numeracy instrument, supported by Quizizz, so that it can become an innovative contextual numeracy assessment tailored to the characteristics of Indonesian students. Therefore, this study aims to develop a Kuningan culture-based numeracy instrument with the help of Quizizz and test its validity, practicality, and reliability.

The research makes an important contribution to the body of mathematics education research by expanding the study of contextual numeracy based on local culture (ethnomathematics) integrated with digital technology. This study shows that the context of Kuningan cultural tourism can be utilized as an authentic source in the development of numeracy assessment instruments, so that numeracy is not only understood as the ability to calculate, but also as the ability to reason and solve problems in real situations (D'Ambrosio, 1985; OECD, 2019). In addition, the development of the Quizizz-based instrument enriches digital assessment research by presenting a numeracy evaluation model that is interactive, adaptive, and relevant to the characteristics of 21st-century learners (Sung et al., 2016). This research also strengthens the ethno-realistic approach in mathematics education by integrating the principles of ethnomathematics and realistic mathematics education at the assessment stage, not only in learning (Rosa & Orey, 2011; Gravemeijer & Doorman, 1999). Thus, this research contributes conceptually, methodologically, and practically to the development of culturally and technologically based numeracy instruments, as well as supporting efforts to improve the quality of mathematics education.

METHOD

This research is a developmental study aimed at producing a numeracy instrument based on the Kuningan cultural tourism context, using the Quizizz platform as an interactive assessment tool. The development model used is based on the Plomp model (Plomp & Nieveen, 2013), which consists of three main stages: preliminary research, design, and evaluation. The Plomp model was chosen because it is systematic, oriented towards empirical validity, and allows for the development of contextual and applicable educational products through an iterative process of needs analysis, design, and evaluation.

The preliminary research stage focused on needs analysis and the development context. The needs analysis was conducted through a literature review of various sources, such as the Merdeka Curriculum numeracy assessment guide (Kemendikbudristek, 2023), previous research on culture-based numeracy assessment (Fitriyani & Setiawan, 2022; Wardhani & Anisa, 2020), and a study of the ethnomathematics concept that integrates local cultural values into mathematics learning (Risdiyanti & Prahmana, 2021). In addition, observations were conducted at several cultural tourism sites in Kuningan Regency, such as the Cibulan Pool and the Linggarjati Museum, to explore contextual potential that could be used as stimulus for numeracy questions. Interviews with teachers and tourism stakeholders were conducted to identify the relationship between cultural tourism activities and numeracy aspects such as measurement, comparison, and data interpretation. The results of this stage included instrument requirements specifications, contextual numeracy indicators, and initial item designs relevant to cultural values and local characteristics.

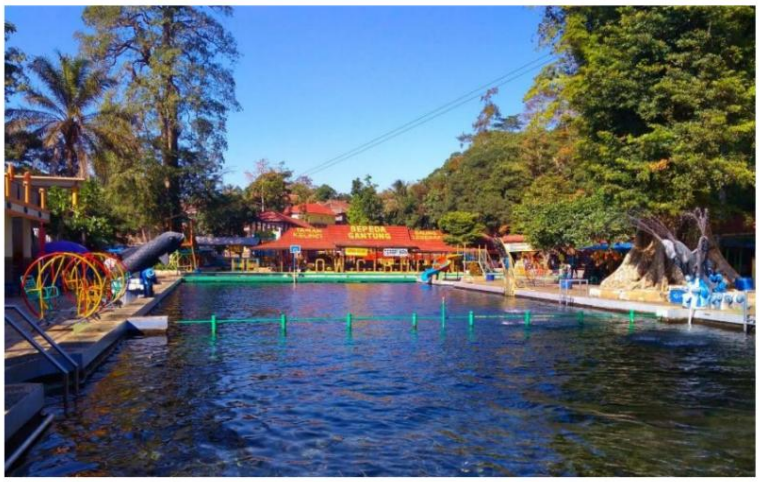

Figure 1. Cibulan Pool

The design phase was conducted to design and develop a prototype numeracy instrument based on Kuningan cultural tourism, which will be implemented through the Quizizz platform. At this stage, an instrument blueprint was developed, containing numeracy indicators, cognitive levels, and item formats appropriate to the cultural tourism context. Each item was designed based on authentic situations at Kuningan cultural tourism sites that involve mathematical activities. The

visual design and narrative of the questions were designed to be engaging and included cultural illustrations to increase student engagement. The Quizizz platform was used because of its gamification features, automatic feedback, and easy access, which support interactive digital learning (Bashith & Amin, 2020).

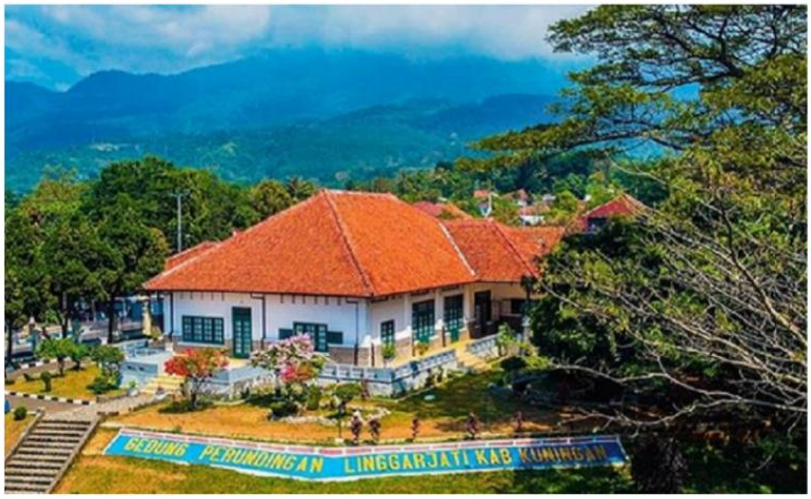

Figure 2. Linggarjati Museum

The evaluation phase aims to assess the validity, reliability, discriminatory power, and difficulty index of the developed instrument. Content validation was conducted by 3 experts. 1 expert in mathematics education, 1 expert in assessment, and 1 expert in local culture using a validation sheet analyzed using Aiken's V coefficient (Aiken, 1985; Azwar, 2012). The instrument, which was declared valid, was then tested on a limited number of 5 junior high school students in Kuningan to obtain initial data on the readability and practicality of using Quizizz. After revisions based on the results of the limited test, a field test was conducted involving 30 junior high schools in Kuningan to obtain quantitative data on the characteristics of the test items. The analysis was conducted using classical test theory including the level of difficulty (p), discriminatory power (D), and reliability using the Cronbach's alpha coefficient (Cronbach, 1951; Tavakol & Dennick, 2011). A p value between 0.30–0.80 and D ≥ 0.30 indicates good item quality, while an α value ≥ 0.70 indicates adequate reliability. The practicality questionnaire data was analyzed descriptively using percentages and categories (Sugiyono, 2022), while the interview data was analyzed qualitatively to obtain input regarding cultural context suitability, ease of use, and student learning experiences. The results of the comprehensive evaluation served as the basis for final revisions to obtain the final product, a valid, reliable, and practical Quizizz-assisted Kuningan cultural tourism numeracy instrument for use in numeracy assessments in the Merdeka Curriculum.

RESULT AND DISCUSSION

Result

The instrument can be found at the following link: AKM Instrument Creation Learning Evaluation Project, join using: https://wayground.com/join?gc=847910. Content validation was conducted to assess the extent to which the items in the Kuningan cultural tourism numeracy instrument, supported by Quizizz, accurately represented numeracy ability indicators and local cultural context. The validation process involved three experts, one from the fields of mathematics education, educational assessment, and Kuningan local culture. The experts were asked to assess each item based on four main aspects: (1) appropriateness of content to numeracy indicators, (2) clarity of construction and language, (3) appropriateness of the local cultural context, and (4) appropriateness to the characteristics of Quizizz-based digital assessments.

Assessments were conducted using a four-point scale, ranging from "not appropriate" (1) to "very appropriate" (4). The expert assessment data were then analyzed using Aiken's V coefficient (Aiken, 1985) to determine the degree of content validity of each item. Based on the calculations, the Aiken's V coefficient ranged from 0.83 to 0.94, with an overall average of 0.89. Referring to Azwar's (2012) criteria, an Aiken's V value of ≥ 0.80 indicates a very high level of validity, thus all test items were deemed content-valid and suitable for use in the field trial phase.

These findings indicate that experts assessed the instrument as capable of integrating numeracy concepts with the Kuningan cultural context in a representative manner. Several minor revisions were made to the language and context visualization aspects to make it more communicative on the Quizizz platform. These validation results reinforce previous findings that developing a local culture-based instrument can increase the relevance and engagement of students in numeracy assessments (Fitriyani & Setiawan, 2022; Wardhani & Anisa, 2020; Rosa & Orey, 2016).

The results of the development of the Kuningan cultural tourism numeracy instrument using Quizizz are presented based on the validity, reliability, discrimination, and difficulty index tests for eight multiple-choice questions piloted on 30 eighth-grade junior high school students in Kuningan Regency. The content validity test was previously conducted by three experts, while the empirical test was conducted based on student responses to the items on the Quizizz platform.

1. Item Validity

Item validity analysis was conducted using Pearson's product-moment correlation between item scores and total scores. The validity criteria were based on the calculated r value compared to the table r (N = 30, α = 0.05) of 0.361. The item was declared valid if the calculated r value was > 0.361. The results of the empirical validity analysis can be seen in Table 1 below.

Table 1. Results of Item Validity Analysis

No. Item	r count	r table	Description
1	0,621	0,361	Valid
2	0,578	0,361	Valid

3	0,492	0,361	Valid
4	0,655	0,361	Valid
5	0,468	0,361	Valid
6	0,382	0,361	Valid
7	0,702	0,361	Valid
8	0,327	0,361	Invalid

Based on Table 1, seven items were declared valid, while one item (number 8) was declared invalid because the calculated r value was < r table. Therefore, the seven valid items were used for the next stage of analysis.

2. Instrument Reliability

The instrument reliability was calculated using Cronbach's Alpha to determine internal consistency between items. The analysis results showed an α value of 0.79, indicating high instrument reliability (Tavakol & Dennick, 2011). This value indicates that the Kuningan cultural tourism numeracy instrument, assisted by Quizizz, has a good level of reliability and can be used consistently to measure students' numeracy abilities.

3. Item Discriminant Power

Item discriminant power indicates the ability of the item to differentiate between high-ability and low-ability students. The discriminant power value is calculated using the difference in proportion between the upper and lower groups (each representing 27% of the total student population). The criteria for discriminatory power according to Arikunto (2019) are: $D < 0.20$ (poor), $0.20 \leq D < 0.40$ (sufficient), $0.40 \leq D < 0.70$ (good), and $D \geq 0.70$ (very good). The results of the analysis are presented in Table 2.

Table 2. Results of the Analysis of Discriminatory Power of Test Items

Item No.	Discriminatory Power (D)	Category
1	0,55	Good
2	0,47	Good
3	0,33	Adequate
4	0,60	Good
5	0,42	Good
6	0,28	Adequate
7	0,67	Good
8	0,20	Adequate

Based on the analysis results, six items had good discrimination power, while two items (numbers 3 and 6) were in the fair category. This indicates that most items were able to effectively differentiate students' abilities.

4. Item Difficulty Index

The difficulty index (p) indicates the level of difficulty of a question. The p value is calculated by dividing the number of students who answered correctly by the total number of students. The difficulty criteria used are: $p < 0.30$ (difficult), $0.30 \leq p \leq 0.80$ (moderate), and $p > 0.80$ (easy) (Arikunto, 2019). The results of the difficulty index analysis are presented in Table 3.

Table 3. Results of the Item Difficulty Index Analysis

Item No.	Difficulty Index (p)	Category
1	0,45	Medium
2	0,63	Medium
3	0,72	Medium
4	0,38	Medium
5	0,56	Medium
6	0,28	Difficult
7	0,81	Easy
8	0,60	Medium

The analysis results show that most items fall into the moderate category, with one item being classified as difficult, and one item being considered easy. This indicates that the instrument's difficulty level is sufficiently proportional and appropriate for measuring the numeracy skills of students with a diverse range of abilities.

5. General Interpretation

Overall, the empirical test results indicate that the Kuningan cultural tourism numeracy instrument, supported by Quizizz, has good psychometric characteristics. Most items are valid, reliable, have adequate discrimination, and have a balanced level of difficulty between easy, medium, and difficult. This indicates that the instrument is suitable for measuring students' numeracy skills in local cultural contexts, while also supporting enjoyable digital assessment through the Quizizz platform.

Furthermore, Kuningan cultural tourism contexts, such as the Cibulan Fish Pond and the Linggarjati Museum, are considered capable of increasing student engagement in answering numeracy questions because they present authentic problems that are close to their daily lives. Therefore, this instrument not only meets the technical criteria for measurement but also has the potential to strengthen the integration between numeracy literacy and local cultural preservation.

Discussion

The results of this study indicate that the Kuningan cultural tourism numeracy instrument, supported by Quizizz, has good quality characteristics, in terms of validity, reliability, discrimination power, and difficulty index. These findings reinforce the importance of developing

numeracy assessments that are contextualized to local culture and adaptable to digital technology to improve students' numeracy skills.

Instrument validity showed that seven of the eight items were declared valid based on the correlation between the items and the total score. This indicates that most of the items measure the same construct: numeracy skills in the context of Kuningan cultural tourism. According to Azwar (2012), items that have a significant correlation with the total score indicate good content consistency across the entire instrument. These results align with research by Fitriyani and Setiawan (2022), who found that the local cultural context can strengthen the clarity of question meaning and increase content validity because students better understand issues close to their environment.

The instrument's reliability value of $\alpha = 0.79$ indicates high internal consistency. Based on the interpretation of Tavakol and Dennick (2011), a Cronbach's Alpha value above 0.70 indicates good reliability for an educational measurement instrument. This result aligns with the findings of Wardhani and Anisa (2020), who developed a local wisdom-based numeracy assessment and obtained similar reliability values, demonstrating that the integration of cultural context and item design can produce a psychometrically consistent instrument. Therefore, the use of Kuningan cultural contexts such as the Cibulan Pool and the Linggarjati Museum in numeracy questions did not reduce the instrument's reliability but instead strengthened students' understanding of the questions.

Item discrimination power showed that most items effectively differentiated between high-ability and low-ability students. This indicates that the developed items encompass a variety of cognitive levels appropriate to the numeracy indicators, ranging from basic mathematical reasoning to application in real-life contexts. According to Arikunto (2019), good discrimination power indicates that the questions are able to separate students who have mastered the material from those who have not. This finding is also supported by research by Pratiwi and Nurjanah (2021), which shows that cultural integration in numeracy assessments can increase discriminatory power because students with strong conceptual understanding are able to interpret cultural contexts more logically.

The difficulty index, which varies from difficult to easy, indicates that the instrument has a balanced level of difficulty, with the majority of items falling in the medium category. This proportion is ideal for measuring the abilities of students with a diverse range of abilities (Allen & Yen, 2002). This diversity in difficulty levels is important in numeracy assessments because it reflects real-world situations where students are faced with problems of varying complexity. Similar results were obtained by Setiawan and Fajriyah (2021), who stated that numeracy

instruments based on local cultural contexts have a more balanced distribution of difficulty levels than conventional questions because the context is more familiar to students.

The use of the Quizizz platform in presenting the instrument has been proven to support the implementation of an engaging and efficient assessment (Adiastuty, et.al, 2023). Students can receive immediate feedback on their answers, and teachers can easily analyze the results through automated reports. Observations also indicate that students are more enthusiastic when taking the assessment.

In addition to meeting the technical aspects of measurement, this instrument also contributes to strengthening numeracy literacy based on local culture. According to Risdiyanti and Prahmana (2021), ethnomathematics can play a role in linking mathematics learning to cultural contexts, so that students not only master numeracy concepts mechanically but also understand their application in everyday life. The Kuningan cultural tourism context provides opportunities for students to reason in real-life situations such as calculating travel costs, estimating the area of a tourist area, or reading visitor data, reflecting the numeracy skills expected in the Independent Curriculum (Kemendikbudristek, 2023).

Therefore, the results of this study confirm that the development of a numeracy instrument based on Kuningan cultural tourism using Quizizz is not only empirically feasible (valid, reliable, and balanced in difficulty), but also pedagogically and contextually relevant. The integration of local culture and digital technology has the potential to be an innovative approach to 21st-century numeracy assessment, supporting more meaningful, adaptive, and character-based learning.

CONCLUSIONS

Based on the research and analysis conducted, it can be concluded that the Kuningan cultural tourism-based numeracy instrument, developed with the assistance of the Quizizz platform, is considered suitable for use as a measure of students' numeracy skills. Validity test results indicate that all test items have high validity, indicating that the instrument is capable of measuring numeracy competency within the local cultural context in which it is integrated. The excellent reliability value confirms the instrument's strong internal consistency. Meanwhile, the discriminatory power analysis showed that most test items effectively differentiated between high- and low-ability students, and the moderate-to-easy difficulty level indicates that the test items were well-received by the test participants.

This study recommends that this Kuningan cultural-based numeracy instrument be implemented more widely at other educational levels, particularly to strengthen numeracy literacy within the context of the Pancasila Student Profile as directed by the Ministry of Education, Culture, Research, and Technology (2023). Future researchers are advised to conduct further development

by expanding the number of test items, involving a more diverse sample, and utilizing Quizizz's digital analytics features for data-driven adaptive evaluation. Thus, this instrument can be a culture-based numeracy assessment model that is not only psychometrically accurate, but also socially and culturally contextual.

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