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# Development of Human Digestion Puzzle Teaching Aids Based on Edutainment and Local Wisdom for Grade V at Special Needs Schools

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**Abstract:** This study aims to develop a learning medium in the form of a human digestive system puzzle that integrates edutainment principles and local wisdom values to improve learning outcomes in Natural Sciences (Ilmu Pengetahuan Alam / IPA) for students in a special school (SLB). The study employed a Research and Development (R&D) method using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. The research participants included five fifth-grade students and one teacher from SLB Muhammadiyah Purworejo. Data were collected through interviews, observations, expert validation, and learning outcome tests. Data analysis was conducted using descriptive quantitative and descriptive qualitative techniques. The validation results indicate that the developed learning media achieved a very high level of feasibility, with an average validity score of 87%. The practicality of the media reached 97.7% based on student responses and 80% based on teacher responses. Interview findings further reveal that the puzzle-based media helped students understand the structure and sequence of the digestive organs more concretely. Overall, the findings demonstrate that the edutainment- and local wisdom-based puzzle media are feasible, practical, and effective for enhancing science learning outcomes in special education settings.

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## Introduction

Science is knowledge and information obtained through reasoning created through observation, experience, and study conducted to understand a phenomenon. The main characteristics of science are objective, provable, and retestable (Parida et al., 2021). Humans can solve problems and create solutions to improve the quality of life by using science to explain various natural and everyday events (Lubis et al., 2023). Meanwhile, Natural Sciences (IPA) is a branch of science that studies the phenomena and events that occur in the universe (Irawan & Bella, 2024).

Science learning in elementary schools and special schools (SLB) still faces challenges, especially in mastering abstract concepts (Zuhriyah et al., 2025). The results of interviews with teachers of Muhammadiyah Purworejo Special Needs School showed that students still have difficulty understanding the human digestive system because the organs cannot be observed directly and the media used are only simple pictures. The teacher also said that students understand the material better if it is presented through real objects or manipulative media that can be touched, so learning about the digestive system needs to be presented concretely to help students understand the process of food processing and develop healthy eating habits in everyday life.

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Misunderstandings arise because many concepts in science learning are abstract and cannot always be directly observed; as a result, students tend to construct knowledge based on everyday experiences that do not necessarily align with applicable scientific principles (Wicaksana et al., 2021). Furthermore, the limited variety of teaching methods and the limited learning resources used also affect student understanding (Putri Husma et al., 2023). One major problem is the emergence of misconceptions, namely misunderstandings that often arise due to the lack of integration of abstract concepts with everyday experiences and the limitations of interactive learning media. Most students still face challenges in understanding abstract ideas in science education, especially regarding the topic of the human digestive system. Zulfa et al. (2025) found that student misunderstandings are often caused by a lack of understanding of basic concepts and a lack of variety of relevant learning media. This study emphasizes the importance of using role-playing tools and a more realistic approach.

Students' difficulties in understanding abstract concepts are not only caused by the difficult-to-observe nature of the material, but are also exacerbated by low learning motivation, both at school and at home, the use of less engaging textbooks, and the limited variety of teaching methods used by teachers (Prahasdita et al., 2025). This condition indicates that the learning media used must be more relevant to the real context and interesting. This is important so that students can more easily understand abstract concepts, especially in material about the human digestive system.

Likewise, children in Special Needs Schools (SLB) have diverse needs, talents, and characteristics, making the learning process challenging. To ensure a better understanding of the principles presented, SLB students often require a more concrete, visual, and participatory learning style. However, in reality, learning activities sometimes rely solely on textbooks or lectures, making it difficult for students to grasp abstract material, particularly in science subjects ( Nunung Nuryati, 2022).

Previous research confirms that visual aids can significantly improve students' understanding of science concepts. Rani (2020) research revealed that student achievement increased from 23.5% to 70.5% after using visual media . In the context of learning in special schools (SLB), visual and manipulative media such as human digestive system puzzles play a crucial role in helping students understand abstract concepts through hands-on experience rather than memorization. These teaching aids integrate cognitive and motor skills, allowing students to assemble the digestive organs while understanding their respective functions. Understanding the abstract concept of biological processes that cannot be seen in the light body as a necessity for education within an engaging context, and have been shown to improve learning outcomes, understanding, and motivation (Widiana et al., 2019).

In addition to educational elements, this media is also designed using an edutainment approach chosen because it combines education with entertainment, making learning the digestive system more interesting and effective for students with low motivation (Muri et al., 2023). This media also utilizes elements of local wisdom through the use of woven bamboo and wood as teaching aids, thus making learning more contextual and closer to the students' environment. The play element is presented through exploratory and interactive activities in the form of manipulative puzzle games that allow students to arrange, match, and sort materials directly using these natural materials. The use of these local materials is in line with the findings of Kristiamita et al. (2023). This shows that bamboo crafts are effective as a learning resource because they are familiar to students. The integration of local wisdom has been shown to increase student attention and engagement in learning. (Lastasa & Basafpipana, 2022). With its simple, economical, and flexible nature for repeated use, this

 

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edutainment-based and local wisdom-based digestive system puzzle is a relevant alternative learning medium for elementary school students and students with special needs, especially for students who have difficulty understanding abstract concepts directly (Ningsih et al., 2023). The aim of this study was to develop a human digestive system puzzle based on edutainment and local wisdom for fifth grade students, including students with special needs, and to assess its practicality and effectiveness in understanding the abstract concept of the human digestive system. The novelty of this research lies in the integration of local wisdom through the use of bamboo, woven bamboo, and wood as teaching aids familiar to students, combined with an edutainment approach that combines learning and entertainment. This media is specifically designed for fifth-grade students with intellectual needs, so that science learning, especially the digestive system, is not only academic, but also applicable, contextual, and fun. This approach differs from previous research because it emphasizes the use of locally sourced manipulative media that supports exploratory, interactive, and multisensory learning experiences for special needs students.

## Research Method

This study applies the Research and Development (R&D) method with the aim of creating a product based on findings and field experiments that are then reviewed. This method allows researchers to produce effective output according to their field of expertise (Judijanto et al., 2024). According to (Karima, 2024), the R&D method is used to develop learning products, including improvements to existing products. This study developed a teaching aid for the human digestive system based on edutainment and local wisdom for fifth-grade elementary school/special needs students, with research subjects consisting entirely of five students with mild intellectual disabilities. According to (Izzaturahma et al., 2021), the development of learning media based on scientific literacy and integrative character is suitable for use and can improve students' conceptual understanding. To test the feasibility and response to the media, this study used a sample of five fifth-grade students. The development model used is ADDIE, which includes the stages of Analyze, Design, Develop, Implement, Evaluate.

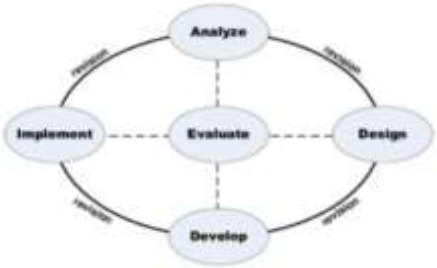


**Figure 1. ADDIE Model Steps**

The data in this study were used to assess the validity and practicality of a human digestive system teaching aid based on edutainment and local wisdom. Product validity was assessed by material experts and media experts through an assessment of content accuracy, design suitability, and presentation quality. Media practicality was measured through teacher and student responses covering aspects of ease of use, attractiveness, and the media's usefulness in supporting conceptual understanding. The results of media use showed that students more easily understood the form, function, and sequence of digestive organs through visual and manipulative representations, in line with previous research findings that stated

 

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that concrete media can improve conceptual understanding in students with special needs (Prihatiningtyas & Haryono, 2019).

The research sources involved subject matter experts, media experts, teachers, and elementary school students and students with special needs. Based on the evaluation, this tool was deemed highly valid, practical, and effective in supporting science learning (Sa'diyah et al., 2025). In line with the research findings (Alawiyah et al., 2022), the media was validated by subject matter experts, media experts, and teachers and declared highly valid and practical in supporting science learning.

1) Validity Analysis

Validity analysis was carried out using a Likert scale of 1-5 according to the validation sheet. Teaching aids can be said to be valid if they get a percentage of 61%–80% and very valid if they get a percentage of 81%–100%.

**Table 1. Validity Analysis**
(Rahmayuni et al., 2024)

| Presentation | Group |
|---|---|
| 81%–100% | Very valid |
| 61%–80% | Valid |
| 41%–60% | Quite valid |
| 21%–40% | Invalid |
| 0%–20% | Not very valid |

2) Practicality analysis

A practicality analysis was conducted to determine the level of ease of use of teaching aids by teachers and students. Data were obtained through a practicality questionnaire using a Likert scale of 1–5. The criteria used to determine the level of practicality refer to those shown in the following table. Teaching aids are declared practical if they obtain a minimum percentage of 50% (practical category) and are declared very practical if they obtain a percentage of ≥75% (very practical category).

**Table 2. Widoyoko's Practical Analysis** (2025)

| Level Achievement | Qualification | Information |
|---|---|---|
| 75%- 100% | Very Practical | No need |
| 50%- 74.99% | Practical | A little revised |
| 25%- 49.99% | Not enough Practical | Lots revised |
| 0- 24.99% | No Practical | Revision total |

## Results and Discussion

This research focuses on the development of learning media in the form of a human digestive system puzzle based on local wisdom and edutainment for fifth-grade students at SD/SLB Muhammadiyah Purworejo. The development process was carried out using the ADDIE (Analyze, Design, Develop, Implement, Evaluate) model so that the resulting product is not only interesting and easy to understand, but also relevant, practical, and effective in supporting science learning.

### Analyze Stage

In the initial analysis stage, interviews with teachers and observations of the science learning conditions at Muhammadiyah Purworejo Special Needs School (SLB) revealed that teachers had used simple media such as pictures of human organs. However, these media

 

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were not able to help students fully understand the concept of the digestive system because the material was abstract and could not be observed directly. This condition is consistent with the findings (Zuhriyah et al., 2025) that science learning in SLB still faces challenges in mastering abstract concepts. Teachers stated that without interesting media, students tend to get bored quickly, have difficulty maintaining concentration, and have difficulty understanding the sequence of digestive organs, especially because they are not yet able to read. Therefore, students with intellectual disabilities need concrete and interesting media that can be touched directly to facilitate their understanding of the material. Teachers also considered the implementation of puzzles based on edutainment and local wisdom very appropriate, because it allows students to learn through games and makes it easier for teachers to explain the concept of digestion.

**Design Stage**

Based on initial analysis, science learning media at Muhammadiyah Purworejo Special Needs School is still limited, especially in helping students with intellectual disabilities understand the abstract concept of the digestive system. To address this, an edutainment puzzle-based learning media was developed that integrates local wisdom through bamboo weaving, which is environmentally friendly, easily accessible, and provides a contextual learning experience for students who are not yet able to read (Kristiamita et al., 2023). This media is designed to facilitate the understanding of abstract concepts concretely, increase (Mugi Rahayu, 2015) engagement, motivation, fine motor skills, and create an interactive and fun learning atmosphere. The puzzle is designed using a reassembly bamboo woven frame, with plywood pieces in the shape of digestive system organs such as the mouth, stomach, intestines, and liver, and is equipped with an interactive spinner made of local wood such as teak or sengon that displays the sequence of the digestive process in stages. In addition to local wisdom elements, this media is also designed using an edutainment approach chosen because it combines education with entertainment, making learning about the digestive system more interesting and effective for students with low motivation (Muri et al., 2023). The activity of assembling and manipulating puzzle components allows students to learn through physical experiences, supports multisensory learning, and can be adjusted to the level of difficulty according to student abilities (Mugi Rahayu, 2015).

**Development Stage**

During the development phase, the initial design for the puzzle learning media, based on edutainment and local bamboo wisdom, was developed into a finished product ready for testing. The main frame, plywood pieces shaped like digestive organs, and interactive spinners were manufactured according to design specifications. The prototype was validated by teachers and experts to assess curriculum suitability, safety, and effectiveness for students with intellectual disabilities (Ayu et al., 2024).

 

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**Figure 1. Human Digestion Demonstration Tool**

Next, a validation test was conducted by three experts: one media expert, one material expert, and one teacher. The media expert assessed the display, design, clarity of form, and ease of use, while the material expert assessed the content's suitability, accuracy, relevance to learning objectives, and suitability to the characteristics of students with special needs.

**Table 1. Puzzle Validation Assessment Results**

| Evaluation | Media Expert | Subject Matter Expert 1 | Subject Matter Expert 2 |
|---|---|---|---|
| Total Score | 84 | 94 | 101 |
| Maximum Score | 104 | 110 | 110 |
| Average percentage | 80% | 85% | 91.8% |
| Criteria | Valid | Very Valid | Very Valid |

Based on the assessment results conducted by media experts, material experts 1, and material experts 2, the human digestive system puzzle media based on local wisdom and edutainment showed a very high level of practicality. All validators gave a practicality percentage in the Very Practical category, according to Widoyoko's (2025) criteria with a range of 75%–100%. The display aspect received a very practical assessment from media experts because the puzzle visualization had fulfilled the principles of educational aesthetics through clear image composition, appropriate proportions, and puzzle pieces that were easy to hold by students with special needs. The material experts' assessment also showed that the content was accurate, coherent, and aligned with the applicable basic science competencies. Local wisdom was reflected through the use of bamboo as the main material of the media, in line with the findings (Dandy et al., 2025) that bamboo material has educational advantages because it is easily accessible, environmentally friendly, and can be produced independently by teachers in various regional contexts. Meanwhile, the edutainment aspect is evident through the interactive puzzle format that encourages motor activity and enjoyable learning engagement, as emphasized by Suirta et al. (2022) that activity-based interactive media can increase student attention and participation in science learning. Overall, the three validators stated that the media was in the valid to very valid category, indicating that this puzzle is suitable for use in science learning at special needs schools without requiring major revisions.

**Implementation Stage**

The implementation stage of the human digestive system puzzle media based on local wisdom and edutainment was carried out in a special needs class involving five students with intellectual disabilities. At the beginning of the lesson, the researcher began the activity with a simple lecture method adapted to the characteristics of the students. The lesson began with

 

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apperception and the screening of a short video about the digestive organs to help students understand the material through concrete visualization. This strategy is in accordance with the characteristics of children with intellectual disabilities who more easily understand information through visual assistance and direct demonstrations due to limitations in abstract thinking . This is consistent with findings (Hidayah et al., 2025) which state that multisensory media-based learning involving visual, kinesthetic, and manipulative activities can improve the focus and ability of students with intellectual disabilities to follow instructions and arrange objects according to examples. These findings indicate that children with intellectual disabilities more easily understand material when learning through concrete activities and involving direct interaction with objects, such as the use of digestive puzzles that require students to attach parts of organs in a structured manner.

After the video, the researcher introduced the digestive puzzle and explained how to use it slowly, clearly, and step by step. This explanation was conducted individually because students with intellectual disabilities require repetition of instructions and intensive support to follow each stage of the learning process. This is consistent with findings by Sauca Arsa Dewanta et al., 2024, which emphasize that, due to limited abstract thinking skills, children with mild intellectual disabilities benefit greatly from concrete and structured three-dimensional media. The use of puzzles in learning is also in line with other research which shows that the activity of matching and arranging visual pieces can increase students' focus, concentration, and engagement in understanding concepts in a gradual and structured manner (Dina Anggraini et al., 2025).

Next, each student was called forward in turn to practice using the media. Students spun the spinner first, then attached the puzzle pieces according to the organs indicated by the spinner. The activities were carried out one by one so that researchers could ensure that each student understood the stages of media use and maintained learning focus which is often easily distracted. This turn-based learning model is considered important because children with intellectual disabilities have limitations in abstract thinking and focusing attention, as explained by Dewanta & Murtadlo (2024) that concrete three-dimensional media is very helpful for children with mild intellectual disabilities to understand difficult concepts and strengthen their cognitive engagement.

The characteristics of the five students with intellectual disabilities involved also influenced the learning process. Student A was already able to read and write and therefore could use teaching aids more independently. Students B, C, and D were not yet able to read but were able to participate in activities with the researcher's guidance. They responded positively to the puzzle but required direct guidance, such as pointing out the position of the pieces and repeating simple instructions. Student E required more intensive guidance from parents and researchers because he was always accompanied in his daily learning activities. This condition aligns with the findings of (Rosyidah et al., 2023) in their study that children with intellectual disabilities experience cognitive barriers that make it difficult for them to understand abstract concepts, thus requiring concrete and interactive learning media and the support of others to carry out the learning process. Furthermore, according to (Endang &, 2024) , modeling techniques assist those with mild intellectual disabilities in vocational learning due to cognitive and coordination limitations. In this case, the use of wood and woven bamboo in teaching aids provides a more realistic tactile sensation than plastic, allowing students to directly experience the shape and structure of the digestive organs. This makes it easier for them to understand abstract concepts while encouraging active engagement during learning.

 

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Furthermore, the learning patterns of children with mild intellectual disabilities tend to be concrete, requiring repetition, and requiring manipulative media due to limited abstract thinking (Sauca Arsa Dewanta et al., 2024). Therefore, the learning strategies implemented, namely the use of digestive puzzles, repetition of instructions, and individual guidance, are very appropriate for their needs. Students can attach the organ pieces one by one in the order indicated by the spinner, thereby strengthening understanding through concrete experiences. This approach also allows teachers or researchers to provide direct guidance, ensure each student understands the steps of the activity, and maintain focus on learning that is easily distracted.

Based on observations and assessments, all students demonstrated high levels of enthusiasm, readily followed instructions, and were able to complete puzzles with appropriate guidance. Teachers also responded positively to the media, assessing that it facilitated teaching, increased student interaction, and supported concrete conceptual understanding. The results of the student and teacher responses are shown in the following table:

**Table 2. Results of Student Response Assessment and Teacher Response**

| Evaluation | Student Response (5 students) | Teacher Response (1 teacher) |
|---|---|---|
| Total Score | 220 | 80 |
| Maximum Score | 225 | 100 |
| Percentage | 97.7% | 80% |
| Criteria | Very Practical | Practical |

Based on Table 2, students' responses to the puzzle media were very positive (97.7%, very practical), while teachers' responses were in the very practical category (80%), which shows that the media helps students' understanding and involvement and makes it easier for teachers to deliver the material. This difference in assessment occurs because students assess the media from the aspects of interest and ease of use, while teachers assess more critically based on the effectiveness of learning and classroom management.

**Evaluation Stage**

In the evaluation stage, the assessment results showed that the human digestive system puzzle media was suitable for use without major revisions, although it still needed minor improvements in safety and comfort aspects, such as the addition of hanging ropes and board edge barriers. In addition, the strength of the puzzle grip needs to be increased for greater stability when used. Overall, the media was considered very practical, safe, interesting, and effective in supporting students with intellectual disabilities' understanding of the human digestive system, in line with findings from research in the Journal of Special Education, which stated that multisensory media or media that is contextually modified can improve the effectiveness of learning for students with special needs. (Hidayah et al., 2025).

## Conclusion

This research successfully developed a learning media in the form of a human digestive system puzzle based on local wisdom and edutainment, designed to help fifth-grade students of SD/SLB Muhammadiyah Purworejo in understanding abstract concepts in science materials, especially the human digestive system. The development process followed the ADDIE model, starting from needs analysis to final evaluation, and validation results by media experts, material experts, and teachers showed that this media was very valid and suitable for use in learning. Implementation in the classroom involved five students with intellectual disabilities who showed high enthusiasm, were able to follow instructions, and were able to assemble the puzzle with guidance according to their respective abilities. The

 

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practicality assessment obtained a very practical category from students (97.7%) and practical from teachers (80%), so the media was considered easy to use and effective in supporting learning activities. This puzzle media was proven to improve conceptual understanding, activate student engagement, and help teachers deliver material in a more concrete and interesting way. The integration of local wisdom through the use of bamboo and an edutainment approach also made the learning process more contextual, enjoyable, and suited to the needs of students with intellectual disabilities who require concrete visualization and manipulative experiences. Overall, this human digestive system puzzle media is declared suitable, safe, and interesting to use as an alternative science learning media in elementary schools/special needs schools, with several suggestions for minor improvements in the safety and comfort aspects of use, and has the potential to be applied more widely in helping students understand abstract science concepts.

**Recommendation**

Based on the findings of this study, it is recommended that educators utilize edutainment-based and local wisdom-based human digestive system puzzle media as an alternative teaching aid in science education, considering its capacity to facilitate students' understanding of the material in a concrete and interesting way. In addition, the development of similar media can include other Natural Science topics, such as the respiratory system or the circulatory system, so that the potential of this edutainment-based media can be implemented more widely according to the needs and characteristics of students in Special Schools. Future researchers are also encouraged to conduct trials with larger samples to obtain more comprehensive results.

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