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# Integrating Edutainment Media and “Nderek Langit” Local Wisdom to Improve Engagement and Motivation in Solar System Learning for Disabled Students

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## Abstract

The problem in Special Schools (SLB) is students' low understanding of Solar System concepts, resulting in low engagement and motivation. This study aims to develop and implement Solar System learning media based on edutainment and local wisdom for grade VI students with disabilities at Private SDLB Purworejo. A descriptive qualitative case study involved 11 students with mild disabilities. Data were collected through participatory observation, in-depth interviews, and learning documentation, and analyzed using thematic analysis to identify patterns in concept understanding, student involvement, and integration of “Nderek Langit” local wisdom. Findings indicate that edutainment-based media with colorful planet visuals and hands-on activities increased students' enthusiasm and active participation. Integrating “Nderek Langit” helped students relate abstract Solar System concepts to cultural experiences, such as using moon phases to determine planting times. Students who were usually passive became more responsive and could recognize planet names through visuals and games. Focus duration increased from 3–5 minutes to 15 minutes, accompanied by more positive social interaction. This media effectively enhances understanding of science concepts, engagement, and learning motivation for students with disabilities, and demonstrates potential as an interactive learning innovation rooted in local culture.

**Keywords:** Learning Media, Edutainment, Local Wisdom, Solar System, Science Learning

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## 1. Introduction

Natural Science (IPA) learning has an important role in developing scientific thinking skills and understanding concepts from the elementary school level. However, in the context of Special Schools (SLB), especially for students with disabilities, science learning, especially abstract materials such as the Solar System, still faces serious challenges. Many students with

intellectual disabilities have difficulty understanding scientific concepts because the learning process is still dominated by verbal explanations without adequate concrete visual media support (Collins, 2021). Learning conditions that tend to be monotonous and less interactive also make the level of student involvement very low, with the duration of attention usually lasting only a few minutes in a single session (Trela & Jimenez, 2018). In the Indonesian context, research shows that most of the visually impaired students in SLB Central Java still experience obstacles in understanding the material of the Solar System due to the limited media that suits their cognitive characteristics, thus having an impact on motivation and learning outcomes that are less than optimal (Maulidiyah, 2020).

Students with disabilities require hands-on approaches and multimodal stimulation through educational yet engaging media (Spooner et al., 2019). Universal Design for Learning (UDL) principles have proven effective in improving accessibility and engagement (Ok et al., 2017; Basham et al., 2016). The edutainment approach offers innovative solutions by integrating play, exploration, and visualization to stimulate cognitive, affective, and psychomotor development (Aksakal, 2015; Hung et al., 2015; Hakim et al., 2023), while hands-on media and mobile technology enhance motivation through adaptive activities (Hwang et al., 2015; Chen & Law, 2016).

In Purworejo, the local tradition of "Nderek Langit" observing the sky to determine planting time can be integrated with the study of the Solar System, for example the concept of earth rotation for day-night, earth revolution for the change of seasons, and the phases of the moon to determine planting time. This research aims to develop edutainment-based Solar System learning media that integrates local wisdom "Nderek Langit" for grade VI SDLB students, so that learning becomes interactive, easy to understand, improves scientific understanding, and fosters love for local culture.

## 2. Methods

This qualitative case study employs a modified ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to explore edutainment-based Solar System learning media integrated with local wisdom for grade VI students with disabilities at SDLB Purworejo. This approach combines qualitative inquiry depth with systematic instructional design (Creswell & Poth, 2018), providing a structured process for developing adaptive media aligned with special education principles (Ok et al., 2017; Risni et al., 2025).

Research conducted in even semester 2024/2025 involved 11 students with mild disabilities capable of verbal or nonverbal communication, following pilot testing with 5 students. Data collection employed participatory observation, semi-structured interviews, visual documentation, and field notes, analyzed using six-stage thematic analysis.

Credibility is maintained through triangulation of sources (students, teachers, and 8 parents providing home learning information via school interviews), methods (observation, interviews, documentation), and member checking. Observations were conducted by the lead researcher with two trained assistants, ensuring consistency through training, standardized protocols, and inter-rater reliability checks (Cohen's kappa > 0.80). Dependability is ensured through trail

audits, transferability through detailed context descriptions. Research instruments include observation guides for focus duration and interaction, teacher interview guides on local wisdom integration, student interview guides adapted to communication abilities, and visual documentation analyzing facial expressions and social interactions.

### 3. Results and Discussion

The products produced from this development research are in the form of Solar System learning media based on edutainment and local wisdom designed for grade VI students at Private SDLB Purworejo Regency. This media was developed as a visual and interactive tool to make it easier for students with disabilities to understand the concept of the Solar System through a fun learning approach. In this media, there are visual components of the planet that are attractively colored, educational game activities, and the integration of local cultural values "*Nderek Langit*" which teaches the connection between natural phenomena and the traditions of the surrounding community.

#### *Analysis*

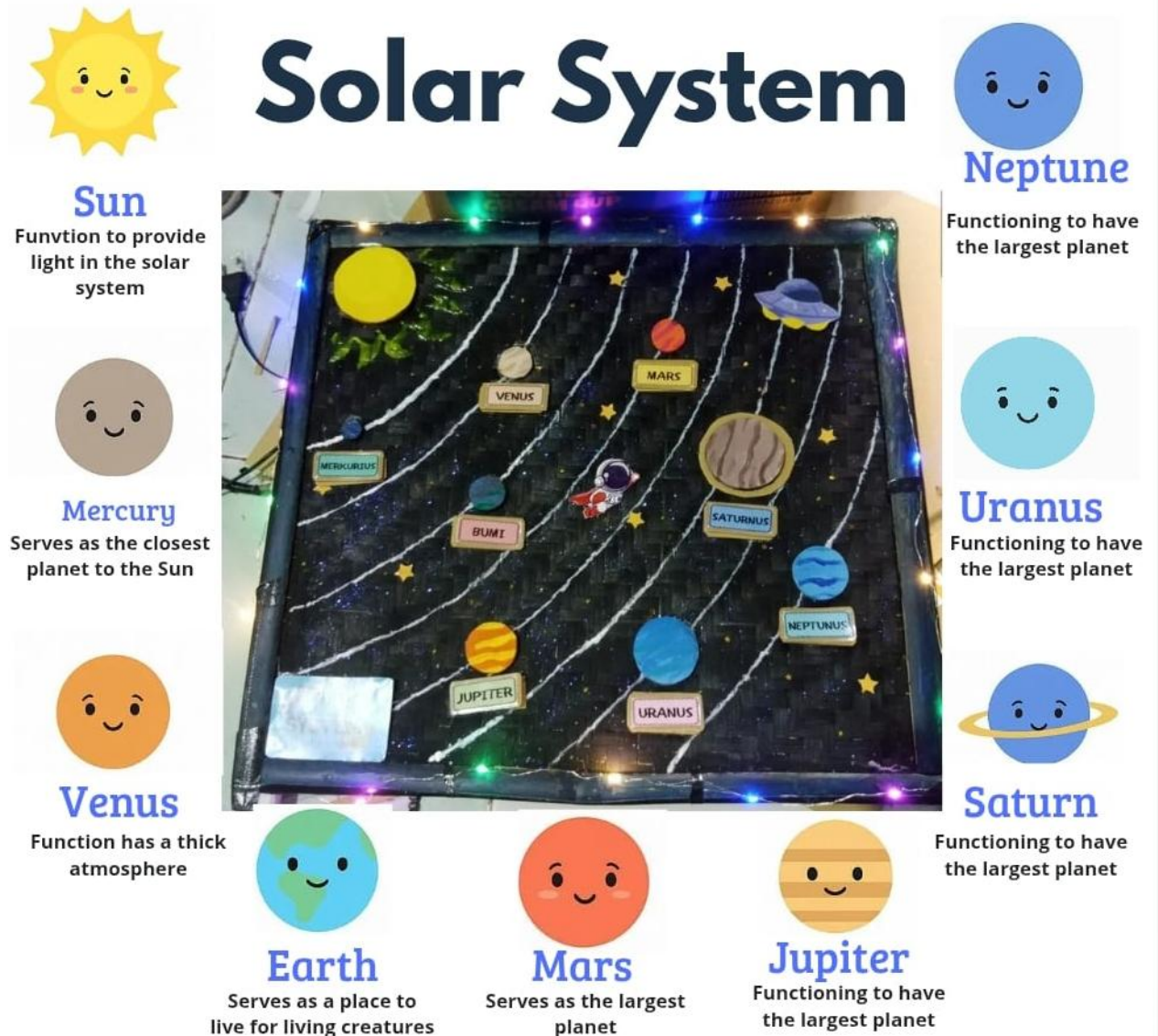
At this stage, an analysis was carried out to identify the needs and problems faced by students in understanding the concept of the Solar System at the Private SDLB of Purworejo Regency. The results of observations and interviews with three teachers (the homeroom teacher, science teacher, and special education coordinator) show that learning is still dominated by conventional one-way methods, so that students with disabilities are less actively involved in the learning process. The limitations of interesting learning media also cause students' interest and understanding of science materials to be low (Nurvitasari et al., 2025). The media used by teachers is mostly textual and does not integrate elements of entertainment and local cultural values, so learning feels monotonous and less meaningful.

#### *Design*

At the design stage, the initial design of Solar System learning media based on edutainment and local wisdom was carried out which was adjusted to the characteristics of class VI students with disabilities at the Private SDLB of Purworejo Regency. The media design was developed based on the results of the analysis of needs, curriculum, and basic competencies of science that discusses the Solar System. The product is designed in two main forms, namely interactive Solar System props and teacher manuals and student question sheets.

**Figure 1 .**

*The Solar System learning media is based on edutainment and local wisdom.*



Source: Researcher Documentation (2025)

The props in figure 1 are made using woven bamboo as a base, reflecting the value of local Javanese wisdom, the planet is made of plywood, with the addition of colorful LED lights to add visual appeal and create a fun learning atmosphere. The planetary layouts are made proportional and brightly colored so that students can easily recognize the differences between each planet. The edutainment element is realized through the display of the planets arranged in a circle, accompanied by planet name labels, pictures of miniature astronauts, and a game of "matching the order of planet names" to increase student participation in learning activities.

**Figure 2 and 3.**  
*Cover and Contents of the Teacher's Handbook*



Source: Researcher Documentation (2025)

Figure 2 and 3 of this media design adopts the principle of Universal Design for Learning (UDL) which emphasizes representation, expression, and dual engagement (Hall et al., 2015; Rappolt-Schlichtmann et al., 2018). The use of woven bamboo as a base reflects local wisdom while meeting the criteria of safe and familiar materials for students with disabilities (Spooner et al., 2019). The integration of LED lights is in line with the findings of Trela and Jimenez (2018) that high-contrast visual stimulation can increase the attention duration of students with intellectual disabilities, while Collins et al. (2021) affirm that hands-on media and manipulative objects effectively help with the understanding of abstract science concepts. This media is equipped with a teacher's manual and play materials containing basic concepts of the Solar System, planetary introductions, and exploratory activities supported by cartoon visuals such as astronauts and rockets to increase interest in learning. The value of local wisdom "Nderek Langit" is also integrated as a link between the concept of science and Javanese culture that respects the order of nature.

### *Development*

In the development stage, the product is tested for feasibility through validation by three experts, including media experts and two subject matter experts, to ensure the suitability of content, design, and material safety for students with disabilities. The assembly is tailored to the characteristics of SLB students using simple designs, contrasting colors, and lightweight materials. The validation results showed that the media met the aspects of content, appearance, and ease of use, although adjustments were needed such as adhesive reinforcement and color affirmation, which were carried out according to the validator's suggestions so that the media became stronger, visuals clearer, and suitable for repeated use. This process is in line with the ADDIE model modified for special education (Branch, 2009), the principle of iterative design (Dewi et al., 2017), as well as the recommendations of Root et al. (2017) and the meta-analysis of Capp (2017) regarding multi-expert validation to guarantee instructional standards and

accessibility for students with intellectual disabilities. The final product in the form of an interactive Solar System board based on edutainment and local wisdom was refined through a series of revisions and was ready for the implementation stage.

### *Implementation*

The implementation stage in class VI for mild disabilities includes learning preparation, limited trials, and extensive trials, with data collected through observation, interviews, questionnaires, and tests. Living class atmosphere; Some students are actively answering questions, while others take longer, so teachers and researchers apply a personalized approach. A simple ice breaking directs attention, followed by a slow and repetitive explanation of the Solar System's material, while the interactive media of brightly colored planets increases the enthusiasm. Variation in focus and repetitive instruction needs are addressed through differentiation and individual scaffolding (Knight et al., 2015; Carter et al., 2016). The increase in involvement from passive to enthusiastic shows the effectiveness of the edutainment approach and hands-on media in increasing motivation and initial understanding of the concept of the Solar System, providing meaningful learning experiences for students with mild disabilities (Aksakal, 2015; Hwang et al., 2015).

### *Evaluation*

The evaluation stage was carried out to assess the validity, practicality, and effectiveness of the Solar System learning media based on edutainment and local wisdom after being implemented in grade VI SDLB students. The evaluation included observation, analysis of teacher and student responses, engagement levels, and learning outcomes after media use. This process aims to ensure that the media is able to improve understanding of science concepts while creating an interactive and enjoyable learning experience. The evaluation stage is an important part of development research to ensure that the media is truly suitable for learning needs and effectively applied in the field (Risni et al., 2025).

The response of students and teachers to learning media was explored through interviews and observations. Mr. Arief (29 years old, G1) reported an increase in student involvement; Previously, static verbal and visual methods made focus disappear in 3–5 minutes, but manipulative media with brightly colored planetary visuals sparked enthusiasm, making passive students become active and those who often drop out of class stay until the end of the lesson (G1, interview, May 14, 2025). The integration of local wisdom "Nderek Langit", which associates the phases of the moon with family farming traditions, helps students understand the relevance of the Solar System to daily life, improving concept understanding and emotional engagement. These findings are consistent with the principles of multisensory and UDL, where hands-on media with visual, tactile, and kinesthetic stimulation increase the duration of attention compared to purely verbal methods (Spooner et al., 2019; Root et al., 2017; Ok et al., 2017).

From the student's perspective, the interview with Rizky (11 years old, mildly disabled, S1) showed his ability to name several planets based on color and shape, for example "That Earth,

Mars is red, Jupiter is large" while pointing to planets, reflecting basic concept memory and intrinsic motivation for learning (Carter et al., 2016). The ease and effectiveness of media use is explained through the principles of Universal Design for Learning (UDL) which includes dual representation (brightly colored visuals, tactile textures, verbal narrative), dual action and expression (detaching, arranging, matching planets), as well as dual engagement through edutainment design, allowing students to learn while "playing" (Hall et al., 2015). This design aligns with the findings that concrete visualization, contrasting colors, manipulative objects, repetitive instruction, and hands-on activities improve students' conceptual understanding of intellectual disabilities (Collins et al., 2021). In addition, the media supports intrinsic motivation through competency needs (tasks according to ability), autonomy (choosing planets), and linkages with the local culture of "Nderek Langit" (Carter et al., 2016).

To understand the impact of media on the understanding of the concept of the Solar System, researchers conducted pre- and post-learning assessments through individual interviews and participatory observations. Assessments do not use formal written tests, but rather casual conversations and hands-on activities tailored to each student's communication skills. Before learning with the media, most students showed a very limited understanding of the Solar System. When asked "Do you know what the Sun is?", S1 replied "the above... in the sky". When asked "How many planets?", he just shook his head. Other students (S2, 12 years old) can say "Earth" and "Moon" but can't explain the relationship.

After two learning sessions, the conceptual understanding of students with mild disabilities improved, although it varied between individuals. S1 was able to name five planets with visual aid: "Mercury, Venus, Earth, Mars, Jupiter are in this order from the Sun. The red one is Mars, the big one is Jupiter" (S1, interview), while S2 begins to associate the phases of the moon with family farming traditions: "Grandpa looked at the moon to grow rice... When the crescent moon is over, grandfather starts planting" (S2, interview), showing the integration of science with the local culture of "Nderek Langit". Assessments are tailored to individual characteristics; Some students give nonverbal responses or take longer. G1 explained: "I asked one question one by one while playing with the media. If he can answer, great. Otherwise, I asked him to point out the planet I mentioned. Every child has a different way" (G1, interview).

Changes in student understanding show that edutainment-based learning media and local wisdom are effective in facilitating the learning of abstract concepts for students with mild disabilities. Visual-concrete media helps build a mental representation of the Solar System for students with verbal processing limitations, in line with the findings that hands-on media with concrete visualization improves conceptual understanding compared to purely verbal methods (Collins et al., 2021). The integration of local wisdom "Nderek Langit" provides a familiar and meaningful context, so that students understand the relevance of the planet to daily life, consistent with ethnoscience research that shows that learning based on local culture increases concept retention (Aikenhead, 2017; Sudarmin et al., 2019; Ngazizah et al., 2020; Rahmawati et al., 2016). The engagement analysis showed a positive emotional response: all students were enthusiastic, happy, and expressive when interacting with the media, including applause when successfully arranging a planet (Mr. Arief's interview). Overall, these media create meaningful

learning experiences, enhancing concept understanding, intrinsic motivation, and social interaction, which are often overlooked in conventional science learning at SLB.

The success of the integration of local wisdom "Nderek Langit" emphasizes the importance of learning rooted in the cultural context of students. The science approach based on local wisdom in Indonesia has been proven to improve science literacy, concept retention, and understanding through the link of the material to students' cultural experiences (Sudarmin et al., 2019; Parmin et al., 2016; Damayanti et al., 2017), as well as fostering an attitude of respect for local wisdom and cultural identity (Rahayu & Sudarmin, 2015; Arfianawati et al., 2016; Rochman & Hartoyo, 2018). Ethnoscience integration also supports science process skills through contextual exploratory activities (Wiyanto et al., 2017). From a specific pedagogical perspective, the developed media fulfills the principles of effective learning for students with intellectual disabilities, such as concrete representations for abstract concepts (Spooner et al., 2019), repetitive instruction with contextual variations (Trela & Jimenez, 2018), hands-on experience (Root et al., 2017), connections with everyday life (Sudarmin et al., 2019), and differentiation of individual abilities (Knight et al., 2015). Thus, this media is worthy of being an alternative to science learning in SDLB, especially for abstract materials, and the edutainment approach and the integration of local wisdom can be adapted to other subjects, opening up opportunities for learning innovation in Indonesian special education.

#### 4. Conclusion

The development of edutainment-based Solar System learning media integrated with local wisdom for grade VI SDLB students produces valid, practical, and effective products. Validity is evident from expert assessments confirming media alignment with student characteristics in material, visual design, and "Nderek Langit" integration. Practicality is demonstrated through positive teacher and student responses regarding usability and engagement. Effectiveness is shown in students' ability to recognize 3–5 planets, associate them with local wisdom, and increase focus duration from 3–5 minutes to 15 minutes with enhanced social interaction.

This study has several limitations. First, the small sample size (11 students) limits generalizability. Second, focusing exclusively on mild intellectual disabilities may not represent diverse special needs. Third, the absence of a comparison group prevents definitive causal claims. Fourth, short implementation duration may not capture long-term sustainability. Despite these limitations, findings provide valuable insights into edutainment-based media integrated with local wisdom for science learning in special education, laying groundwork for future research with larger, diverse samples and longitudinal designs.

Based on these findings, several actionable recommendations are proposed for effective implementation. For educators, adopt a gradual approach by introducing media in short 10–15 minute sessions, progressively extending as engagement increases. Document student responses through observation journals to track progress and adjust strategies. Establish collaborative learning groups pairing students with varying abilities to enhance peer interaction. Participate in professional development focused on Universal Design for Learning (UDL) and culturally responsive pedagogy. For media developers, prioritize multi-sensory design combining visual, tactile, and auditory elements. Create modular, scalable architectures

allowing customization of difficulty and pacing. Integrate gamification elements and conduct iterative user testing with diverse populations. Provide comprehensive teacher guides with lesson plans and differentiation strategies. For policymakers, allocate dedicated funding for adaptive learning technologies. Establish resource centers providing validated materials. Mandate inclusive curriculum standards integrating local wisdom as core content. Invest in comprehensive teacher training programs with hands-on workshops and ongoing support. Incentivize collaborative research partnerships and create ethical guidelines for special education research.

Future research should test media effectiveness across diverse disability populations. Longitudinal studies (6–12 months) tracking engagement and retention are needed. Comparative designs with control groups would strengthen causal inferences. Research integrating emerging technologies (AR, VR, AI) with cultural content could advance personalized learning. Cross-cultural studies examining indigenous knowledge integration would contribute to culturally sustaining pedagogy. Cost-effectiveness analyses would guide scaling interventions, advancing equity in special education.

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