

Validity of Flashcards on Elements, Compounds, and Mixtures in the Context of Sumenep Kokot Broth as a Medium for Practicing Critical Thinking Skills

Try Hartiningsih⁽¹⁾, Dina Fatin Nafisah⁽²⁾

^{1,2}Universitas Trunojoyo Madura, Indonesia

Email: try.hartiningsih@trunojoyo.ac.id

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ABSTRACT

Flashcards are a visual learning medium consisting of small, illustrated cards. The images are created by hand, from photographs, or by pasting existing images onto the flashcard sheets. Through observations conducted in the science subject, problems were found, namely, the ability of students to understand the material on elements, compounds, and mixtures presented by the teacher was still low, while the activeness and use of media were not varied because learning was still focused on textbooks, and the absence of flashcard learning media in this subject. The method in this study was development research, with the procedure taken using the ADDIE model. Based on the results of data processing, it was stated that (1) the content aspect of the material received a validity value of 91.67% with very valid criteria, (2) the presentation aspect of the material received a validity value of 87.50% with very valid criteria, (3) the language aspect received a validity value of 100% with very valid criteria, (4) the form aspect received a validity value of 100% with very valid criteria, and (5) the color aspect received a validity value of 81.25% with very valid criteria. Overall, the media expert validator assessed the media as very valid with a value of 92.08% so that the designed media can be used in learning.

Keywords: critical thinking, flashcard, Kokot Broth, validity

INTRODUCTION

Natural science (IPA) is a subject taught in junior high schools (SMP/MTsN). It is a compulsory subject taught at the junior high school level (Lestari et al., 2025). It studies natural phenomena and the surrounding environment, emphasizing student experience (Anggraini et al., 2021).

Critical thinking skills among Indonesian students are still relatively low. According to (Suwita et al., 2023) The results of a critical thinking skills test indicated that students' critical thinking in science learning was 34.26%, which was categorized as low. Implementing science learning requires improving critical thinking skills, as science ideally encourages students to face and solve challenges in everyday life (Sopacua et al., 2026). This requires skills in interpretation and evaluation (Azzarkasyi et al., 2025).

According to (Davies & Willing, 2023) Students' low critical thinking skills are due to a teacher-dominated learning process in schools, leading to insufficient training in critical thinking. Low critical thinking skills are also influenced by students' passive participation in the learning process, which



negatively impacts subsequent education (Sarwanto et al., 2021). Critical thinking skills are an educational goal that must be achieved (Wardani & Fiorintina, 2023).

The 21st century has brought changes to society's lifestyles, leading many to choose new cultures over local ones (Nurhayati et al., 2023). This has led students to face challenges that have shifted local cultural values, which the younger generation should protect and preserve (Auzar et al., 2025). Therefore, learning based on local wisdom is needed to improve critical thinking skills. Local wisdom can be used as a learning medium in schools, helping to develop self-love and shape students' character, enabling them to reflect local wisdom values in their daily lives (Yunianto & Sriyanto, 2026). According to (Winangun et al., 2025) Integrating local wisdom into science education can improve students' critical thinking skills. The use of science learning media integrated with local wisdom provides more engaging and informative learning materials (Hikmawati et al., 2025). The developed learning media, complemented by indicators of critical thinking skills, can train students (Arni et al., 2024).

According to (Afkarina et al., 2025) Integrating local wisdom into effective learning enhances students' critical thinking skills. Meaningful learning can be achieved if classroom learning involves real-world environments, such as the surrounding environment, because this is where students can analyze the problems they encounter (Tan et al., 2023). Learning aims to enable each individual to recognize the local wisdom surrounding their homes, and enable students to preserve it (Auzar et al., 2025).

An interview with a science teacher in Sumenep revealed that she experienced difficulty explaining elements, compounds, and mixtures. The interview also revealed that students' critical thinking skills in the classroom were still relatively low. A needs questionnaire revealed that 90.91% of students experienced difficulties with elements, compounds, and mixtures. Students stated that schools in Sumenep had never used flashcard-based learning media and had never discussed local wisdom, namely *broth kokot*, in their learning media. The needs questionnaire for developing integrated science flashcard-based learning media indicated 100% need, indicating that all students needed such media.

The use of local wisdom-based learning media in science learning materials should be continued and further enhanced to improve students' critical thinking (Mulatsih & Yamtinah, 2023). The use of visually appealing learning media based on local wisdom increases enthusiasm and enthusiasm for the material presented by teachers (Basari et al., 2025). Engaging learning media can stimulate students in the learning process. (Haerani et al., 2026). Learning media is often used to deliver new and unfamiliar material to students (Anjelia et al., 2025). Teachers can create visually appealing media to make learning more interactive and effective. Visually engaging learning media that can enhance critical thinking include flashcards (Azura et al., 2023).

The development of flashcard learning media is an effective form of visual

media. This learning media can help students better understand concepts visually and interactively (Mulyono et al., 2025). Flashcard learning media is an educational medium specifically designed to improve several aspects (Putri et al., 2024). Using flashcards as a learning medium makes it easier for students to visualize and analyze material, thereby helping them improve their critical thinking skills (Ningsih et al., 2025). The development of flashcards is an innovation in science learning that enhances critical thinking skills (Damayanti et al., 2025). Research indicates that developing flashcards is an effective way to train students' critical thinking skills (Marifuddin et al., 2025).

Local wisdom is integrated into the flashcards, namely, the Kokot broth. Kokot broth is a Sumenep specialty made primarily from mung beans and cow's feet. Kokot broth is a Sumenep specialty often served at important events. Kokot broth has a salty and savory taste. It is usually served with ketupat (rice cakes), lime, chili sauce, and soy sauce (Afifah, 2026)

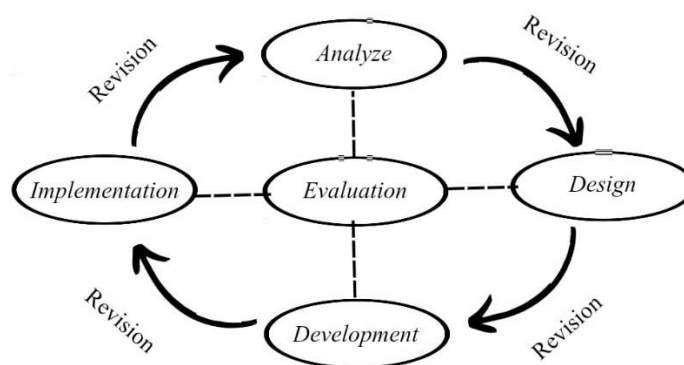
Learning materials that can be integrated with the Kokot broth include elements, compounds, and mixtures. This material requires a strong conceptual understanding and direct application in everyday life. Therefore, learning media are needed that can help students grasp the concepts more deeply. This research develops flashcards on elements, compounds, and mixtures in the context of the Kokot broth to practice critical thinking.

METHOD

The research and development (R&D) model is frequently used in education. This research model can identify development solutions by implementing the product. The R&D model includes the stages of identifying needs, developing the product, and validating it, thereby creating a new product that meets those needs (Iqbal & Suzianti, 2021).

This research produced flashcards, which were then incorporated into the material on elements, compounds, and mixtures to improve students' critical thinking skills. The flashcards also provided information about the materials, tools, and process for making the Kokot broth. The flashcards were developed using the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation.

The flashcard development research procedure includes the ADDIE model. According to Branch (2009), the stages of the ADDIE development model are (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. The stages of the ADDIE model are shown in Figure 1 below.



Gambar 1. ADDIE Model

Source: (Branch, 2009).

The first stage is analysis, which involves identifying a problem, gathering information, and analyzing it (Restanti et al., 2023). The second stage is design, which involves developing the learning methods, strategies, and approaches to be used (Fitriyah et al., 2021). The third stage is development, which involves adapting the learning media to the research needs framework, validating them, and revising them. The fourth stage is implementation, which involves implementing the learning media in the classroom (Christin & Siagian, 2024). The fifth stage is evaluation, which involves making improvements after trials in small and large groups (Weldami & Yogica, 2023).

The ADDIE model's development procedure tests the product's validity. The design stage includes product creation from start to finish and adaptation to predetermined images, while the development stage includes validity testing by media experts and revision of the learning media.

Data Collection Techniques

Questions are a frequently used data collection technique. They are administered by providing respondents with a set of written questions or statements to answer (Phongthiya et al., 2024). This study used a questionnaire to determine whether the flashcard learning media product developed in the context of Sumenep kokot broth was valid for use. This study utilized a media validation questionnaire.

Data Collection Instrument

The media expert validation sheet is a series of statements used to determine the validity of the developed product before it is implemented with students. This instrument is often used by media experts to assess the development of learning media. This study used a media expert validation sheet covering aspects of content, presentation, and language, as shown in Table 1 below.

Tabel 1. Media Expert Validation Sheet Instrument Grid

No	Aspect	Indicator
1	Content aspect of the material	The suitability of the material to the learning outcomes and learning objectives The accuracy of the material The clarity of the material related to the context of the Sumenep kokot broth
2	Aspects of material	The flashcard presentation of the material is neat and The layout of the material on the flashcard is structured.
3	Language aspects	Use of easy-to-understand language Use of structured grammar
4	Form aspect	Attractiveness of images displayed on flashcards Legibility of fonts used on flashcards
5	Color aspect	Appropriateness of color combinations used on flashcards Appropriateness and selection of color combinations do not cause distraction or disinterest for the reader

Source: Modification (Sari et al., 2024)

The media expert validation sheet instrument includes flashcard sections, and the validation results will be used to inform improvements. The assessment scores for the media expert validation sheet instrument, using a Likert scale ranging from 1 to 4, are shown in Table 2 below.

Tabel 2. Likert Scale

Score	information
1	Sangat Tidak Setuju (STS)
2	Tidak Setuju (TS)
3	Setuju (S)
4	Sangat Setuju (SS)

Source: Modification (Sari et al., 2024)

Data Analysis Techniques

The validity analysis used in this study aims to test the validity of the media aspects. The validity test was conducted by media experts and junior high school science teachers to determine the validity of the flashcard development. The validity calculation was performed mathematically. The validity test results were calculated using Formula 1 as follows.

Formula 1. Validity Analysis

$$V = \frac{\sum x}{\sum x_i} \times 100\%$$

Source: (Jumaniar & Ahmad, 2024)

Information:

V : Validity percentage
 $\sum x$: Total score obtained
 $\sum x_i$: Maximum total score

The percentage criteria for the validity test are shown in Table 3.

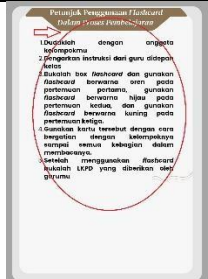
Table 3. Validity Test Percentage Criteria

Percentage (%)	Validity Criteria
$75\% < V \leq 100\%$	Sangat Valid
$60\% < V \leq 75\%$	Valid
$50\% < V \leq 60\%$	Cukup Valid
$V \geq 25\%$	Tidak Valid

RESEARCH RESULTS AND DISCUSSION

The development stage involved conducting validity tests. The validation stage was conducted by three validators: two lecturers and a science teacher in Sumenep. The results of the validation stage were used to inform media improvements. Several inputs and suggestions from the validators were provided as material for further media improvements. The results of the improvements are shown in Table 4 below.

Table 4. Media Validation Improvement Results

Revision	Before	After
Instructions for use: Flashcards are made into cards, not paper, so they don't get lost easily		

The next validation result, according to the media expert, was 92.08%, categorized as very valid. The only improvement to the media expert's validity was the addition of flashcard instructions to prevent them from being easily lost. The media expert validation results are shown in Table 5 below.

Table 5 Media Expert Validation Results

Assessment Aspects	Average	
	Validity	Criteria
Content aspect	91,67%	Sangat valid
Presentation aspect	87,50%	Sangat valid
Language aspect	100%	Sangat valid
Form aspect	100%	Sangat valid
Color aspect	81,25%	Sangat valid
Average	92,08%	Sangat valid

Media expert validation was conducted to determine whether the developed science flashcard media in the context of kokot broth was valid for use. The assessment aspects applied in the media expert validity test included content, presentation, language, form, and color. The media expert validation test scored

92.08%, categorized as very valid.

The content aspect scored 91.67%, indicating it is very valid. The content aspect consisted of three indicators: the suitability of the material to the learning outcomes and objectives, the accuracy of the material, and the clarity of the material related to the context of kokot broth in Sumenep. Flashcards cover the topics of Elements, Compounds, and Mixtures, linking them to the materials, tools, and processes used to make kokot broth. The associated material was adjusted to the learning outcomes and objectives. The flashcard lesson was divided into three sessions. The topic of Elements, Compounds, and Mixtures focused on distinguishing physical and chemical changes and separating simple mixtures. Learning objectives should be based on the expected learning outcomes. The use of flashcards in the context of kokot broth in Sumenep, focusing on the topic of Elements, Compounds, and Mixtures, has six learning objectives. Material related to the context of the kokot broth was validated for accuracy and clarity and sourced from reliable sources. In line with research by (Husnanda & Ikhsan, 2021), the developed learning media were first validated by subject matter experts to determine their suitability, followed by media validation.

The second aspect, material presentation, received a low score of 87.50%, categorized as very valid. The material presentation aspect consists of two indicators: a neat and coherent presentation of the flashcard material and a structured layout of the material on the flashcard. The material developed for the flashcard learning media was structured and coherent, starting with elements, then compounds, and finally mixtures and separations. The material presentation on the flashcards was found on the first and second sides. The material presented on the flashcards consisted of a brief explanation of its relationship to the kokot broth context. In line with research by (Yasir et al., 2022), the presentation of material in learning media should be sequential to facilitate student learning and make the presentation more enjoyable. The media expert validation results for the material presentation aspect received a low score, possibly due to several factors: the material on the flashcards was not neat, and there was too much of it, causing students to be confused about the order in which they read the information. In line with research by (Birrenbach et al., 2021), the presentation of material in learning media must be neat and consistent so that students can easily digest the content.

The third aspect, language, received the highest score of 100%, indicating it is very valid. The language aspect comprises two indicators: the use of easy-to-understand language and structured grammar. The sentences presented in the flashcard learning media use everyday language, as seen in Figure 2. The use of easy-to-understand language makes it easier for students to understand the material related to the context of the kokot broth. In line with research by (Hidayat et al., 2024), which states that learning media should use clear, easy-to-understand language when delivering material.



Figure 2. Language Used in Flashcards

The fourth aspect, form, received the highest score of 100%, indicating it is very valid. The form aspect comprises two indicators: the attractiveness of the images displayed on the flashcards and the legibility of the fonts used. The flashcards include images of materials, tools, and the manufacturing process. The images displayed in the flashcards are real, not illustrations, such as images of shallots, pans, and the process of making Sumenep kokot broth, as seen in Figure 3. The font used in the flashcards must be clear and legible. In line with research by (Husnanda & Ikhsan, 2021), which revealed that letters or fonts are an important element in a design for learning media.



Figure 3. Images on Flashcards

The fifth aspect, namely color, received the lowest score among the other aspects at 81.25% and was categorized as very valid. The color aspect consists of two indicators: the suitability of the color combination used in the flashcard, and the suitability and selection of color combinations that do not distract or disinterest the reader. The developed flashcard uses a harmonious color combination to make it more attractive and less distracting to the reader. In line with the research of (Ningsih et al., 2025), who stated that flashcards are designed with the use of images and bright colors to attract attention in reading. The developed flashcard already uses bright colors to attract the reader's attention, but in reality, the validity results of the color aspect get the lowest score. This occurs because the colors used on the flashcard do not match the material's theme: Elements, Compounds, and Mixtures. In line with the research by (Hikmawati et al., 2025), the selection of colors and color combinations should be adjusted to the material's theme.

CONCLUSION

Based on the results of media validity from several aspects that have been

explained, the average value of media validity obtained was 92.08% with very valid criteria.

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