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Audio-Assisted Smartbox Learning Media in IPAS Content of Metamorphosis of Animals for Fourth-Grade Students

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ABSTRAK

Permasalahan siswa yang sering terjadi pada muatan IPAS salah satunya adalah penggunaan media yang membosankan bagi siswa yang berdampak pada rendahnya hasil belajar siswa. Penelitian ini bertujuan mengembangkan serta menguji kelayakan dan keefektifan media SmartBox berbantuan audio pada muatan IPAS materi siklus hidup hewan. Penelitian ini merupakan penelitian dan pengembangan mengacu metode Borg and Gall. Sample penelitian berjumlah 27 siswa. Teknik pengumpulan data berupa observasi, wawancara, tes, angket, dan data dokumen. Hasil penilaian dari validator ahli materi dan ahli media menunjukkan skor 98% dan 92% dengan kategori sangat layak. Hasil penggunaan media mendapatkan respons positif dari siswa dan guru. Media yang dikembangkan juga efektif untuk meningkatkan hasil belajar yang dibuktikan dengan hasil uji t-test yang menunjukkan bahwa nilai Sig. 0,000 berarti terdapat perbedaan yang signifikan antara hasil belajar pada data pretest dan posttest dan didukung dengan uji n-gain sebesar 0,44 kategori sedang menunjukkan peningkatan hasil rata-rata pretest dan posttest menggunakan media pembelajaran SmartBox berbantuan audio. Kesimpulannya adalah media pembelajaran SmartBox berbantuan audio muatan IPAS materi siklus hidup hewan dinilai sangat layak, efektif, dan valid digunakan pada proses pembelajaran karena dapat meningkatkan hasil belajar siswa.

ABSTRACT

One of the prevalent issues faced by students in the IPAS subject is the utilization of monotonous media, resulting in lower learning outcomes. This research aims to develop and evaluate the feasibility and effectiveness of SmartBox media assisted by audio for the IPAS subject, specifically focusing on the topic of animal life cycles. Employing the Borg and Gall method, this study falls under the category of research and development with the research sample consisting of 27 students. The data collection techniques encompassed observation, interviews, tests, questionnaires, and document analysis. The evaluation results from expert validators in both content and media fields revealed scores of 98% and 92%, respectively, indicating a highly suitable categorization. Moreover, the media garnered positive responses from both students and teachers. Additionally, the developed media demonstrated its effectiveness in enhancing learning outcomes, as evidenced by a t-test result with a Sig. value of 0.000, indicating a significant difference between pretest and post-test data. This finding is supported by an n-gain score of 0.44, classified as moderate, signifying an increase in the average results of pretest and post-test using the audio-assisted SmartBox learning media. In conclusion, the SmartBox learning media with audio assistance for the IPAS subject on animal life cycles is deemed highly appropriate, effective, and valid for implementation in the teaching process, as it effectively improves student learning outcomes.

1. INTRODUCTION

Education is fundamentally regarded as a crucial process aimed at attaining excellence and balance in the development of both individuals and collectives. Distinguishing itself from mere instruction, education emphasizes the cultivation of comprehension acation can also be a way to gain new knowledge and experience. It further facilitates students in adapting to their surroundings and acts as a catalyst for transformative endeavors (Nabela et al., 2021; Sari & Manuaba, 2021). The functions and objectives of education in Indonesia have been duly stipulated in Act No. 20 of 2003, which pertains to the national

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education system. This legislative framework outlines the course of national education, encompassing the overarching aims and functions of the nation's educational pursuits. The underlying aspiration is to nurture a more refined and accomplished generation, often referred to as the "golden generation" thereby elevating Indonesia's educational standards (Shaturaev, 2021; Sujana, 2019). Education must be clear, aligned with its objectives, relevant to the curriculum, effective, efficient in its methods and implementation, and guided by a strong foundation. The curriculum is continually developed to keep pace with the advancements in educational theory and practice. Therefore, in order to ensure that the educational process remains relevant with the changing times and is adapted to the context and characteristics of the learners, who are the future generation of the nation, the government has issued Minister of Education, Culture, Research, and Technology Decree No. 56 of 2022, pertaining to guidelines for implementing the curriculum in the context of learning recovery. This curriculum aims to optimize the dissemination of education in Indonesia through diverse intracurricular learning. Supporting learning recovery is a hallmark of the Merdeka Curriculum (Fauzi, 2022; Inayati, 2022).

In the Merdeka Curriculum, the subject of Natural Sciences (IPA) is integrated with Social Sciences (IPS) to form the subject of Natural and Social Sciences (IPAS). The scope of IPAS encompasses the interconnectedness between phenomena, characteristics, and interactions in the universe with human life as individuals and social beings who interact with the environment, including their related issues (Agustina et al., 2022; Fanani et al., 2022). One of the specific learning objectives of IPAS phase B, particularly for fourth-grade elementary school students, is for students to identify the life cycle of living organisms. The learning goals of IPAS are to foster curiosity and interest, encourage active participation, develop research skills, gain self-awareness and awareness of the surroundings, as well as enhance knowledge and understanding of IPAS concepts (Agustina et al., 2022; Wicaksono & Sayekti, 2020). However, in reality, the content of IPAS learning is predominantly teacher-centered, leading to a sense of boredom and disengagement among students. The utilization of limited and monotonous teaching methods and resources further contributes to students becoming disinterested in the learning process (Maulidah & Aslam, 2021; Yulianti & Lestari, 2019).

Moreover, a recurrent issue is that students encounter difficulty in grasping IPAS subjects due to the utilization of unstimulating learning media by teachers (Lusidawaty et al., 2020; Megita Rani et al., 2019; Nur Jannah, 2020). This is evident from the observation results of fourth-grade students at SDN Petompon 03, Semarang City, where it was found that students lacked the motivation to learn and easily became bored during the learning process. The teachers tended to rely on visual aids, mainly using images from the teacher's and student's book. Moreover, the available media related to the animal life cycle was limited to mere images. According to the results of interviews with teachers, students exhibited less interest in the IPAS subject due to the limited use of learning media, particularly those related to modern technology, and the lack of engaging teaching materials. Consequently, this situation resulted in a decline in students' motivation and enthusiasm to actively participate in IPAS learning optimally. If these issues persist, they could have adverse implications on students' learning outcomes, particularly in the animal life cycle subject. This was substantiated by the IPAS learning results of fourth-grade students of SDN Petompon 03, Semarang City, where out of 27 students, only 10 students (43%) had successfully met the minimum passing grade (KKM), while the remaining 17 students (57%) had not yet met the established KKM criteria.

One of the solutions to enhance students' learning outcomes is the utilization of instructional media that can assist teachers during the teaching process. The use of media has been shown to increase student motivation (Eri Karisma et al., 2020; Gaol & Sitepu, 2020). Media can also be regarded as an indirect communication tool that enhances the effectiveness and efficiency of learning. It facilitates teaching and learning activities (Maula & Fatmawati, 2022; Sulthon, 2018). To address the challenges present in the fourth-grade class at SDN Petompon 03 in Semarang City regarding the IPAS subject matter on the animal life cycle, the development of SmartBox learning media assisted by audio is proposed. SmartBox learning media with audio assistance is designed to facilitate students in comprehending the IPAS subject matter on the animal life cycle.

This media takes inspiration from pop-up books and transforms them into a pop-up within a box. The pop-up media comprises folded paper or books with surprising three-dimensional elements that move when the pages are opened. It features a variety of beautiful colors and offers engaging visualizations and displays to enhance students' understanding of the content. Moreover, this media is practical for independent or group learning, providing an appealing and practical tool to improve students' knowledge on the subject matter (Frima et al., 2022; Winda et al., 2022). Audio is one of the alternative media to assist students in improving their listening and comprehension skills. It involves recording sound with a scripted scenario or content to be delivered, which is then played back through an audio player (Kesumaningtyas et al., 2022). Audio media is often referred to as a center for listening as it

relies on audio-based materials (Pratiwi & Puspitaningtyas, 2019). Furthermore, audio media can enhance memory retention and enable students to recall the ideas and narratives they have listened to (Maulida et al., 2021). Apart from being engaging and motivating students' interest in learning, audio media has the advantage of being replayed multiple times (Setiyawan, 2021). One form of audio in education is storytelling. Storytelling is the activity of conveying stories through various captivating media, aiming to impart values to the listeners (Demirbaş & Şahin, 2022; Yolanda & Muhid, 2022). Storytelling can also be an effective method for developing literacy skills and capturing students' attention and motivation, making it easier for them to remember the conveyed messages (Saidah et al., 2020; Ulya & Rofian, 2019). In this research, the term "SmartBox media" refers to a pop-up media packaged within a box. When opened, the SmartBox reveals pop-up elements equipped with audio in the form of storytelling, presented in the context of fables related to the life cycle of animals.

Several studies have demonstrated that the development of audio-assisted pop-up media yields promising and effective results in the context of education. These findings are supported by previous research, which has established that pop-up media is both valid and effective in the learning process (Baiduri et al., 2019; Bila et al., 2022; Cahyani et al., 2020; Finna et al., 2022). Furthermore, it has been found that such media can enhance students' motivation and learning outcomes (D. A. Lestari & Farhurohman, 2020; Sumayana et al., 2021; Tuwijati et al., 2021). Previous studies are relevant to the current research: however, there is a distinction, as the present study focuses on developing audio-assisted SmartBox learning media for the IPAS subject on the life cycle of animals. This novelty and differentiation make this study unique. Based on these considerations, there is a need to create an audio-assisted pop-up media that combines three-dimensional pop-up images presented in a box format with audio in the form of storytelling, revolving around fables related to the life cycle of animals. The objective of this research is to develop and assess the suitability and effectiveness of the SmartBox audio-assisted media for the IPAS subject on the life cycle of animals, aimed at motivating students in their learning process and thereby positively influencing their learning outcomes.

2. METHODS

This research employed the *Research and Development* methodology, which, as described by Borg and Gall (Sugiyono, 2015), is utilized to develop a specific product and evaluate its effectiveness through a systematic process of designing and developing the product until it meets the criteria for effective use in the teaching and learning process. The selection of the *Research and Development* methodology was driven by the researcher's aim to develop the audio-assisted SmartBox learning media for the IPAS subject on the life cycle of animals. The development of the SmartBox media with audio assistance underwent various stages of testing and validation by media experts and competent subject matter specialists. The design of the SmartBox learning media is carried out using Borg and Gall's procedural model, which consists of ten stages, with eight stages completed in this study: (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) product testing; (7) product revision; and (8) field testing. This research was conducted at SDN Petompon 03 in Semarang City. The subjects of the study were as follows: (1) fourth-grade teachers at SDN Petompon 03 in Semarang City; (2) 27 fourth-grade students at SDN Petompon 03 in Semarang City for the academic year 2022/2023; and (3) experts. The data for assessing the suitability of the audio-assisted SmartBox media on the topic of the life cycle of animals were collected using questionnaires. The questionnaires used in this research included the media expert validation questionnaire, instructional material expert validation questionnaire, teacher response questionnaire, and fourth-grade student response questionnaire at SDN Petompon 03 in Semarang City. The questionnaire items used in the research and development of the audio-assisted SmartBox media for the life cycle of animals, aimed at improving IPAS learning outcomes, are presented in Tables 1, Table 2, Table 3, and Table 4.

Table 1. The Rubric of Media Expert Instrument

Aspect	Component	Component Indicator	Item Numbers
Content Quality and Objectives	Comprehensiveness	The title of the media is relevant to the subject matter Learning outcomes Progression of learning objectives and learning goals	1, 2, 3
	Engagement and motivation	Design of the learning media	4, 5, 6, 7

Aspect	Component	Component Indicator	Item Numbers
Instructional Quality	Impact of the media	The capability of the media in response-building	8 ,9
		The capability of the media to foster two-way communication	
Technical Quality	Readability	Appropriateness of image type and size	10, 11, 12
		Text and images are clear and visible	
		The audio is audible and clear	
	Usability	Flexibility	13, 14
		Usage guidelines	
	Display Quality	Selection of image colors	15, 16, 17,
		The appeal of the content	18, 19, 20
		The appeal of the audio	
		The appeal of the visuals	
		Images and audio combination	
		Precision in layout arrangement	

Table 2. The Rubric of Subject Matter Expert Instrument

Aspect	Component Indicator	Item Numbers
Content suitability	Compatibility of CP, TP, and ATP	1, 2, 3, 4, 5
	Material scope	
	Language utilization	
	Material comprehensiveness	6, 7, 8 ,9
Learning support	Learning material relevance	10, 11, 12, 13, 14, 15, 16, 17
Language aspects and readability	Readability	18, 19, 20
	Information comprehensibility	
	Adherence to language rules	

Table 3. The Rubric of Teacher Responses Instrument

Aspect	Component Indicator	Item Numbers
Material content	Compatibility of CP, TP, and ATP	1, 2, 3
	Adherence to language rules	4, 5
	Availability of supporting illustrations	6, 7
	Usage guidelines	
Media quality	The appeal of the media's visual and auditory elements	8, 9, 10
	Versatility in use during learning	11, 12, 13, 14

Table 4. The Rubric of Students Responses Instrument

Aspect	Component Indicator	Item Numbers
Media quality	The appeal of the media's visual and auditory elements	1, 2, 3
	Versatility in use during learning	4, 5, 6
Material content	Adherence to language rules	7
	Media comprehensiveness	8, 9, 10
	Material extensiveness	

The usage trial design utilized in this study employed a pre-experimental design with a one-group pretest-posttest design. Pretest and posttest measurements were conducted before and after the treatment. The data analysis method employed in this research was quantitative descriptive analysis, which was obtained from the questionnaire results using a Likert scale reference.

3. RESULTS AND DISCUSSION

Results

The result of this developmental research is the SmartBox instructional media assisted by audio on the subject of the life cycle of animals in the fourth grade of elementary school to enhance student learning outcomes. The suitability of the media can be measured through stages of validity testing, media experts' evaluation, subject matter experts' evaluation, teachers' feedback, and student responses. The percentage results of the assessments can be seen in Table 5 and Table 6.

Table 5. The Percentage of Product Validation Results

Test Subjects	Validation Results	Qualification
Media Expert Assessment	98 %	Highly Suitable
Subject Matter Expert Assessment	92 %	Highly Suitable

Table 6. The Percentage of Responses to the Media

Test Subjects	Validation Results	Qualification
Student Responses Small-scale Assessment	92 %	Highly Positive
Student Responses Big-scale Assessment	95 %	Highly Positive
Teacher Responses	100 %	Highly Positive

Based on the findings presented in Table 5 and Table 6, it is evident that the development of audio-assisted SmartBox learning media is deemed suitable for the learning process. This developmental research employed a normality test to ascertain whether the learning outcomes data followed a normal distribution or not, using SPSS version 25 with the Shapiro-Wilk technique, as shown in Table 7.

Table 7. Results of Normality Test for Pretest and Posttest Data

	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest	0.940	27	0.121
Posttest	0.957	27	0.323

Based on the results presented in Table 7, it can be observed that the pretest calculation yielded a significance value of 0.0121 > 0.050, indicating a normal distribution of values. Similarly, the posttest calculation resulted in a significance value of 0.323 > 0.050, also indicating a normal distribution of values. Subsequently, the data were subjected to a paired sample t-test to determine the effectiveness of the product using SPSS version 25, as shown in Table 8.

Table 8. Results of the Difference in Pretest and Posttest Mean (Paired sample t-test)

Test Subjects	Mean	df	Sig. (2-tailed)
Big-scale Assessment	-17.629	26	0.000

Based on the findings presented in Table 8, the t-test results indicate that the significance value (sig.) of 0.000 suggests a significant difference between the pretest and posttest data. Subsequently, the data were analyzed using the n-gain method to determine the average improvement between the pretest and posttest, as shown in Table 9.

Table 9. Results of Improvement Mean (N-gain)

Test Subjects	Pretest	Posttest	N-gain	Criteria
Big-scale Assessment	59.70	77.33	0.44	Moderate

Based on the results presented in Table 9, it can be observed that the n-gain value indicates a moderate improvement, with fourth-grade students of SDN Petompon 03, Semarang City, experiencing an average increase of 0.44

Based on the developmental research, the creation of audio-assisted SmartBox learning media followed the Borg and Gall development model, which consists of 8 stages: (1) potential and problems, the preliminary research conducted through interviews with fourth-grade teachers at SDN Petompon 03, Semarang City, revealed that students showed limited interest in IPAS subjects due to the lack of diverse learning media, especially those involving technology, resulting in suboptimal IPAS learning processes. Additionally, observations indicated that students lacked motivation and easily became disinterested during the learning process, primarily because teachers mainly utilized images from the teacher's and student's books as instructional media. Furthermore, the existing media related to the animal life cycle merely comprised static images. Documented data on student learning outcomes indicated that out of 27 students, only 17 students (57%) had not reached the minimum passing grade (KKM), while the other 10 students (43%) had achieved the required KKM; (2) data collection involved analyzing the needs of teachers and students through a needs assessment questionnaire; (3) product design encompassed developing the audio-assisted SmartBox learning media according to the predetermined design. The steps involved in designing the product include: content development, appropriate format and design layout, creating a prototype of the audio-assisted SmartBox learning media using wood, 0.5 cm thick plywood, coloring, and a Bluetooth speaker (4) design validation, which comprises validation of media presentation components by media experts and validation of content appropriateness by subject matter experts. (5) design revision, where improvements were made based on the assessments and suggestions from experts until the developed product is ready for small-scale trial (6) product trial, a small-scale trial was conducted with 6 fourth-grade students at SDN Petompon 03, Semarang City, using a purposive sampling technique. A questionnaire is given to both teachers and students to assess their responses to the developed media. (7) product revision, during this stage, the audio-assisted SmartBox learning media did not require any revisions as it received positive feedback from teachers and students. The next step involves testing its effectiveness through a product usage trial. (8) product usage trial, a large-scale trial was conducted with the entire fourth-grade students at SDN Petompon 03, Semarang City, for the academic year 2022/2023, totaling 27 students, using a saturated sampling technique. The final design of the developed SmartBox instructional media assisted by audio in this research is shown in Figure 1.

Figure 1. Results of Media Development

Discussion

The results indicate that the audio-assisted SmartBox learning media is suitable for use in IPAS (Ilmu Pengetahuan Alam dan Sosial) learning, particularly for the topic of animal life cycles in fourth-grade elementary school, based on several research aspects. Firstly, the audio-assisted SmartBox learning media is deemed appropriate for use in IPAS learning, especially for the animal life cycle topic in fourth-grade elementary school, concerning the aspect of media design. This is supported by the evaluation conducted by a media expert validator with a Master's qualification in educational technology, yielding a score of 98% with the category of highly suitable. The developed media pays attention to the integration and support of text, images, and audio elements. The design ensures that text, images, and audio complement each other, aiming to facilitate a more effective learning process. Presenting text, images, and audio in an appealing manner is crucial for clarity in conveying information during the learning process (Anggraeni et al., 2021; Geni et al., 2020; Ningtiyas et al., 2019). Therefore, in developing the audio-assisted SmartBox learning media the use of text, images, and audio significantly influences students' engagement and interest. Secondly, the audio-assisted SmartBox learning media is deemed suitable for use in IPAS learning, especially for the animal life cycle topic in fourth-grade elementary school, concerning the aspect of the content. This is supported by the evaluation conducted by a subject matter expert validator with a Master's qualification in Elementary School Science, yielding a score of 92% with the category of highly suitable. This indicates that the media aligns well with the content aspect of the animal life cycle. The content used in the media must be relevant to the learning objectives to achieve the intended learning outcomes (Dewi & Yanti, 2021; Marwiki, 2021). Assessing the alignment between the content and learning objectives is essential, and therefore, the developed audio-assisted SmartBox learning media, based on the IPAS content, has been validated and can be used by students in the learning

process, especially for the animal life cycle topic in IPAS. Thirdly, the audio-assisted SmartBox learning media is deemed applicable for use in IPAS learning, particularly for the animal life cycle topic in fourth-grade elementary school, concerning the aspect of effectiveness in improving learning outcomes. This is supported by the t-test results, showing a significance value (sig.) of 0.000, indicating a significant difference between the pretest and posttest data. The n-gain test also shows that the fourth-grade elementary school students at SDN Petompon 03, Semarang City, experienced an average increase of 0.44, with a moderate criterion. This demonstrates the effectiveness of the audio-assisted SmartBox learning media in IPAS learning, specifically for the animal life cycle topic in Grade IV. Other relevant research has shown the effectiveness of pop-up media in improving science learning outcomes (Hiranmayena et al., 2022; Masturah & Mahadewi, 2018). Additionally, other studies have revealed that pop-up media has a positive impact on increasing students' interest in learning (D. A. Lestari & Farhurohman, 2020). Furthermore, the responses from both students and teachers towards the audio-assisted SmartBox learning media are highly positive. This is shown from the questionnaires administered to students and teachers, which show that students are motivated and capable of critical thinking during the learning process. Other relevant research has also shown the motivating effect of pop-up media on student engagement in learning (Sumayana et al., 2021). Pop-up instructional media has been found to enhance students' critical thinking abilities (F. D. Lestari & Sari, 2021; Suroiha et al., 2021).

In conclusion, several studies have provided evidence that the development of pop-up media with audio assistance yields favorable and effective results in learning. These findings are further supported by previous research indicating that pop-up media with audio assistance is valid and effective in the learning process (Baiduri et al., 2019; Bila et al., 2022; Cahyani et al., 2020; Finna et al., 2022). The implications of this research highlight the positive impact of utilizing the audio-assisted SmartBox learning media for IPAS content on the animal life cycle, benefiting both students and teachers. This research has positive implications for improving student learning at the fourth grade level. The use of learning media adapted to audio can help students understand the concept of animal life cycles better. Innovation in Learning: The development of Smartboxes equipped with audio can open the door to innovation in learning methods. This could be an example of how technology can be used to enhance the classroom learning experience. However, the results of this study may be difficult to generalize to different contexts. The effectiveness of learning media can be influenced by different local factors, such as culture, infrastructure, and level of technology. Developing sophisticated learning media such as Smartbox can require significant time and resources. Limited resources may be a barrier to adopting these solutions across schools.

4. CONCLUSION

Based on this developmental research, it can be concluded that the development of the audio-assisted SmartBox learning media for the topic of animal life cycles in the fourth-grade IPAS content at SDN Petompon 03, Semarang City, is deemed suitable and valid for use. This conclusion is supported by the trial results and assessments conducted by media experts, subject matter experts, teachers, and fourth-grade students at SDN Petompon 03, Semarang City. The use of the audio-assisted SmartBox learning media is considered effective in improving learning outcomes, as evidenced by the t-test results, showing a significance value (sig.) of 0.000, indicating a significant difference between the pretest and posttest data. Additionally, the n-gain test demonstrates that fourth-grade students at SDN Petompon 03, Semarang City, experienced an average increase in a moderate criterion. These results indicate that the development of the audio-assisted SmartBox learning media for the animal life cycle topic in fourth-grade elementary school is valid, suitable, and effective for use during the learning process.

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