



DEVELOPMENT OF CROSSWORD PUZZLE-BASED VISUAL MEDIA TO ENHANCE ELEMENTARY STUDENTS' INTEREST IN SCIENCE LEARNING

Lutfy Nur Rahmawati¹, M. Ngali Zainal Makmum², Nurul Aisyah³

^{1,2,3}*Pendidikan Guru Madrasah Ibtida'iyah, Fakultas Tarbiyah, Universitas Ma'arif Lampung, Metro, Lampung*

lutfy405@gmail.com

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ABSTRAT

Learning IPAS (Integrated Science and Social Studies) in elementary schools is often hampered by the lack of interactive media which results in low student learning interest. This study aims to develop crossword puzzle learning media and determine the level of media feasibility and student responses to its use in increasing student learning interest. The research method used is Research and Development (R&D) with the ADDIE. The research subjects were students of class third A MI Ma'arif 18 Trimurjo. Data collection techniques were carried out through documentation, interviews with class teachers and principals, validation questionnaires from material experts and media experts, and student response questionnaires. The results of the study showed that the developed crossword puzzle media obtained a feasibility percentage of (100%) from material experts and media experts with a very feasible category. Student responses to the use of crossword puzzle media also obtained a percentage (100%) with a very good category, which indicates that this media is very valid and feasible to increase student learning interest in science learning. The study results show that crossword puzzle are a viable alternative solution for science learning. The use of this creative medium has a positive impact on increasing student learning interest, making it a strategic choice for creating a more dynamic and enjoyable learning environment.

Keywords: *Natural and social sciences, Learning media, Interest in learning, elementary school, crossword puzzles*

ABSTRAK

Pembelajaran IPAS di sekolah dasar sering terkendala oleh minimnya media interaktif yang berdampak pada rendahnya minat belajar siswa. Penelitian ini bertujuan untuk mengembangkan media pembelajaran teka-teki silang serta mengetahui tingkat kelayakan media dan respon peserta didik terhadap penggunaannya dalam meningkatkan minat belajar siswa pada mata pelajaran IPAS. Metode penelitian yang digunakan adalah *Research and Development* (R&D). Subjek penelitian adalah peserta didik kelas III A MI Ma'arif 18 Trimurjo. Teknik pengumpulan data dilakukan melalui dokumentasi, wawancara dengan guru kelas dan kepala sekolah, angket validasi ahli materi dan ahli media, serta angket respon peserta didik. Hasil penelitian menunjukkan bahwa media teka-teki silang yang dikembangkan memperoleh persentase kelayakan sebesar (100%) dari ahli materi dan ahli media dengan kategori sangat layak. Respon peserta didik terhadap penggunaan media teka-teki silang juga memperoleh persentase (100%) dengan kategori sangat baik, yang menunjukkan bahwa media ini sangat valid dan layak untuk meningkatkan minat belajar siswa dalam pembelajaran IPAS. Hasil studi menunjukkan bahwa media teka-teki silang layak diandalkan sebagai solusi alternatif dalam pembelajaran IPAS. Penggunaan media kreatif ini berdampak positif terhadap peningkatan minat belajar peserta didik, dapat menjadikan pilihan strategis untuk menciptakan ekosistem pembelajaran yang lebih dinamis dan menyenangkan.

Kata Kunci: *IPAS, Media Pembelajaran, Minat Belajar, Sekolah Dasar, Teka-teki Silang*

1. Introduction

Learning is an essential foundation for the sustainability of human educational life. Law Number 20 of 2003 affirms that education is a structured and planned effort to create a learning process that enables students to actively develop their potential, including spiritual-religious strength, moral virtue, self-control, intelligence, personality, and the skills needed for themselves, society, and the nation (Ichsan, 2021). Thus, education serves as a vehicle for developing human resources that are cognitively superior, and based on good character (Silalahi et al., 2022).

The effectiveness of the learning process cannot be separated from the existence of supporting elements that support the achievement of instructional objectives, including the selection of methods, the application of techniques, and the use of relevant learning media (Siregar et al., 2024). Learning media is a pedagogical instrument used by educators to transmit teaching materials more systematically and communicatively. Its use plays a strategic role in increasing motivation, fostering learning interest, and stimulating student creativity, thus making the learning process more meaningful and contextual (Nurfadhillah, Nurfalalah, et al., 2021).

Based on facts on the ground shows that the implementation of learning media is not yet fully optimal. A number of educators still face obstacles in integrating diverse media, particularly in science subjects. Learning practices tend to be dominated by lecture methods, which are teacher-oriented, theoretical, and emphasize memorization. This pattern has implications for limited authentic learning experiences for students. Siti Aisyah's research revealed that low student interest in learning is correlated with the use of monotonous methods and minimal interactivity. (Aisyah et al., 2022). Similarly, Rizqi Ubaidillah emphasized that learning quality improved significantly after implementing more innovative and attractive media (Ubaidillah, 2024).

Initial observations and interviews with grade III A teachers indicate that science learning is still dominated tends to be dominated by lecture methods, which are teacher-oriented, theoretical, and emphasize memorization aspects. This situation results in uneven student participation and low learning interest. Students tend to be passive and have difficulty understanding and relating material to real-world contexts. Therefore, contextual, engaging learning media are needed that align with the developmental characteristics of elementary school students. The use of crossword puzzles is considered relevant because it can train concentration, encourage activeness, and potentially increase student interest in science.

The use of media in the learning process has the potential to provide a fresher and more contextual learning experience for students, stimulate curiosity, and foster intrinsic motivation and interest in learning. Therefore, developing innovative learning is essential to address the various challenges that arise. Designed media should be able to enliven the learning atmosphere, leave a lasting impression, and provide space for students to gain direct experience in understanding the material (Aisyah et al., 2022). However, the reality in a number of educational institutions shows that the application of concrete learning media is still limited, especially those that provide comprehensive material. This condition demands the development of concrete media that can effectively transmit learning messages from teachers to students, thereby stimulating students' cognitive, affective, and attentional aspects. Thus, the learning process takes place optimally and the messages conveyed are well received (Cahya, 2025). In this context, learning media plays a significant role in increasing learning effectiveness while supporting the achievement of instructional objectives. This condition creates a discrepancy between the demands of the curriculum, which requires a holistic understanding of concepts, and the limited availability of concrete media in the field.

Therefore, innovative learning media that can integrate material more comprehensively is needed.

Learning media can function optimally if there is a harmonious connection between the sender and receiver of the message. Learning is a dynamic entity that integrates aspects of interaction and transactional communication between educators and students. In this context, learning is not seen as simply the transfer of information, but rather as a systemic mechanism in which instructional messages are codified by teachers and decoded by students to form a comprehensive construction of understanding. Indicators of successful communication are reflected in the responses or feedback provided by students. A positive response indicates a message is well understood, while a negative response indicates the need for improvement in delivery (Aisyah et al., 2022). Therefore, the quality of communication between teachers and students is essential in ensuring the effective delivery of information.

The presence of learning media helps students construct an understanding of the material being taught. A strong understanding will lead to optimal achievement of learning objectives. Furthermore, learning media also supports teachers in delivering material in a more systematic and engaging manner (Putri, 2023). Through the use of appropriate media, a conducive classroom atmosphere can be managed, creating effective and efficient learning conditions that can continuously students' interest in learning.

Student interest in learning is an essential determinant of the success of the education and teaching process. Rahmayanti emphasized that cognitively, interest functions as a driving force to achieve goals or fulfill needs, so that every individual's actions have clear value and direction (Zuschaiya, 2024). Thus, interest becomes an internal energy that drives individuals to realize their learning goals. To optimize learning outcomes as expected, increasing interest in learning needs to be supported by the use of appropriate learning media (Reski, 2021).

Science learning in elementary schools should be interactive, enjoyable, and foster active student engagement. Ideally, the learning media used should not only deliver material in a one way fashion but also hone students memory and critical thinking skills in understanding fundamental concepts (Kamila, 2024). One media relevant to these characteristics is the crossword puzzle. This medium integrates questions with engaging visual displays, thereby focusing attention and fostering student interest. Crosswords also align with the tendency of elementary school students to prefer visual and communicative learning (Nurfadhillah, Ningsih, et al., 2021).

As a game crossword puzzles serve as a catalyst for comprehensive cognitive stimulation. Empirically this medium facilitates an active recall mechanism that enhances material retention and conceptual mastery through measurable problem solving. Furthermore the characteristic of crossword puzzles, which demands precise character counts, inherently trains orthographic skills and lexical expansion, making it an effective means of integrating cognitive and literacy aspects in a single instructional activity. Learning is also presented in a fun, game-like atmosphere, encouraging active student engagement (Dewi & Meilina, 2021).

Based on previous research have shown that crossword puzzles contribute positively to students' interest and learning outcomes in science. Maghfirotn Nisa's research demonstrated an increase in elementary school students' interest and learning outcomes through the use of this media (Nisa & Munif, 2025). Similar findings were presented by Nisca Oktaria, who stated that crossword puzzles can improve students' understanding and learning outcomes (Oktaria et al., 2024). Although studies on the effectiveness of learning interest have been widely documented in the literature, most of this research remains fragmented, focusing on cognitive learning outcomes as the primary success factor. There is a significant literature gap exploring how these interventions specifically impact students' learning interest. Yet, learning interest is a key predictor of academic sustainability that is often overlooked in previous

empirical analyses.

Previous research on crossword puzzles has generally focused on improving quantitative learning outcomes. Therefore, this study aims to address this gap by developing media that emphasizes affective aspects and active student engagement in exploring natural and social phenomena. Meanwhile, development that specifically emphasizes the dimension of elementary school students' learning interests has not been widely carried out. Yet, learning interests play a strategic role in helping students understand material more deeply. Therefore, this research focuses on the development of crossword puzzles with the "Five Senses" material adapted to the characteristics of third-grade elementary school students as a systematic effort to increase learning interest.

This approach provides researchers with the opportunity to design and refine learning media that are not only grounded in strong theoretical foundations but also empirically tested through validation and trial stages. Through the development of crossword puzzles, science learning is expected to be more engaging, contextual, and meaningful for students (Riski, 2024)

The purpose of this research is to develop crossword puzzle media in science learning, assess the feasibility level of the resulting product, and analyze student responses to its use in an effort to increase the learning interest. Theoretically, this research strengthens the literature on innovative pedagogy in the science and science discipline. Practically, this study contributes to optimizing student engagement through an approach oriented towards situational and personal interests, while also serving as an instructional reference for teachers to improve learning effectiveness at the educational unit level.

2. Method

This research applies the Research and Development (R&D) is directed at designing and producing attractive and effective crossword puzzles (TTS) to support learning in Natural and Social Sciences (IPAS). The effectiveness of the media is measured based on classical completeness and increased student interest results through, while the attractiveness aspect is analyzed through a student response questionnaire with a Likert scale that includes the dimensions of aesthetics, ease, and involvement. This approach aims to produce a product while simultaneously testing its feasibility and effectiveness in a measurable manner. Feasibility is measured to determine the extent to which a product meets conceptual, procedural, and theoretical standards through data collection techniques, evaluation subjects, and data analysis. Effectiveness is measured to demonstrate that a product is capable of delivering the desired impact or change on target users through trial design, instruments, and data analysis. (Ningsih et al., 2023). It is not solely oriented towards product creation but encompasses systematic stages from planning, development, and testing, ensuring that the resulting product aligns with real-world needs (Ekawati et al., 2021).

The development model used is ADDIE as proposed by Dick and Carey in Dalimunthe, which includes five main stages: analysis, design, development, implementation, The ADDIE model was chosen for this study based on its systematic, comprehensive, and adaptive structure, which is crucial for ensuring the quality of learning media. The relevance of this model to the goal of increasing student learning interest lies in the depth of each phase (Dalimunthe et al., 2021).

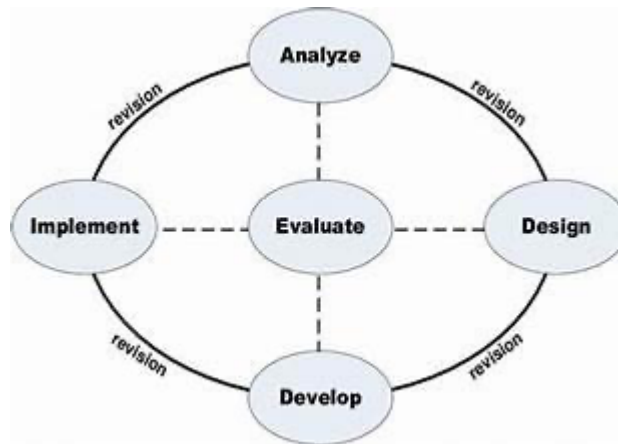


Figure 1. Research Design

The subjects of this study were twenty students of class IIIA at MI Ma'arif 18 Trimurjo. The sample was determined using a saturated sampling technique, where all members of the population were included in the sample. Justification was based on representativeness, research scale, and suitability of characteristics. In addition to involving students as the primary users of the product, this study also involved one class III teacher as a learning practitioner, as well as two validators consisting of a material expert and a learning media expert to assess the feasibility of the developed product. Material validators and media experts were tasked with providing objective assessments of the substantive and technical aspects to meet theoretical feasibility standards. Next, third-grade teachers acted as practitioners to evaluate the practical aspects and functionality of the product in learning. Finally, third-grade students were involved as subjects in user trials to obtain empirical data regarding student responses and the product's effectiveness in increasing classroom learning engagement.

The data collection techniques used included observation, interviews, questionnaires, and documentation. Interviews were conducted to obtain initial information regarding the current state of science learning and the need for learning media. Questionnaires were used to collect validation data from experts and student responses to the developed crossword puzzle media. The data collection instrument was a closed-ended questionnaire with a Likert scale of one to five. Material validation consisted of six statements, media validation consisted of six, and the student response questionnaire consisted of nineteen statements covering aspects of media attractiveness and ease of use. Documentation served as supporting data in the form of activity recordings and relevant learning archives (Lestari et al., 2024).

The data analysis technique in this study combines quantitative and qualitative descriptive approaches. Quantitative data were obtained through the assessment results of expert validators and student response questionnaires, which were then analyzed by calculating the percentage of the media's suitability level. Meanwhile, qualitative data in the form of suggestions and comments from validators were analyzed descriptively as a basis for improving the Crossword Puzzle learning media product developed (Okpatrioka, 2023). This research was conducted at MI Ma'arif 18 Trimurjo, especially in class III A. The research was carried out in the even semester of the 2024/2025 academic year, starting from the material analysis stage to the limited trial of the Crossword Puzzle learning media in science learning.

Details of the assessment procedure are outlined in the following table:

Table 1. Expert Validation Assessment Scores

Category	Score
Very Worthy	5
Worthy	4
Quite Worthy	3
Not Worthy	2
Very not Worthy	1

Validation data obtained from experts or validators is then analyzed using a predetermined calculation formula. This formula serves as the basis for determining the feasibility of the media being developed in a systematic and measurable manner.

$$P = \frac{\sum X}{\sum XI} \times 100$$

Information:

x: Score of answers by respondents

xi: Highest answer score

P: Percentage of validity level

Based on the cumulative scores obtained from the expert assessments, conclusions can be drawn regarding the feasibility of the developed product. The classification of learning media suitability criteria is presented systematically in the following table as a reference for interpreting the assessment results.

Table 2. Eligibility Interpretation Criteria

Achievement Level	Criteria
81% - 100%	Very Worthy
61% - 80%	Eligible
41% - 60%	Quite Decent
21% - 40%	Not feasible
0% - 20%	Totally Unworthy

The questionnaire data completed by students was used to obtain an overview of their perceptions and responses to the developed media. The percentage of student responses was calculated using the following formula.

$$P = \frac{\sum X}{\sum XI} \times 100$$

Information:

x: Score of answers by respondents

xi: Highest answer score

P: Percentage of validity level

Next, the criteria for the responses given by students are interpreted and described

qualitatively based on the following assessment indicators.

Table 3. Percentage Criteria for Student Response Questionnaire

Percentage	Criteria
81% - 100%	Very interesting
61% - 80%	Interesting
41% - 60%	Quite interesting
21% - 40%	Less Interesting
0% - 20%	Very Uninteresting

3. Results and Discussion

3.1 Results

The results of the study entitled "Development of Visual Learning Media Based on Crossword Puzzles in Increasing the Learning" are presented with reference to the ADDIE development model, which includes five systematic stages: analysis, design, development, implementation, and evaluation.

Level analysis the phase focuses on identifying and assessing learning material needs. In this phase, an initial analysis was conducted through observation and interviews with the class III A teacher at MI Ma'arif 18 Trimurjo to obtain an overview of the current state of science learning in the classroom. It was found that the science learning process still faces significant obstacles in the availability of relevant instructional media. Class teachers identified an urgent need for visual aids that could facilitate students' understanding of abstract material. The characteristics of students in this class indicate a tendency to learn more actively through visual and interactive stimulation, yet currently available learning resources are still limited to conventional methods. Analysis of the five senses material revealed a gap between basic competency indicators and the level of student engagement in the field. Findings indicate that achieving learning objectives is often hampered by students' difficulty in visualizing the function and anatomy of the sense organs in depth. Therefore, it is necessary to develop learning media that not only align with the scope of the five senses material but also accommodate students' learning styles to enhance the effectiveness of conceptual understanding at the elementary school level.

Level design the phase of this research focused on developing the concept and systematically designing a crossword puzzle media product. The design is a printed crossword puzzle designed using the Canva platform and implemented on HVS paper. The visual characteristics of this media emphasize a neat layout and design aesthetics that are attractive to elementary school students. Substantially, the content in this product focuses on the five senses, which is explained in questions relevant to learning indicators. The use of language in the media is communicative and adaptive to students' cognitive levels to ensure the message is conveyed clearly and easily understood. Furthermore, this product has the characteristics of a measurable learning instrument because it is accompanied by expert validation tools and student response evaluation instruments to ensure the quality of the material and design.

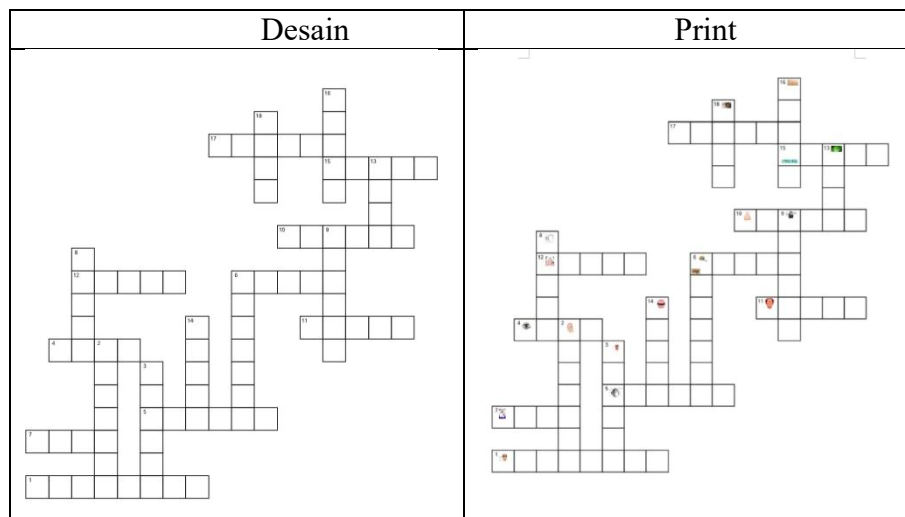


Figure 2. Crossword Puzzle Media Design Results

Level development is the phase resulted in the development of the Crossword Puzzle media design into an initial product, validated by material experts and media experts. Based on the assessment instrument, the material experts awarded a validation score of 100%, indicating that the content and accuracy of the material met very high standards of feasibility. Consistently, the media experts awarded a 100% rating for the visual aspects and ease of use of the media. After revisions based on validator input, the media was piloted on a limited basis with third-grade students at MI Ma'arif 18 Trimurjo. The trial results showed a positive response, with a 100% success rate. This data confirmed that the developed crossword puzzle media is highly feasible, practical, and effective as an interactive learning tool for elementary school students.

Level implementation includes two main activities, namely media socialization and measuring initial learning interest. Before the media was implemented, the researcher first explained the rules and mechanisms for using crossword puzzles to students. At the same stage, initial observations were conducted to measure the level of learning interest before the treatment was given. Based on the pre-test results conducted through initial observations and questionnaires, the average student interest score was 62.5%, which falls into the "interesting" category. At this stage, student engagement in learning is still passive and limited to teacher instructions. Next, the educational game-based learning media crossword puzzles were implemented to 20 students of class III A MI Ma'arif 18 Trimurjo. After the learning process took place, a final measurement of learning interest was conducted using the same instrument, namely a student response questionnaire to the developed media, to obtain comparative data before and after the media implementation. Measurement results after the media was applied showed an average score increase to 100%, falling into the "Very Interesting" category. Cumulatively, there was a 37.5% increase after the treatment. This comparative data demonstrates that the use of crossword puzzles not only increased students' enthusiasm in answering questions but also effectively strengthened their focus and positive response to the learning material in class.

Level evaluation this is the assessment phase for achieving product development objectives. Evaluation is conducted by comparing initial and final observation results to identify increases in student learning interest after using the media. Product effectiveness

analysis is conducted by calculating the level of increase in learning interest as an indicator of successful development. Initially, students' learning interest was low, characterized by a lack of active participation and poor focus during learning. However, after implementing the media, a significant transformation occurred in the final observation, indicating increased enthusiasm, increased confidence in expressing opinions, and more stable concentration in class. Analysis of the product's effectiveness showed an increase in the average learning interest score from 62.5% in the initial observation to 100% in the final observation. This 37.5% margin of improvement confirms that the use of the media significantly stimulated students' intrinsic motivation. Therefore, this comparison of results demonstrates that the development success indicators have been met and the product is effective in increasing learning interest at the elementary school level.

The research results were obtained through a series of systematic data collection procedures, carried out according to the media development stages. The Crossword Puzzle media product has been validated by material and media experts to ensure the appropriateness of the content and visuals. Based on the experts' input, revisions were made before being trialed with third-grade students at MI Ma'arif 18 Trimurjo to gauge user response.

3.1.1 Results of the Learning Media Validation Trial

a. Material Expert Validation Test

The validation of material experts was carried out by Ibnaty Lailatul Arofah, S.Pd., as the homeroom teacher of class III A MI Ma'arif 18 Trimurjo. Based on the results of the assessment of the crossword puzzle media in science learning, a score percentage of 100% was obtained, which indicates that the product meets the eligibility criteria in the "Very Feasible" category. With this achievement, the developed media is declared to have met the material substance standards and can be used without revision as a means of science learning to increase the learning interest of class III A students.

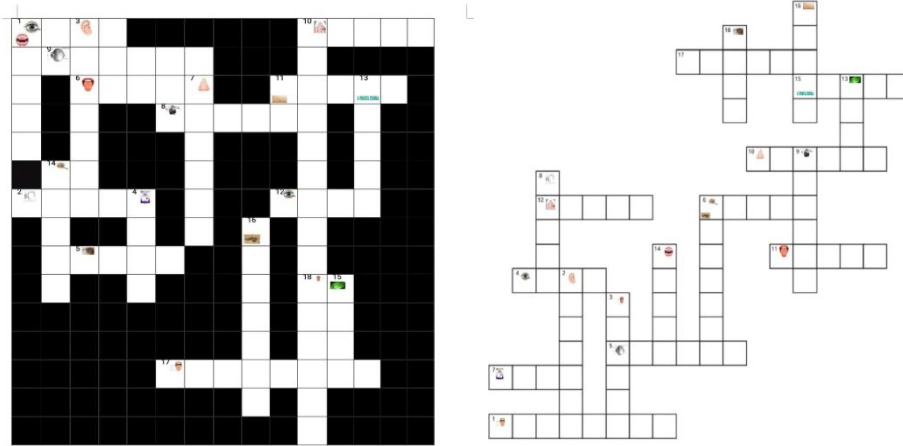
The validation results show that the five senses material integrated into the crossword puzzle media has been arranged in line with the basic competencies and learning objectives stated in the curriculum. The presentation of the material is considered coherent, systematic, and reflects the integration between conceptual understanding and its application. The questions presented represent concrete situations that are close to students' learning experiences at school, so that the material is not merely theoretical, but also applicable and contextual. The use of language is considered communicative, clear, and appropriate to the level of cognitive development of grade III students, without causing ambiguity. In addition, the flow of material presentation is considered capable of encouraging student involvement and contributing to increasing interest in learning ((Hasil validasi ahli materi mdia teka-teki silang, 2026).

b. Media Expert Validation Test

Media expert validation was carried out by Masrurrotul Mahmudah, M.Pd.I., a lecturer at Ma'arif University, Lampung. In the initial assessment stage, the crossword puzzle media received the category of "Very Inadequate" because there were still inaccuracies in the box design, especially the arrangement of several parallel parts so that they were not proportional. Based on this input, the researcher made revisions according to the validator's recommendations. After the improvements were made, the media was re-validated and obtained a score percentage of 100%, which placed it in the "Very

Appropriate" category. Thus, the crossword puzzle media developed has met the feasibility standards from the media aspect and is declared to be usable without further revision in science learning.

Validation results indicate that the media meets the eligibility criteria in terms of design and visual appearance. The composition of illustrations and questions is arranged proportionally, making it easier for students to fill in answers. Typographic aspects, including letter size and font selection, as well as the placement of illustrations, are considered to support student readability and understanding. The use of varied yet harmonious colors also strengthens the visual appeal without distracting from learning focus. From a technical perspective, the media is considered practical and applicable for use in classroom learning. All suggestions regarding visual improvements have been accommodated in the final product, so the crossword puzzle media is declared ready to be implemented in learning activities (Hasil validasi ahli media pembelajaran, 2026).



(a) (b)
Figure 3. (a) Before Revision, (b)After Revision

3.1.2 Student Response Questionnaire Results

The results of the student response questionnaire regarding the application of crossword puzzle media in science learning showed a percentage of achievement of 100% with the category "Very Interesting". All statement items received a score of 5 (Strongly Agree) from class III A students, which indicates that the media is effective in arousing interest in learning, facilitating understanding of concepts, and helping students restate the material on the five senses more clearly.

These results indicate that crossword puzzles have received a very positive response and are considered highly suitable for use in science learning. In addition to contributing to material understanding, their use also encourages increased student active participation, both through questioning and peer interaction. Thus, crossword puzzles are able to create a more dynamic, communicative, and participatory learning environment.



Figure 4. Finish an assignment

The results of an interview with a class III A teacher at MI Ma'arif 18 Trimurjo, which included six questions, provided a comprehensive overview of the implementation and impact of using crossword puzzles in learning. The teacher revealed that before the media was implemented, the science learning process tended to be one-way, with relatively low student interest.

After using crossword puzzles, teachers observed significant changes in learning behavior, marked by increased student attention, concentration, and enthusiasm during learning activities. Furthermore, students were found to understand the material more easily. Teachers also stated that this media was able to reduce the dominance of the lecture method and facilitate the explanation of material previously considered difficult to understand. In terms of implementation, crossword puzzles were considered flexible and relevant for use as a learning support in class III A MI Ma'arif 18 Trimurjo (Ibnaty, 2026).



Figure 5. Interview with a teacher

The results of an interview with the principal of MI Ma'arif 18 Trimurjo, which included six questions, revealed a constructive response to the implementation of crossword puzzles in science learning. The principal viewed the media as a form of learning innovation that aligned with the institution's needs to improve the quality of the learning process while strengthening character education values.

Furthermore, crossword puzzles are considered to have potential for further development and implementation at other grade levels as an alternative science learning medium. The school's support reflects the positive reception of the product and its recognition of its benefits in encouraging increased student learning interest (Utami, 2026).

3.2 Discussion

The results of the study indicate that crossword puzzles as a learning medium have a provide statistical evidence in supporting the learning process of Natural and Social Sciences (IPAS) in grade III MI Ma'arif 18 Trimurjo. The feasibility level obtained through validation by material and media experts confirms that this media not only meets substance and design standards but also aligns with the developmental characteristics of elementary school students. The average feasibility percentage obtained in the very feasibility category proves that the integration of visual elements and content depth has achieved the indicators for successful learning media development (Huda, 2024).

From a material perspective, The use of crossword puzzles reflects the principles of constructivism, where students actively construct knowledge through cognitive assimilation and accommodation when solving problem clues. This aligns with research findings showing that game-based educational media can significantly improve memory retention and student engagement. Compared to conventional methods, crossword puzzles have been shown to be effective in reducing learning anxiety, allowing information to be more optimally absorbed into students' cognitive structures. Students are not solely dependent on textbooks but are engaged in playful learning activities through educational media (Cahyani, 2025).

From a media perspective, The media validation results confirm that the integration of visual design elements is a crucial determinant in capturing attention and stimulating students' retention interest. This effectiveness is achieved through the use of representative illustrations, proportional color composition, and systematic layout organization to minimize extraneous cognitive load while increasing the readability of the material. In this context, crossword-based instructional media provides stronger cognitive stimulation than conventional text because it involves a dual coding process, which facilitates accelerated understanding of the material and strengthens long-term memory traces (Fira, 2022).

The positive student response to the implementation of this learning media provides a strong indication of its effectiveness in increasing interest in learning science. Based on the analysis of student response questionnaire data, the percentage categorized as "Very Interesting" was obtained. This indicates a significant increase compared to student interest in the previous cycle. The engaging and non-monotonous presentation of the material encourages active student engagement, such as asking questions, answering questions, and participating in discussions. This reflects the creation of an active, effective, and participatory learning environment, which is essential for science instruction at the elementary school level.

In addition to fostering interest, the use of crossword puzzles also trains students' conceptual understanding to the material they have learned. The activity of completing the puzzles requires a thorough understanding of concepts, so this medium serves not only as a learning aid but also as a means of reinforcing the material (Ismawati et al., 2024).

Interviews with a third-grade teacher at MI Ma'arif 18 Trimurjo showed that crossword puzzles effectively transformed the previously one-way science learning model into a more interactive and communicative one. The use of this medium enabled contextual presentation of material, enhancing students' conceptual understanding while simultaneously fostering greater focus and enthusiasm for learning. Overall, the use of crossword puzzles is a practical and innovative solution proven to increase student engagement and interest in learning in the classroom.

A constructive view was also expressed by the principal of MI Ma'arif 18 Trimurjo, who assessed that the use of crossword puzzles not only impacts academic aspects but also contributes to strengthening students' character. This institutional support indicates that this type of learning media innovation has the potential for sustainable implementation. Its existence not only provides direct benefits to students but also supports the school in realizing more comprehensive educational goals (Cahyani, 2025).

These findings converge with studies on the effectiveness of using crossword puzzles as an instrument to transform science learning into a more interactive one. The fundamental similarity between these two studies lies in the premise that students' active engagement in solving puzzles positively correlates with stimulating interest and retaining understanding in elementary school. However, significant differences emerge in the stimulus modality used. While previous studies generally relied on descriptive text-based instructions, this study offers novelty through the integration of predominantly visual elements. This visual approach is specifically designed to accommodate the concrete operational cognitive stage of third-grade students, thereby minimizing the textual literacy barriers that often present obstacles at that stage. Thus, this study does not simply replicate the effectiveness of crossword puzzles but also broadens the horizon for developing more contextual and accessible media (Muttaqien et al., 2024). This research brings a new dimension in the development of learning media in elementary schools through the integration of crossword puzzles that are transformed from conventional textual formats to adaptive visual-based ones. In contrast to previous studies that mostly used crossword puzzles as vocabulary evaluation instruments based on written definitions, this development positions visual stimuli as the main key to bridging the understanding of abstract science concepts for third-grade students. Explicit comparisons show that if previous studies emphasized purely cognitive aspects in the scope of memorization, this research is specifically directed at stimulating the affective aspect in the form of learning interest through contextual object representations.

Overall, The development of visual-based crossword puzzles has proven to be a crucial solution in overcoming cognitive boredom in science learning at the elementary school level. Data analysis shows that the integration of visual elements in the structure of crosswords does not merely function as decoration, but as scaffolding that makes it easier for students to associate abstract concepts with concrete representations. The main findings of this study confirm that the use of this media significantly improves material retention, as seen from increased active participation in class and longer student focus duration compared to using conventional methods. Therefore, crossword puzzles can be considered as an alternative sustainable learning medium in efforts to improve the quality of the learning process and student interest in science learning.

4. Conclusions

Based on a series of research results and discussions, this study concluded that the crossword puzzle media developed was highly feasible and effective in increasing the learning interest of third-grade elementary school students. After undergoing design and layout refinement stages according to expert recommendations, the final product achieved a feasibility percentage of 100%, categorized as very feasible. These results demonstrate that the media has met the criteria for validity, practicality, and effectiveness, thus having great potential for use as a learning instrument to increase student engagement and learning interest in the classroom.

Interviews with teachers and principals further support this finding, stating that crossword puzzles can stimulate learning interest, enhance student engagement, and enhance the effectiveness of the learning process. The main novelty of this research lies in the transformation of crossword puzzles into a hybrid learning medium that combines cognitive aspects that integrate the function of delivering science and science material as well as adaptive evaluation instruments specifically designed based on the psychological characteristics and learning needs of third grade elementary school students.

Based on these findings, Elementary school teachers can regularly integrate crossword puzzles, both as an apperception tool at the beginning of the lesson to spark curiosity and as a fun formative assessment tool at the end of the session. Furthermore, teachers are advised to combine engaging visual design with contextual keywording to make theoretical science material more concrete and easier for students to understand. Furthermore, crossword puzzle media development can be directed toward integrating digital technology to adapt to the dynamics of learning development and student needs.

5. Acknowledgements

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