Development of Interactive Multimedia Motion Graphics Based on Reroroja Mangrove Local Wisdom to Improve Conceptual Understanding of IPAS

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Abstract: This study aims to develop and examine the effectiveness of interactive multimedia motion graphics based on mangrove reroroja local wisdom in enhancing students' conceptual understanding of IPAS. This research employed the Research and Development (R&D) method using the ADDIE model. The subjects of the study were fourth-grade students and a teacher at SDI Magelo'o. The results of the material expert validation showed a score of 32 with a percentage of 96%, categorized as "highly feasible," while the media expert validation achieved a score of 33 with 100%, also "highly feasible." Students' responses indicated a 100% "strongly agree" category, showing that the multimedia was attractive and engaging. Field testing with 18 students demonstrated a significant improvement in understanding, with pretest and posttest average scores of 45.00 and 96.11, respectively. The N-Gain Score of 0.91 was categorized as "high." Thus, the motion graphic–based interactive multimedia grounded in mangrove reroroja local wisdom proved to be effective in improving students' conceptual understanding of IPAS and fostering interest in learning.

Keywords: Conceptual understanding of IPAS; Mangrove reroroja; Motion graphic

Introduction

Social studies learning in elementary schools is a field of study that studies humans in all aspects of life and their interactions in society, where the role of social studies is very important to educate students to develop knowledge, attitudes, and skills in order to take an active part in their lives as members of society and good citizens (Amalia et al., 2021). In the teaching at many elementary schools, the use of learning resources based on local experiences, surrounding ecosystems, and traditional cultural values is minimal, even almost neglected (Hs et al., 2025). A learning process becomes meaningful when supported by appropriate learning resources and methods. Potential learning resources are those related to elements of the students' surrounding environment. Learning will be more meaningful for students if the learning materials are contextualized with their environment and direct experiences. IPAS

learning should always be linked to the regional environmental context and local wisdom (Helvina et al., 2024). This is important to ensure that the knowledge acquired by students can be useful and beneficial to their surroundings (Lestari et al., 2021).

Teaching materials with local history, cultural traditions, customs, and regional natural resources can enrich the content and enhance its relevance, particularly in the context of IPAS (Ilmu Pengetahuan Alam dan Sosial) instruction in elementary schools. Such integration supports meaningful learning experiences and promotes cultural awareness and contextual understanding among students (Guslinda et al., 2025). Teachers need to develop learning materials that integrate the local values and wisdom of their region so that social studies learning becomes more concrete and easier for students to understand (Taksu & Wesnawa, 2019). Learning will be more meaningful for students if the instructional materials are contextualized with the

environment and experiences they directly encounter in their daily lives (Prayogi et al., 2019).

Local wisdom is a potential or advantage possessed by a region in the form of culture, customs, and natural resources that can be utilized by humans. Local wisdom is a cultural product of the past that deserves to be preserved in daily life (Fayola et al., 2022). In IPAS learning, teachers must help students develop their curiosity about phenomena occurring in their surroundings (Dua & Rawin, 2024). Learning implementation should be linked to the students' environment, aiming to achieve knowledge and understanding of their surrounding environment. One of the activities that can be carried out is integrating local wisdom into learning (Antari et al., 2023). The implementation of learning by involving the environment directly is considered effective in shaping children's knowledge.

The Reroroja Mangrove Forest is one example of local wisdom that can be utilized by teachers in the learning process to enhance students' conceptual understanding of IPAS, as the learning materials are closely related to the potential and uniqueness of the region. The Reroroja Mangrove Forest is an integral part of the daily activities of the Reroroja village community, as the residents depend on it for their livelihoods and as a source of sustenance for the flora and fauna living within it (Warta Cendana, 2016).

Over time, the existence of the mangrove forest has become increasingly recognized by tourists from various regions and backgrounds. The Reroroja Mangrove Forest has become a popular tourism icon due to its refreshing natural atmosphere and beautiful scenery that attract many visitors. In addition, the Reroroja Mangrove area serves as an educational tourism site by introducing various types of mangroves found in the area, making it a medium and learning resource for visitors. Facilities such as bamboo bridges are also provided, allowing visitors to explore the mangrove forest and reach the coastal area integrating social studies materials with the local wisdom of the Reroroja mangrove is therefore an appropriate step for teachers to create contextual and meaningful learning experiences. The presence of mangroves can serve as a resource that provides community welfare if managed properly and effectively. The development of the mangrove ecosystem largely depends on human management as the driving force for mangrove forest conservation. If mangrove forests are utilized appropriately, they can offer numerous benefits to the community. The mangrove ecosystem contributes significantly to the sustainability of coastal communities, as people meet their needs by utilizing mangrove resources. Mangrove forests serve several functions, both from economic and ecological perspectives (Warta Cendana, 2016).

Based on observations, it was found that in social studies learning, teachers only used the thematic book for students and teachers as the sole learning resource in the classroom. Teachers have never utilized the uniqueness and potential of the surrounding environment as learning resources. The learning activities also still employ conventional or lecture-based methods, resulting in students remaining passive and less enthusiastic in learning. In addition, teachers have not yet optimized the use of learning media during the teaching and learning process. Even homeroom teachers often do not understand or do not explore local wisdom which should be an important part of education. Without an emphasis on local wisdom, students lose the opportunity to understand their cultural identity, which can actually enrich their learning experiences in various subjects, including Natural and Social Sciences (IPAS) at the Elementary School (SD) level (Tai et al., 2020). Educators are expected to reduce their role as the main actors in teaching and learning activities that explain a lot of material and provide a lot of instructions (Krishantari, 2025).

A local wisdom-based approach in elementary schools needs to be implemented through strategies involving innovative learning media that can attract students' attention and help them understand social studies materials (Lestari et al., 2021). Entering the 21st century, teachers are required to innovate in supporting the learning process according to the needs of students. Responding to these challenges, teachers must equip themselves with literacy competencies in accordance with the demands of the changing era (Hidayatullah et al., 2021). The nation's quality of life can improve if it is supported by an education system that is balanced with technological advances, because a good education system allows us to think critically, creatively and productively (Mantoviana et al., 2023).

The teacher as an educator must be more creative and innovative by utilizing modern technology. One of the innovations that can be carried out by teachers is to create IT-based learning media. Teachers can develop IT-based learning media according to learning needs, so that it will foster students' self-motivation to be actively involved in participating in the learning process (Buchori, 2019). The use of technology in the field of education is integrated with a learning sub-system, namely as one of the facilities that can be utilised by educators or students who can benefit from the use of learning media (Purwanto et al., 2024).

On the other hand, technological developments continue to advance and can be utilized by educators to find solutions that can solve various problems faced. That way, both educators and students must adapt to

technology to develop self-competence. The use of technology can facilitate learning activities; the learning process cannot be separated from the process of communicating and providing information from educators to students in the form of knowledge, understanding, expertise, ideas, experiences, and others. The performance of educators in informing students also depends on how the process of learning activities takes place (Mudrikah et al., 2022). To support the quality of the education process, learning media is needed (Komarudin et al., 2024).

Learning media is a tool in the teaching and learning process. Media can attract learners' reasoning, emotions, attention, and abilities (Degner et al., 2022). Learning media is one of the factors that influence students' learning activities. It serves as an effort to create classroom conditions that foster the development of students' attitudes, knowledge, and skills (Rahman & I Nyoman, 2020). The use of learning media is one of the key factors determining the success of the teaching and learning process in the classroom. According to Dhey and Branch as cited in Qondias et al. (2016), the media used by teachers in creating quality learning experiences has a direct impact on students' academic achievement. The presence of interactive media in learning can facilitate an effective learning process, which ultimately leads to improved student learning outcomes. Based on developmental theory, elementary school students are at the concrete operational stage; therefore, they require instructional media to help concretize abstract materials or concepts (Juwantara, 2019).

In the learning process, the use of media in learning becomes one that must be used and utilized by teachers, because learning media has a very important role because by using the media the teaching and learning process makes it easier for students to understand from a material that will be conveyed. The benefits obtained if using Learning media can increase learning motivationand can also attract students attention (Susilo, 2020). Based on existing limitations, teachers need to choose good learning media by adjusting the learning characteristics they want to achieve (Putri et al., 2023).

Through the development of interactive multimedia motion graphics, teachers can deliver learning materials more effectively. Learning also becomes more engaging through real visualizations rather than merely listening to lectures. Interactive multimedia motion graphics consist of animated forms choreographed together using various effects to produce appealing and expressive presentations that enhance understanding (Carra et al., 2019).

This medium integrates elements that are enjoyable for elementary students—such as a combination of audio, text, images, and animations—into a cohesive whole. Interactive multimedia motion graphics are suitable for elementary education because they align with the characteristics of young learners (Nugraha, 2022). Motion graphics capture students' interest by presenting cartoon-like visuals and animations (Hapsari et al., 2019). Motion graphics generally refer to a combination of visual design or animation elements based on visual media, such as two-dimensional (2D) and three-dimensional (3D) graphics, video, film, typography, illustration, photography, and music (Siregar, 2017).

Now Learning media is more diverse, ranging from conventional media such as books or traditional props to modern media audio visual form in cassettes, videos, and other modern visual device (Wiana et al., 2018). Video animation also prevents students from getting bored, as they can present a pleasant, relaxed and humorous learning atmosphere, and still accommodate the main aspects learning material elements. Motion graphic is a sequentially manipulated image becomes a look like moving animation. Combined with audio, motion graphic can create the illusion of motion operated using animation technology (Hanif, 2020). Motion graphics videos offer a powerful means of communicating complex concepts through engaging visuals and animation (Jahanlou et al., 2021).

Integrating local wisdom-based materials from the Reroroja Mangrove ecosystem with motion graphic multimedia makes the learning process more engaging, easier to understand, and enjoyable, thereby facilitating the effective delivery of social studies content to students. the integration of local wisdom in each area is a very important reason in learning (Fayola et al., 2022). Therefore, a solution that can be provided is the development of interactive motion graphic multimedia based on local wisdom that utilizes current advances in information and communication technology. In addition, the use of instructional media integrated with local wisdom can make the learning process more effective, efficient, and meaningful for students, thereby enabling classroom learning to effectively change students' perceptions of scientific concepts and optimally improve their learning outcomes.

The use of technology in learning, such as the use of computers and digital applications, can increase the effectiveness and efficiency of the learning process. Apart from that, the use of concrete objects can also make it easier for students to understand abstract concepts. Therefore, teachers need to choose the right learning resources to suit the material to bedelivered and the characteristics of the students (Hariana et al., 2023). Local wisdom can be combined with technological developments to create innovative learning models and media that can improve students' thinking skills, literacy skills, and students'

behavior in accordance with local wisdom values (Toharudin et al., 2021). Animated video materials have been shown to considerably increase student engagement and interest in various contexts (Suwanphan et al., 2025).

Several studies related to this research include the development of elementary school learning media based on the local wisdom of mangrove forests by Lestari et al., (2021); the development of local wisdom values of mangrove forests as a learning resource for Social Studies (IPS) by Taksu et al. (2019); the internalization of local wisdom in learning through the development of interactive multimedia for IPS content by Prayogi et al. (2019); the development of motion graphic–based digital media for in-depth Social Studies learning in elementary schools by Nugraha (2022); and interactive multimedia oriented toward the Pancasila Student Profile on the topic of human–environment interaction in Grade V Social Studies by Diputra, et al. (2023). However, none of these studies have utilized the Reroroja mangrove ecosystem as a learning resource, particularly in the IPAS learning process at the elementary school level in Magepanda District, Sikka Regency. The novelty of this research lies in the development of interactive motion graphic multimedia that integrates the local wisdom of the Reroroja mangrove ecosystem with Social Studies (IPS) learning materials in elementary schools to enhance students' understanding of IPAS concepts, an approach that has not previously been undertaken by other researchers.

This study aims to describe the process of developing interactive motion graphic multimedia based on the local wisdom of the Reroroja mangrove ecosystem to enhance students' understanding of IPAS concepts, as well as to describe the effectiveness of the developed interactive multimedia in determining the extent to which the media influences students in improving their understanding of IPAS concepts. The urgency of this study lies in the need for Natural and Social Sciences (IPAS) learning needs to present contexts that are relevant to students' surrounding natural and environmental conditions in order to make learning more contextual. The Reroroja Mangrove Forest represents a form of local wisdom that can be utilized by teachers as a learning resource to enhance students' understanding of IPAS concepts, as the learning materials are closely related to the potential and uniqueness of the region. However, IPAS teachers have not utilized the environmental potential and local wisdom of the area. The only learning resources used are teacher and student textbooks. The learning activities are still conducted using conventional or lecture-based methods. IPAS learning is also perceived by students as difficult and less engaging because teachers have not optimally used instructional media. Therefore, teachers

need to connect learning materials with the local wisdom of the Reroroja mangrove ecosystem and present the content through innovative instructional media that can assist students in understanding IPAS material. Based on these problems, the researchers are interested in developing interactive motion graphic multimedia based on local wisdom to improve students' understanding of IPAS concepts.

Method

This research was conducted at SDI Magelo'o, located in Reroroja Village, Magepanda District, Sikka Regency, East Nusa Tenggara Province. The study was carried out in stages from May to September 2025. The subject of this study was the fourth-grade students of SDI Magelo'o. Population refers to the entire research object or all subjects to be studied (Notoatmodjo, 2018). In this study, the population consisted of all fourth-grade students of SDI Magelo'o. A sample is a part of the population that is studied and considered representative of the entire population (Notoatmodjo, 2018). The sample in this research included all fourth-grade students, totaling 18 students. The sampling technique used was total sampling, in which the entire population is involved as the research sample. Total sampling was applied because the population size was fewer than 30 students (Sugiyono, 2017). Data in this research were collected through observation, interviews, questionnaires, tests, and documentation. The instruments used included observation sheets, interview guidelines, questionnaire sheets, and test items. The data analysis technique used in this research was descriptive quantitative analysis, which included the following: a) Product Validity and Practicality Analysis, This analysis was conducted to determine the level of validity and practicality of the developed product. The data were analyzed based on the scores obtained from questionnaires filled out by expert validators for product validity, and students' responses using a Likert scale. b) Trial Data Analysis, This analysis aimed to determine the achievement of the established learning objectives. The product trial data were collected using tests (pretest and posttest). The tests were used to assess students' learning outcomes before and after learning with the developed interactive multimedia motion graphics based on the local wisdom of the Reroroja mangrove. The test results were then analyzed using descriptive quantitative methods.

This study employed a Research and Development (R&D) method. This method is used to produce a specific product and to test the effectiveness of that product (Sugiyono, 2017). Research and development is a method used to produce a specific product and test its effectiveness in the context of community use

(Cash et al., 2023). The development model used in this research is the ADDIE model. The ADDIE development model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Wiphasith et al., 2016). The researcher uses the ADDIE model because this development model is simple, easy to learn, and the stages of the ADDIE model align with the product to be developed (Widiantari et al., 2025). The development in learning is essential to prepare education for the global era (Ali et al., 2021). The development procedure in the ADDIE model consists of the following stages. First, the Analysis stage. This stage is conducted before developing the multimedia by performing a needs analysis. During this stage, problems are identified, instructional objectives are established, learner characteristics and available resources are analyzed, recommendations for media types are made, and the final media type is determined (Reyvalda et al., 2019). One way to conduct this process is through interviews and observations. The interviews and observations were carried out at the school selected as the research site. The interview subjects included the principal, teachers, and students. The results of the interviews and observations then served as a guideline for finding solutions to the identified problems.

Second, the Design stage. At this stage, all information obtained from the analysis phase is used to begin the creative process of designing learning materials based on the local wisdom of the Reroroja mangrove. The results of the needs analysis are then used to determine the design of the product to be developed. The product design is presented in the form of diagrams or illustrations that can serve as a reference for evaluation and product creation. Third, the Development stage. This stage involves turning the blueprint into a real product. During this process, all materials and supporting components needed for development are prepared. The collected materials—including content and supporting elements—are integrated into a complete interactive multimedia motion graphic product.

Fourth, the Implementation stage. At this stage, the developed media is evaluated after the completion of the interactive multimedia motion graphic. Several activities are conducted, including: (a) expert validation involving content experts and media experts; and (b) field testing, during which respondents are given pre-tests and post-tests to measure the effectiveness of the developed product.

Fifth, the Evaluation stage. This stage involves formative evaluation aimed at collecting data on the effectiveness of the developed media through expert validation, including content and media evaluations. Revisions are made based on the experts' suggestions and feedback. The product is then tested through

individual trials, small group trials, and field trials. Subsequent revisions are carried out to refine the product until a final version is obtained that can be effectively used by teachers in the teaching and learning process.
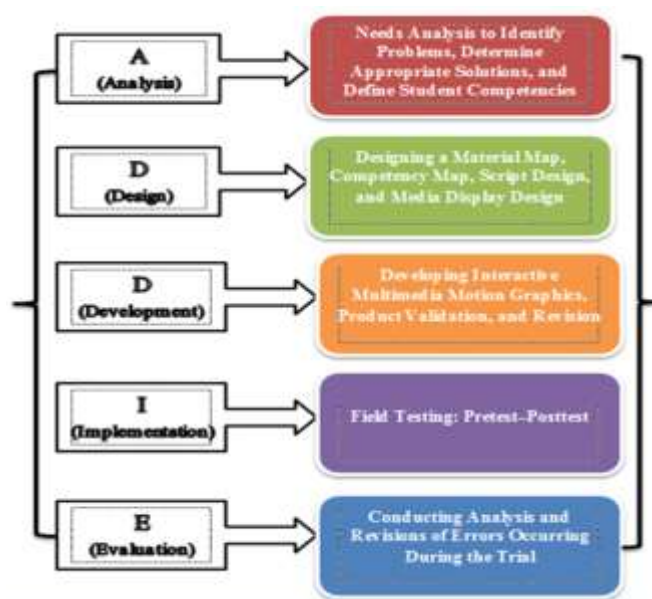

Figure 1. Product development flow using the ADDIE model

Result and Discussion

This study employed a Research and Development (R&D) method. This method is used to produce a specific product and to test its effectiveness (Sugiyono, 2017). The development model used in this research is the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The first stage is Analysis, The initial stage of the ADDIE development model involves conducting an analysis of IPAS learning at SDI Magelo'o to identify the overall background and learning problems faced by students. Based on interviews and observations conducted with the IPAS teacher, it was found that the use of instructional media during the learning process was still very limited. In social studies learning, teachers only relied on thematic textbooks for both teachers and students as the sole learning resource in the classroom. The uniqueness and potential of the surrounding environment had not been utilized as learning resources. Moreover, learning activities still applied conventional or lecture-based methods, causing students to be passive and less enthusiastic in class. The use of learning media by the teacher had also not been optimized in the teaching and learning process.

The second stage is Design, At this stage, the researcher prepared the Adobe After Effects application to design the motion graphic learning media. The media

was designed by reviewing materials aligned with the local wisdom of the Reroroja mangrove ecosystem to ensure that the developed product appeared engaging. The design process was adjusted to match the learning content to be included in the media so that it would appear more attractive and relevant to the learning objectives. The results obtained from the research have to be supported by sufficient data. The research results and the discovery must be the answers, or the research hypothesis stated previously in the introduction part.

Figure 2. Concept map of IPAS material

Figure 3. The design process of motion graphic media based on the local wisdom of reroroja mangrove
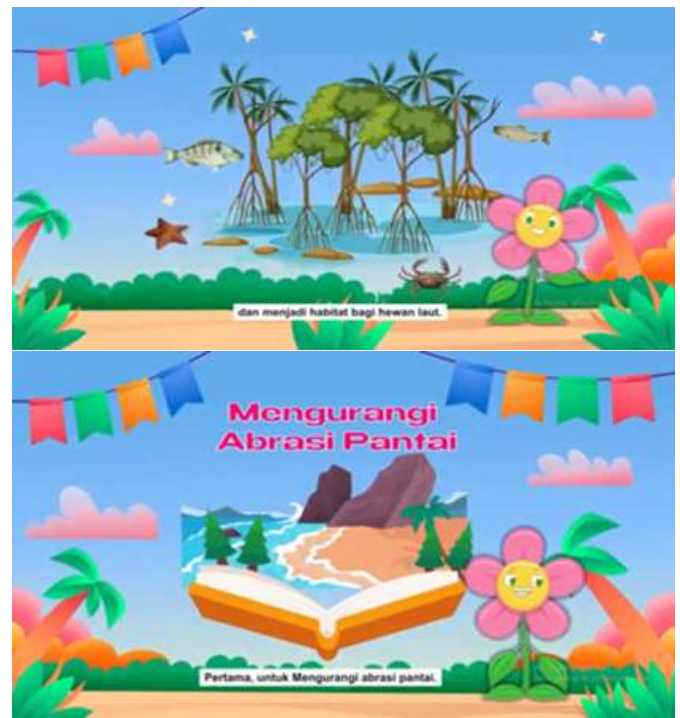

Figure 4. The display of interactive multimedia motion graphic based on the local wisdom of reroroja mangrove

The third stage is Development. The motion graphic media that has gone through the design process then enters the stage where the product is developed. After the media was fully developed using the Adobe After Effects application, the next step was validation by material experts and media experts to determine whether the motion graphic media was feasible for trial implementation. In this development stage, the media was validated by two validators—one for material validation and the other for media validation.

At this development stage, the validation or feasibility of the motion graphic learning media based on local wisdom was assessed from two aspects, namely material feasibility and media feasibility. The results of the material validation test are presented in Table 1.

Table 1. Results of Material Validation

Material Validation	Score obtained	Percentage	Criteria
Validation 1	28	84%	Very feasible
Validation 2	32	96%	Very feasible

The results of the material expert validation in Table 1 show that the first validation obtained a score of 28 with a percentage of 84%, indicating the criterion of highly feasible. However, the material expert suggested adding subtitles to the learning media and correcting the information regarding the area of the mangrove forest. The second validation obtained a score of 32 with a percentage of 96%, also categorized as highly feasible.

Table 2. Results of Media Validation

Media Validation	Score obtained	Percentage	Criteria
Validation 1	32	96%	Very feasible
Validation 2	33	100%	Very feasible

The results of the media expert validation presented in Table 2 show that the first validation obtained a score of 32 with a percentage of 96%, indicating a highly feasible category. However, similar to the material expert's feedback, the media expert suggested adding subtitles to the learning media. The second validation obtained a score of 33 with a percentage of 100%, also categorized as highly feasible. Therefore, after validation by both material and media experts, the motion graphic learning media based on the local wisdom of the Reroroja mangrove was considered suitable for use in the next stage.

The fourth stage is implementation. At this stage, the motion graphic learning media based on local wisdom, which had been validated by media and material experts, was tested on students. Based on the students' responses to the motion graphic learning media based on the local wisdom of the Reroroja mangrove, using "Yes" statements scored as 1 and "No" statements scored as 0, the results showed that the students' responses reached a total score of 126, with a percentage of 100%, categorized as strongly agree. Therefore, based on the questionnaire data, it can be concluded that the motion graphic learning media based on the local wisdom of the Reroroja mangrove is very engaging and suitable for use as a learning medium in the teaching and learning process.

The students' conceptual understanding of IPAS was measured through an experimental test. This test was conducted using a pretest–posttest design to determine the effectiveness of the interactive motion graphic multimedia based on the local wisdom of the Reroroja mangrove in improving students' conceptual understanding of IPAS.

Table 3. Recapitulation of Pretest and Posttest Scores

Information	Pretest	Posttest	N-Gain Score	N-Gain Score Present
18 students	45.00	96.11	0.91	91.14%
Effectiveness Interpretation Criteria				Effective
Improvement criteria categories				High

The data obtained from the pretest showed that the students' average score was 45.00, while the posttest results indicated an improvement with an average score of 96.11. Based on these results, the N-Gain Score achieved was 0.91, which falls into the high category. The Gain value obtained from the trial demonstrates that the interactive multimedia motion graphic based on the local wisdom of the Reroroja mangrove effectively enhances students' conceptual understanding of IPAS.

The fifth stage is evaluation. This stage is conducted to determine the success of the interactive multimedia development in improving students' learning outcomes and the overall quality of learning. The evaluation process consists of two phases: formative evaluation and summative evaluation. Formative evaluation is carried out at the end of each stage of the ADDIE model to refine and improve the interactive multimedia, while summative evaluation is conducted after all stages of ADDIE have been completed to assess the effectiveness of the developed interactive multimedia on students' cognitive learning outcomes. The effectiveness of the motion graphic–based media incorporating local wisdom was assessed through testing. Data were collected using pretest and posttest instruments to measure students' conceptual understanding of IPAS before and after the implementation of the media.

The results of this study indicate that the use of local wisdom as a learning resource can strengthen the context and relevance of learning for elementary school students. The integration of local potentials, such as the Reroroja Mangrove Forest, not only enriches IPAS material but also fosters students' environmental awareness and appreciation of regional cultural values.

This finding aligns with Fayola et al. (2022) who stated that local wisdom is a cultural heritage that should be preserved through educational processes.

The significant improvement in learning outcomes demonstrates that interactive motion graphic multimedia plays an important role in creating a more meaningful learning experience. This media can present abstract concepts in a more concrete manner through a combination of visuals, audio, and engaging animations, in cognitive multimedia learning theory, which emphasizes that integrating images and sounds can enhance students' information processing. Moreover, students' highly positive responses indicate that this media successfully increases motivation and engagement during learning. This supports previous research by Wiphasith et al. (2016) which stated that interactive multimedia-based learning approaches can enhance interactivity and learning outcomes significantly.

Thus, it can be concluded that interactive motion graphic multimedia based on the local wisdom of the Reroroja Mangrove is an effective, valid, and practical learning media for teaching IPAS in elementary schools. This media not only improves students' conceptual understanding but also instills cultural values and a sense of care for the local environment.

Conclusion

Based on the research conducted, it can be concluded that the interactive multimedia motion graphic based on the local wisdom of the Reroroja mangrove has been declared valid based on the validation results from both material and media experts. Students' responses to the motion graphic learning media based on the local wisdom of the Reroroja mangrove showed a score of 126 with a percentage of 100%, categorized as strongly agree, indicating that the multimedia attracted students' attention during the learning process. Furthermore, field trials conducted on 18 fourth-grade students of SDI Magelo'o showed that the average pretest score was 45.00, while the average posttest score increased to 96.11. Based on these results, the N-Gain score was 0.91, which falls into the high category. The gain value obtained from the trials demonstrates that the interactive multimedia motion graphic based on the local wisdom of the Reroroja mangrove effectively improves students' conceptual understanding of IPAS.

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