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Integrated Ethnoscience Barcode Quartet Card Media: A Solution to Optimize Student Science Literacy

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Abstract

Purpose: This study aims to develop and analyze the feasibility of learning media in the form of ethnoscience-integrated barcoded quartet cards to optimize the science literacy of grade IV elementary school students.
Methodology: This research employed Research and Development (R&D) using the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation), limited to the media development stage. Data were collected through interviews, observations, questionnaires, and validation sheets.
Results: The results showed that: (1) the developed product is a science learning media in the form of barcoded quartet cards integrated with ethnoscience, containing material about changes in the state of matter; (2) the feasibility tests of the media and material gained scores of 95.59% and 95%, respectively, indicating that the media is highly feasible.
Applications/Originality/Value: The originality of this media lies in its integration of ethnoscience—local wisdom related to changes in the state of matter—into interactive learning tools to enhance the science literacy of fourth-grade elementary students.

Introduction

As per Nabilah & Nana (2020) human resources must be equipped with skills to face the challenges of the 21st century, including critical thinking, collaboration, communication, and creativity (4C). One of the skills that must be possessed in the 21st century is scientific literacy (Pratiwi et al., 2019). Scientific literacy is a skill necessary to adapt in the 21st century, serving as a foundation in various aspects of daily life (Gultepe & Kilic, 2015) because through science literacy, it is hoped that students will be able to understand, convey, and apply scientific concepts in everyday life (Utami et al., 2022).

Science literacy according to the Organization for Economic Cooperation and Development (OECD) (2019) can be characterized by three interrelated aspects, namely context, knowledge, and competence. Based on the PISA results conducted by the OECD, it shows that Indonesian students' science literacy has declined over time, with scores of 403 in 2015, 396 in 2018, and 383 in 2022. This result confirms that the average ability of Indonesian students in science literacy has been declining year by year. Therefore, concrete steps are needed to improve students' science literacy skills to approach the international standard of achieving a score of 500.

According to the evaluation of Indonesia's PISA results studied by experts, several reasons behind the low science literacy skills include the lack of precision in selecting books as teaching materials, misconceptions, minimal application of context in classroom learning, low reading skills among students, and a lack of supportive learning environments (Fuadi et al., 2020). Infrastructure and facilities also play a role in the low level of science literacy in Indonesia. One of the important elements in the learning process is learning media or infrastructure. Learning media becomes one of the learning components that can enhance the quality of education (Daulae, 2019). As Indriyani (2019) states learning media has a very influential role and function in the learning process.

Learning media is an integral part of the learning activities that are essential for teachers and students during the learning process (Pane & Dasopang, 2017). Besides serving as a tool to convey messages or materials, learning media can also stimulate students' thinking, emotions, and enthusiasm during the learning process, thereby achieving the learning objectives (Nurdyansah, 2019). Learning media also plays a role in introducing complex or abstract concepts in a more concrete and easily understandable form. This is in line with Jean Piaget's theory of cognitive development, which states that children in elementary school are in the concrete operational stage. At this stage, students need real objects in their learning activities (Istiqomah & Maemonah, 2021).

The use of quartet cards as learning media was also carried out by previous research, namely by Safitri et al (2023) who developed barcoded quartet card media and proved that the media developed was very valid and suitable for use. Research using quartet card media was then conducted by Ningsih & Gunansyah (2023) showing the results of the QR

Code quartet card media developed there was an increase in learning outcomes. Furthermore, research that develops flashcard media conducted by Nuraini & Suryanti (2022) states that barcode flashcard learning media is suitable for improving the science literacy of fifth-grade elementary school students. Azkia et al (2023) stated that interactive learning media integrated with ethnoscience on the topic of salt hydrolysis is considered suitable for enhancing students' science literacy and learning motivation in chemistry education.

From several studies that have been conducted, the researchers will develop a learning media called the Barcode Quartet Card. The Barcode Quartet Card is a thick paper grouped in fours, consisting of several illustrated cards and written explanations that describe the images. According to research by Quartet cards, as the name suggests meaning "four," are played by forming pairs of cards that total four as one set. Media Quartet Card with barcodes is a combination of Kuartet cards with barcode codes. Barcodes are symbols consisting of lines or specific codes that serve to store data (Meliawati, 2020). The type of barcode that will be used in this Quartet media is QR-Code. The device that will be used to read the barcode codes on the Quartet cards is a barcode scanner.

Researchers will also integrate the Quartet Card media into ethnoscience, as shown by the PISA results conducted by the OECD, which indicate that a learning approach is more effective and relevant when linked to the local context. Research conducted (Djafar et al., 2024) states that ethnoscience-based quartet card media is deemed suitable for use in learning to enhance students' conceptual understanding. This can improve students' understanding and interest in science. Therefore, the integration of local contexts with ethnoscience is very necessary in education. The integration of ethnoscience in learning can clearly reflect the uniqueness of teaching materials, classroom space, learning environment, methods, and culturally-based learning approaches. Learning will be more effective if ethnoscience is incorporated into the main themes that are the focus of the learning process (Perangin-Angin & Anggraini, 2023).

As per Rahmawati & Atmojo (2021) The ethnoscience approach is a learning method that combines culture and science, providing a more meaningful learning experience for students. Integrating culture into this approach, not only enhances students' connection with the subject matter but also helps them build a deeper and socially relevant understanding of scientific concepts. Julia et al (2021) also emphasize that an ethnoscience approach is very much needed in science learning because it provides a clearer context, thereby strengthening students' conceptual understanding. In line with the research that has been conducted Jacinda et al (2023) show that connecting science and culture can enhance students' understanding.

This study has a problem formulation in the form of how media development and validity of ethnoscience integrated barcoded quartet card learning media to optimize the science literacy of elementary school students. So the purpose of this study will develop and analyze the feasibility of ethnoscience integrated barcoded quartet card learning media to optimize the science literacy of grade IV elementary school students.

Method

The type of research used in this study is Research and Development (R&D). Okpatrioka (2023) states that R&D is a process or stage aimed at developing new products or improving existing products. The development model used in this research is the ADDIE model. The product resulting from this research is a quartet card learning media with a barcode integrated with ethnoscience on the topic of matter changes for fourth-grade elementary school students. Hidayat & Nizar (2021) state that ADDIE is an instructional design that focuses on individual learning. The ADDIE model has five steps: Analysis, Design, Development, Implementation, and Evaluation. However, in this study, the researchers only limited themselves to the development stage. The analysis stage is the initial step in development research. The purpose of this analysis stage is to identify the possible causes of a learning performance gap (Asmayanti et al., 2020). This analysis includes two aspects, namely performance analysis which focuses on various issues in the learning process, and needs analysis which aims to understand the conditions occurring on the ground.

Based on the analysis of these two aspects, it is expected to be able to address the solutions to the identified problems. The second stage is the design stage or planning stage. According to Waruwu (2024), The design stage is the stage for designing the product that will be developed. At this stage, the researchers design the basic framework of the Quartet Card and analyze the learning materials to be included in these cards. Media at this stage is evaluated in terms of physical aspects, design, and content. The next stage is development or enhancement. According to Hidayat & Nizar (2021), This stage aims to produce and validate the selected learning resources. The steps taken by the researchers in developing the quartet card media include: 1) designing the layout using the Canva application tailored to the selected material and the student's needs; 2) reviewing the Quartet Card media by validating it with the designated experts, namely media experts and content experts. The data collection techniques for this research were through observation, interviews, and questionnaire instruments. The interview was conducted with the class teacher Mrs. An, while the observation was carried out during the IPAS lesson in the fourth grade. The questionnaire instrument is used for product validity testing, which is conducted twice: media validation and material validation. Media validation testing through four assessment aspects, namely: 1) graphic aspect; 2) media presentation aspect; 3) media content aspect; 4) and linguistic aspect. The media validity test was conducted with Mr. MA, a lecturer at PGSD UMS with expertise in the field of media. Meanwhile, the material validation testing through three aspects, namely: 1) content feasibility aspect; 2) presentation feasibility aspect; 3) and linguistic aspect. The validity test of this material was conducted with Mrs. Ad, a lecturer at PGSD UMS who has expertise in the field of science. The

data obtained will be analyzed based on the criteria of the questionnaire assessment adopted by Haking & Soepriyanto (2019), which is presented in Table 1.

Table 1. Questionnaire Assessment categories adopted from Haking & Soepriyanto (2019)

Criteria	Score
Very Deserving	4
Deserving	3
Less Deserving	2
Not Deserving	1

Filling out the questionnaire with scores and criteria in Table 1, it is explained that a score of 1 indicates that the product criteria are not feasible for implementation, while a score of 4 indicates that the criteria are very feasible for implementation. Next, the score calculation for media and material experts was conducted using the Likert scale formula adopted from Afriyanti et al (2018), those are:

$$xi = (\_Smax \text{ ^}(\sum S))x\ 100\%$$

Explanation:
Smax = Maximum score
$\sum S$ = Total Score
xi = eligibility score

Next, the feasibility results will be obtained based on the feasibility scale adopted and modified from Haking & Soepriyanto (2019) which is presented in Table 2.

Table 2. Media adoption feasibility categories (Haking & Soepriyanto, 2019)

Criteria	Percentage Score
Very Deserving	$75\ \% \leq xi \leq 100\ \%$
Deserving	$50\ \% \leq xi < 75\ \%$
Less Deserving	$25\ \% \leq xi < 50\ \%$
Not Deserving	$0\ \% \leq xi < 25\ \%$

The interpretation scale criteria table is used as a reference to see the percentage and feasibility level of the media trial. If the product yields a percentage result of < 25%, it is declared unfit for use. Whereas if the obtained percentage is ≥ 75%, it is declared very fit for use.

Result and Discussion

The results obtained from the development of barcoded quartet card media on the material of changes in the form of substances using the three stages of the ADDIE development model.

Analysis stage

In the analysis stage, the researcher conducts an in-depth analysis of students' needs by exploring the various learning styles they possess and reviewing the existing teaching materials used in previous learning processes. The results of observations and interviews show that fourth-grade students prefer interactive learning methods, where they can be directly involved in the learning process. They find it easier to understand the material when the learning process is dynamic, varied, and not monotonous. Additionally, interviews with teachers revealed that they have not yet utilized varied and innovative learning media in teaching the material on the changes in the states of matter. Most of the teaching process still relies on traditional practical methods, without involving concrete media integrated with ethnoscience, which can provide broader insights into the cultural and environmental context of students. Therefore, the development of ethnoscience-based media is very important to create a more holistic and contextual learning experience.

The researchers also made careful adjustments between the teaching materials and the learning media that would be used. This process involves the preparation of content based on the applicable curriculum, the identified characteristics of the students, and their learning styles so that each material can be delivered most effectively. In selecting teaching materials, the researcher considers the suitability of the content with the quartet card media being developed, ensuring that the presented content is not only relevant but also supports the overall learning objectives. This aims to increase student engagement and facilitate a deeper understanding.

Based on these findings, the researchers are striving to develop ethnoscience learning media that can be used in the classroom engagingly and interactively. This media is expected not only to optimize students' science literacy but also to provide a richer and more relevant context so that students can relate scientific concepts to their local culture and experiences. With this approach, it is hoped that science learning becomes more engaging and effective, encouraging students to actively participate in their learning process, as well as developing critical and analytical thinking skills. Through the use of ethnoscience media, it is hoped that students not only learn about science but also understand how science interacts with their daily lives and culture, thereby fostering a positive attitude towards science and technology in the future.

Design stage

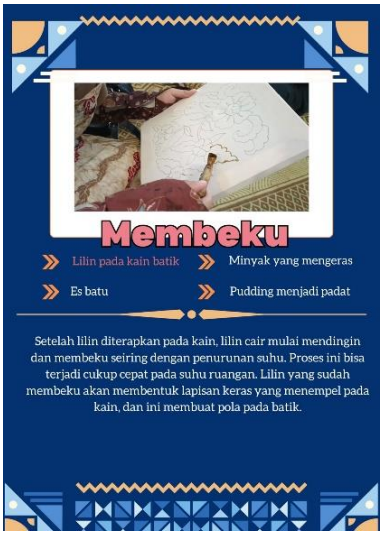
At this stage, the researcher conducts thorough and meticulous preparations before proceeding to the development of learning media that is expected to optimally meet the needs of students. This process begins with designing a general framework for the quartet cards that includes various structures and elements to be incorporated, such as content categories, supporting images, and questions that stimulate critical thinking. The researchers then meticulously analyzed the relevant learning materials, ensuring that the selected content not only aligns with the established learning outcomes but also considers the specific needs of the students, including their learning styles and the cultural context present in their environment.

Based on the results of in-depth analysis and observation, the researcher decided to focus on Natural and Social Sciences lessons, specifically on the topic of Changes in the State of Matter. This decision was made because the topic has high relevance in students' daily lives and can be easily integrated with the concept of ethnoscience that emphasizes local wisdom. Through this approach, researchers strive to create a more contextual and meaningful learning experience for students, so they can understand the relationship between science and the social realities they experience.

Next, the researchers developed the design of quartet card media by integrating elements of ethnoscience into it. This means that the examples of changes in the state of matter used in the quartet cards will reflect local wisdom and phenomena known to the students, allowing them to see a clear connection between scientific concepts and their culture. This integration aims to enrich students' understanding of the subject matter, as well as to enhance their engagement and motivation in the learning process. Through an innovative and participatory approach, it is hoped that the quartet card media will not only become an effective learning tool but also serve as a bridge connecting knowledge with local values present in the community, creating a deeper connection between students, knowledge, and their culture. Thus, it is hoped that students not only master scientific concepts but also appreciate and understand the social and cultural contexts in which they live.

Development Stage

In the development stage, the researcher develops quartet card media by selecting applications that support the development process. The researchers chose the Canva application to design barcode quartet cards, which consist of 24 cards, with 4 cards in each group, categorized based on 6 types of state changes of matter. The design of these quartet cards follows the general format, with a theme or title at the top, an image, and four subtitles below it. However, the difference lies in the content of the cards, which includes the types of state changes of matter, examples of state changes of matter, and explanations for each example below the image. The researchers also designed the game rules for the quartet cards. In addition, the researchers added definition cards for the types of changes in the state of matter and science literacy cards integrated with ethnoscience to optimize students' science literacy skills. The stages carried out include: 1) designing the media; 2) reviewing the media through expert validation; and 3) revising the media according to the experts' suggestions.



Translation
Freezing
1. Wax on batik cloth
2. Ice cube
3. Hardened oil
4. Pudding becomes solid

Once the wax is applied to the fabric, the molten wax begins to cool and solidify as the

Translation
Quartet Card
Changes in the form of substances

temperature drops. This process can happen quite quickly at room temperature. The frozen wax will form a hard layer that sticks to the fabric, and this creates the pattern on the batik.

Figure 1. Design of the quartet card with barcode

At the design stage of this media, the quartet cards are made with a size of 7 cm x 9.8 cm using 230 art carton paper. The front of the card displays a title that contains the type of phase change of matter, followed by four sides that include examples of those changes, along with explanations below the images. On the back of the card, there is a barcode that leads to a video about examples of phase changes of matter.

Translation
Sublimate
Sublimation is the process by which a solid changes directly into a gas without passing through liquid form. For example, mothballs placed in a cupboard will eventually shrink and disappear, because the mothballs change directly from solid to gas. This process is called sublimation.

Translation
Quartet Card
Changes in the form of substances

Figure 2. Definition card design

In the design of this definition card, it is made of the same size and paper as a quartet card. Definition cards are created to facilitate the understanding of the concept of types of phase changes in matter. There are 6 definition cards, namely melting, freezing, evaporating, condensing, sublimating, and crystallizing. On the back of the card, there is a barcode that leads to a video explaining the types of changes in the states of matter.

Translation:
The evaporation process is often used in traditional coastal salt making. In this process,

Translation:
Science literacy card
changes in the form of substances

seawater is heated in sunlight so that the water turns into a gas. The change in the form of substances that occurs in salt making is called?

Figure 3. Science literacy card design

In the design of this science literacy card, is made of the same size and paper as a quartet card. There are 10 science literacy cards containing questions related to everyday life. In addition, this card is also integrated with local wisdom. Science literacy cards are created to evaluate students' understanding of the material on the changes in the states of matter.

Translation:

1. Bring a friend until there are at least 3 of you. The more the merrier, up to a maximum of 6 people.
2. Mix all the cards into one pile and shuffle them randomly.
3. Distribute four cards randomly to each player and the rest are stacked in the center.
4. The first player asks one of the other players for a card by saying the name of the group and the name of the card. For example: CLIMATE (group name), DRY ES (card name).
5. If the requested player has the card, then he/she must hand it to the requesting player.
6. If the requested card is missing, the first player must take one card from the pile.
7. This mechanism continues in turn to the next player.
8. Each player must try to collect four cards in a group. The player who has successfully collected four cards in a group (quartet), lays down and shows his quartet, and earns one point.
9. The game ends when a player has run out of cards and there are no more cards left in the pile. The player with the greatest score, or who has collected the most quartets, is the winner.

Figure 4. Packaging design

The quartet's card packaging is designed with a predominantly blue background. On the front of the packaging, there is a title that reads "Quartet Cards of State Changes of Matter." On the back, there are game instructions for using the quartet cards. This packaging is printed using 260 art carton paper with dimensions of 7.5 cm x 10 cm.

After the researchers successfully developed the design of the quartet card learning media with an integrated ethnoscience barcode, the next step is to conduct a trial of the quartet cards to determine how feasible this media is for use. Media experts and content experts conducted tests on the quartet card media according to their respective questionnaire instruments.

The media validity test was conducted by Mr. MA, a lecturer at PGSD UMS who has expertise in the field of media. Based on the results of the media expert validation analysis, the developed teaching media achieved a percentage of 95.59% and falls into the "very feasible" category as shown in Table 3. The aspects evaluated include graphics, media presentation, media content, and language.

Table 3. Results of media expert validator

No	Rated Aspect	Score Obtained	Maximum Score	Percentage	Information
1	Graphic aspects	30	32	93,75%	Very worthy
2	Media presentation aspects	12	12	100%	Very worthy
3	Media content aspects	12	12	100%	Very worthy

4	Linguistic aspects	11	12	91,67%	Very worthy
Total		65	68	95,59%	Very worthy

Several suggestions from media experts can be used to improve the produced media, namely: 1) this quartet card media already meets good standards and attracts attention. However, improvements are needed regarding the color selection on the font; and 2) there are typos and punctuation errors found on the science literacy cards.

Meanwhile, the material validity test was conducted by Mrs. Ad, a lecturer at PGSD UMS who has expertise in the field of science. Based on the results of the expert validation analysis regarding the developed teaching media, it yielded a percentage of 95% and falls into the "very feasible" category as shown in Table 4. The aspects being evaluated include content feasibility, presentation feasibility, and language use.

Table 4. Results of material expert validator

No	Rated Aspect	Score Obtained	Maximum Score	Percentage	Information
1	Content feasibility aspect	20	20	100%	Very worthy
2	Presentation feasibility aspect	26	28	92,86%	Very worthy
3	Linguistic aspect	11	12	91,67%	Very worthy
Total		57	60	95%	Very worthy

There are several suggestions from material experts that can be used to improve the produced media, namely: 1) each type of matter change should be represented by at least two cards that integrate local wisdom, and 2) pay more attention to the wording on the science literacy cards.

Discussion

Science education has a very important goal of preparing human resources who are not only excellent in knowledge but also able to adapt quickly in the rapidly changing era of the 21st century. Fitariya (2018) stating that scientific literacy, which includes understanding and applying scientific concepts, enables someone to understand and make decisions based on his knowledge. This becomes key to be taught from the elementary education stage. Thus, children can start developing sensitivity to their surroundings and learn how to solve problems effectively from an early age.

In general, science literacy can be defined as an individual's ability to understand scientific concepts and apply them in daily life, enabling them to behave wisely both as individuals and as members of society (Wasis et al., 2020). When individuals have good science literacy skills, the impact can be felt not only in their personal lives but also on a larger scale, including for society and the nation (Jamilah et al., 2023). They will be better able to face complex challenges, make informed decisions, and contribute to the development of a science-based society.

This research resulted in an innovation in the form of quartet cards with barcodes integrated with ethnoscience. This media is specifically designed to help teachers optimize the science literacy skills of fourth-grade elementary school students. By using an interactive and engaging approach, it is hoped that students will not only understand scientific concepts but also be able to relate them to relevant local values and culture. This will create a more meaningful and comprehensive learning experience, and encourage students to become more critical and sensitive individuals towards the scientific issues present in their environment.

The development of this learning media uses the ADDIE design model. The ADDIE model has 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model development research conducted only reaches the Development stage because the purpose of this research is limited to developing and producing valid learning media for implementation based on the validator's assessment.

Media experts evaluate four important aspects, namely graphics, media presentation, media content, and language. The results of this assessment can be seen more clearly in the diagram presented in Figure 5. The graphic aspect received a fairly high average score of 93.75%. This indicates that the barcode quartet card media is very suitable for development in terms of visuals. These results show that the design and colors used in the media are very attractive and effective. Overall, strong visual appeal can be an added value for users and support success in the development of learning media (Ngadiman & Sulaiman, 2017). An attractive learning media display not only enhances students' interest and attention but also motivates them to actively engage in the learning process. Additionally, appealing visuals can facilitate material comprehension, help students remember information better, and create a more enjoyable and interactive learning atmosphere (Shabiralyani et al., 2015). However, media experts also provided input regarding the color selection for the font used. They noted that some texts appear unclear and may hinder readers from understanding the conveyed information. This is feared to reduce the media's effectiveness in delivering messages optimally. Therefore, experts recommend that the selection of colors for fonts be bolder and more varied, with the right contrast between the background and the text, so that the writing can stand out more, be easy to read, and attract attention. The use of the right colors on fonts not only enhances readability but also adds overall visual appeal to the media (Azhari, 2024).

The aspect of media presentation achieved a perfect average score of 100%. This score indicates that the media is very easy to use, especially because it is accompanied by clear and structured instructions. The presence of good guidelines makes it easier for users to understand how to use this media effectively (Pramudya et al., 2023), so that the presentation

aspect truly supports maximum user engagement in the learning process. The ease of use is very important to support efficient learning, allowing students to quickly access and utilize content without technical barriers. With the usage pattern offered, this media increases student engagement in learning activities.

The content aspect of the media also received a perfect average score of 100%. This result indicates that the presented content has successfully addressed the main issue, which is optimizing students' science literacy by connecting scientific concepts with ethnoscience. This approach not only enriches students' learning experiences but also allows them to see how scientific knowledge interacts with their culture and traditions. Thus, students can more easily understand scientific concepts because they can relate them to the experiences and knowledge they already possess. Additionally, linking local wisdom with science can help students develop pride in their culture while encouraging them to preserve that wisdom (Martir et al., 2024). This can also foster critical thinking skills, where students are encouraged to explore, analyze, and apply scientific knowledge in a broader context (Reka Nurjanah et al., 2024), so that learning becomes more comprehensive and meaningful.

However, on the other hand, the linguistic aspect received an average score of 91.67%. Although it already shows good quality, this score indicates there is room for improvement. The use of typography on quartet card media has helped facilitate students' understanding, but media experts recommend that some typos and punctuation errors be addressed. By improving linguistic aspects, especially through revisions of these minor errors, the media can be more effective in conveying information clearly and accurately. Clarity of language is key to ensuring that the message to be conveyed can be optimally received by students (Wardani, 2023), so that the desired communication becomes more effective and supports the overall learning objectives.

Overall, the assessment from media validators resulted in an average score of 95.59%, which clearly places the barcode quartet card media in the category of highly feasible for further development. This high score not only reflects the quality of the content and media design but also demonstrates the great potential of this media in significantly enhancing students' learning experiences. With the presence of interactive features and an innovative approach, this media can capture students' attention and encourage them to engage more actively in the learning process. Additionally, the assessment results also indicate that with some minor improvements, such as enhancements in linguistic aspects or more appealing visual presentations, this media can become a very effective tool in achieving educational goals. With proper development, it is hoped that this media will not only be able to provide quality information but also create a more dynamic and enjoyable learning atmosphere for students so that they can achieve optimal learning outcomes.

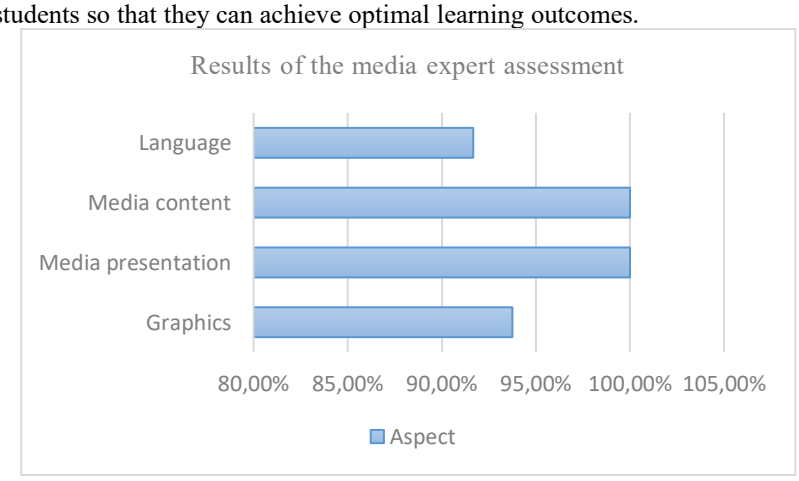


Figure 5. Media expert assessment diagram

Subject matter experts evaluated three key aspects: content feasibility, presentation feasibility, and language. The results of this evaluation are illustrated in the diagram in Figure 6. The content feasibility aspect received an outstanding average score of 100%, indicating that the material aligns precisely with the intended learning objectives, particularly in fostering an understanding of changes in the state of matter. This perfect score underscores the quality of content design, delivering an optimal educational experience for students. Additionally, this media enhances science literacy by creatively linking scientific concepts taught in class to real-life applications. Such integration is essential for stimulating students' interest and motivation, while also cultivating critical and analytical thinking about the phenomena they observe daily (Munoz-Campos et al., 2020). Thus, this media not only serves as a source of information but also as an effective tool in creating a connection between knowledge and the student's real-life experiences, which in turn will enhance their understanding and mastery of the material.

The media presentation feasibility aspect achieved a commendable average score of 92.86%, indicating a strong quality of presentation, though there remains room to enhance the clarity and impact of information delivery to further enrich students' learning experiences. Material experts suggested that each type of phase change be represented by at least two cards, ideally integrating elements of local wisdom. This approach aims to help students connect scientific concepts taught in the classroom with familiar cultural practices and traditions, thereby creating a learning experience that is more contextual, relevant, and engaging (Dewi et al., 2021). In addition, the material presented is integrated with ethnoscience, which encourages students to think critically and analytically in the application of the knowledge they acquire. This is

important because students are encouraged not only to memorize facts but also to understand and explore the relationship between science and their cultural experiences, so they can see the relevance of what they learn in their daily lives.

The linguistic aspect in this media received an average score of 91.67%, indicating that although it has met the eligibility criteria, there are still some areas that can be improved to achieve better results. This improvement is very important so that the message intended to be conveyed can be clearly understood by the students, allowing the material being taught to be well comprehended. This shows that the language used in this media is effective and appropriate for the student's development, which will certainly make it easier for them to understand the concepts being conveyed (Astuti et al., 2020). Focusing on enhancing this linguistic aspect will significantly improve communication between teachers and students, thereby elevating the overall quality of the learning experience and making information more accessible and comprehensible for students. The material validators' assessment yielded an average score of 95%, categorizing this quartet card media as highly feasible for further refinement. With targeted improvements and continued development, this media promises to be an effective tool for bolstering science education in elementary schools.

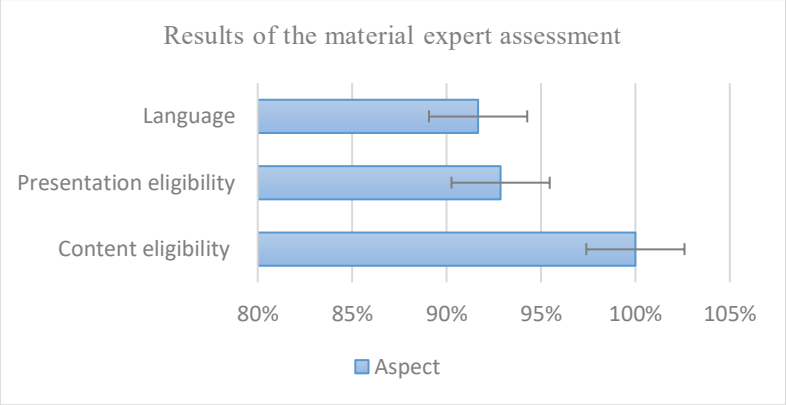


Figure 6. Material expert assessment diagram

The integration of barcode-enabled quartet card media with ethnoscience presents an innovative approach within the Natural and Social Sciences (IPAS) curriculum to enhance students' science literacy. These quartet cards add an interactive layer that not only makes learning more engaging but also fosters a lively, enjoyable learning environment, ultimately improving students' comprehension and active participation. By using these quartet cards, students can explore concepts of matter transformation in a dynamic way, examining real-world examples related to ethnoscience, which grounds the content in a meaningful, relatable context. Each card includes a scannable barcode, granting students access to detailed supplementary information on matter changes, thus enriching both their theoretical and practical understanding. This media encourages independent exploration and provides a more enriched, relevant learning experience that deepens students' engagement with the material.

Conclusion

This study successfully developed and evaluated the feasibility of barcode quartet card media integrated with ethnoscience to enhance elementary students' science literacy. Following the ADDIE model, the development process began with an analysis of student needs, leading to the design of content aligned with both the curriculum and student characteristics. Observational data indicated a student preference for interactive learning methods.

The developed media not only covers material on changes in the state of matter but also incorporates elements of local wisdom, making learning more contextual and engaging. Validity testing shows that this media is highly suitable for use, with assessments from media and material experts yielding approval ratings of 95.59% and 95%, respectively, categorizing the barcode quartet card media as very suitable. This innovative approach aims to deepen students' understanding of scientific concepts by connecting them with their local culture and experiences. The quartet card media is anticipated to effectively boost student engagement, foster active participation in learning, and equip students with knowledge that can be applied in daily life.

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material support provided. Hopefully, this article can be beneficial to readers and make a meaningful contribution to the field that the researcher is pursuing.

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