Indonesian Journal of Early Childhood Educational Research, 4(1) - June 2025, 269-283

Indonesian Journal of Early Childhood Educational Research

ISSN : 2963-6760 (Online)
ISSN : 2962-1364 (Print)

Development of "SITAYA" Interactive Multimedia (Solar System) to Stimulate Science Ability in Children Aged 5–6 Years

Hanisa Buabara[1*], Syamsuardi [2], Rika Kurnia R[3], Herlina[4], Muhammad Akil Musi[5]
[1]*Universitas Negeri Makassar, Indonesia*

***Corresponding Author**: Hanisa Buabara, **E-mail**: hanisabuabara@gmail.com

Received: March 19, 2025	Revised: April 22, 2025	Accepted: May 25, 2025	Online: June 30, 2025

ABSTRACT
Early childhood science learning requires engaging and interactive media to support children's curiosity and conceptual understanding, particularly for abstract topics such as the solar system. Interactive multimedia is considered an effective alternative to overcome limitations in conventional teaching methods for children aged 5–6 years. This study aimed to (1) describe the actual need for SITAYA (Solar System) interactive multimedia in stimulating science abilities in children aged 5–6 years, (2) determine the validity and practicality of the developed multimedia, and (3) examine its effectiveness in improving children's science skills. This research employed a Research and Development (R&D) approach using the ADDIE model, which consists of the analysis, design, development, implementation, and evaluation stages. Data were collected through observations and questionnaires. The research subjects involved four teachers and thirty children aged 5–6 years. Data analysis was conducted to assess validity, practicality, and effectiveness, as well as to test the research hypotheses. The results showed that SITAYA interactive multimedia was highly needed by teachers, as it was perceived as practical, attractive, and effective in stimulating children's science abilities. Expert validation indicated that the multimedia met the valid criteria, while practicality assessment showed a very practical category. Effectiveness testing demonstrated that the multimedia was categorized as very effective. The findings revealed that the alternative hypothesis (H_1) was accepted and the null hypothesis (H_0) was rejected, indicating a significant effect of SITAYA interactive multimedia on the science abilities of children aged 5–6 years. Therefore, it is suggested that SITAYA interactive multimedia be integrated into early childhood science learning to enhance children's understanding and engagement with scientific concepts.

Keywords: *Interactive Multimedia, SITAYA (Solar System), Science Abilities, Early Childhood Education*

Journal Homepage https://ejournaluinmybsk.ecampus.id/index.php/ijecer/index

How to cite: Buabara, H., Syamsuardi, S., Kurnia R., R., Herlina, H., & Musi, M. A.. (2025). Development of "SITAYA" Interactive Multimedia (Solar System) to Stimulate Science Ability in Children Aged 5–6 Years. *Indonesian Journal of Early Childhood Educational Research (IJECER), 4(1),* 269-283. https://doi.org/10.31958/ijecer.v4i1.16119
Published by: Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia

INTRODUCTION

Education serves as a fundamental foundation for shaping future generations and must be continuously nurtured and strengthened to enable individuals to compete at both national and international levels. Well-planned education beginning in early childhood plays a critical role in optimizing children's cognitive development, particularly brain growth, which significantly influences later learning outcomes. Early childhood education (ECE) has therefore become an essential component of the educational system, as the most delicate and dynamic stages of growth and development occur during early childhood (Lestari & Fathiyah, 2023). Consequently, learning activities for young children must be interactive and developmentally appropriate to support optimal growth.

In contemporary early childhood education, teacher quality is a key determinant of learning effectiveness. Educators are required to possess a deep understanding of child development, apply creative teaching strategies, and create engaging and enjoyable learning environments (Hasmawaty et al., 2024). Early childhood education should be grounded in children's developmental needs, adopting a developmental learning approach that emphasizes stimulation rather than academic pressure. As defined by Santika and Muthohar (2024), early childhood education is a systematic effort to provide educational stimulation for children from birth to six years of age to support their physical and psychological development and prepare them for further education. Each child develops uniquely, displaying distinctive characteristics aligned with their developmental stage (Akollo et al., 2023).

The importance of introducing natural sciences, including astronomy, from an early age is increasingly emphasized in early childhood curricula. Indonesia's Regulation of the Minister of Education and Culture No. 137 of 2014 explicitly states that early childhood curricula must facilitate high-quality learning experiences that develop children's skills, knowledge, and positive attitudes toward science. This orientation aligns with the Merdeka Curriculum policy (Decree No. 262/M/2022), which emphasizes joyful, meaningful, and student-centered learning. Within this framework, learning should encourage curiosity, exploration, and active participation. As a result, innovative educational technologies—particularly interactive multimedia—have become highly relevant tools for delivering scientific concepts in early childhood education.

Educators, as facilitators of learning success, are expected to design innovative, engaging, and enjoyable learning environments. One effective strategy is the use of learning media that support the communication of abstract concepts in concrete and child-friendly ways (Lismayani et al., 2024). Learning media function as instructional aids that enhance clarity, engagement, and comprehension. Well-designed media occupy a strategic position in learning processes and assist teachers in achieving instructional objectives more effectively (Herman et al., 2020). In the digital era, education must adapt to technological advancements to maintain children's motivation and engagement in learning activities (Darojat et al., 2022).

Astronomy, as a branch of science, plays a significant role in helping children understand natural phenomena and the universe. The concept of the solar system has historically undergone paradigm shifts, beginning with Aristarchus' heliocentric ideas and later refined by Copernicus and Galileo, who established the sun as the center of the solar system (Firdaus & Sinensis, 2019). Introducing such concepts at an early age encourages children to explore scientific reasoning, causality, and observation. Science learning trains children to use their senses, recognize cause-and-effect relationships, employ simple measurement tools, and understand natural phenomena through direct experience (Husin, 2021).

Science education in early childhood supports the development of critical and logical thinking. Through exploration and experimentation, children become accustomed to scientific inquiry, problem-solving, and analytical thinking. Carson emphasized that science for children involves curiosity and fascination with phenomena that stimulate investigation and discovery (Wahid & Suyanto, 2015). Accordingly, science abilities in early childhood encompass understanding basic natural concepts, developing observational skills, and engaging in logical reasoning (Wahyuni & Suryana, 2023).

One science topic that strongly attracts children's interest is the solar system. The solar system consists of the sun, eight planets, dwarf planets, asteroids, comets, and other celestial bodies, all orbiting the sun as the central body (Maulana, n.d.). Despite its relevance, teaching this topic often encounters challenges, including limited instructional media, reliance on conventional teaching methods, and insufficient visual aids that match children's developmental characteristics. Traditional lecture-based approaches are generally ineffective in stimulating young children's curiosity and scientific skills.

Advances in educational technology have opened new opportunities to address these challenges. Interactive multimedia, which integrates visual, audio, animation, and user interaction, offers a promising solution for creating engaging and meaningful learning experiences (Firdausy, 2019). Research has demonstrated that interactive multimedia increases motivation, engagement, and conceptual understanding, particularly for young children who are highly responsive to visual and auditory stimuli (Firdaus & Prasetyo, 2025). Multimedia-based learning also aligns with multisensory learning principles, which are essential in early childhood education.

Several previous studies have confirmed the effectiveness of interactive multimedia in science learning. Najib et al. (2023) developed solar system multimedia based on scientific literacy for elementary students and reported high effectiveness and feasibility. Ningtiyas et al. (2024) found that SITAYA interactive multimedia was valid, practical, and effective for teaching science at the elementary level. Similarly, Agustina and Aziz (2024) demonstrated that interactive solar system media developed using the ADDIE model significantly enhanced student engagement and understanding. Although these studies highlight the benefits of interactive multimedia, most focus on elementary-level learners rather than early childhood contexts, where cognitive and perceptual needs differ substantially.

Existing studies consistently demonstrate the effectiveness of interactive multimedia for science learning; however, limited research specifically addresses the development of astronomy-based interactive multimedia tailored to the cognitive characteristics of children aged 5–6 years. Moreover, previous studies largely emphasize learning outcomes without explicitly integrating developmental science indicators such as observation, exploration, and early scientific reasoning. This study addresses this gap by developing SITAYA interactive multimedia specifically designed for early childhood learners, integrating age-appropriate visualizations, interactivity, and science process skills to stimulate children's scientific abilities.

Preliminary observations at Group B at Aisyiyah Tuppu Kindergarten revealed that many children experience difficulties in understanding abstract scientific concepts, particularly distinguishing celestial objects. Learning activities were predominantly teacher-centered and lacked interactive media, resulting in reduced motivation and limited conceptual understanding. These findings underscore the urgent need for developmentally appropriate multimedia learning tools that can transform abstract scientific concepts into concrete and engaging experiences for young learners.

Therefore, this study aims to develop an alternative interactive multimedia learning tool, SITAYA (Solar System Interactive Multimedia), to stimulate science abilities in children aged 5–6 years. The study is important because it offers a pedagogically grounded solution to

early childhood science learning challenges, supports curriculum goals, and contributes to the advancement of educational technology research in early childhood education.

RESEARCH METHODOLOGY

Research Design

This study employed a Research and Development (R&D) approach aimed at developing and testing the effectiveness of an interactive multimedia product named SITAYA (Solar System Interactive Multimedia) to stimulate science abilities in children aged 5–6 years. R&D was selected because it enables systematic product development through needs analysis, expert validation, limited trials, and effectiveness testing. The development procedure followed the ADDIE instructional design model, consisting of Analysis, Design, Development, Implementation, and Evaluation, which is widely used in educational product development due to its structured and iterative nature.

Research Setting and Participants

The study was conducted at Aisyiyah Tuppu Kindergarten during the 2024/2025 academic year. Participants were selected using purposive sampling, considering their relevance to the research objectives. The research subjects consisted of 30 children aged 5–6 years, divided into an experimental group and a control group, as well as three classroom teachers and one school principal who served as informants and evaluators during the development and implementation stages.

Development Procedure

At the analysis stage, a needs assessment was conducted through teacher interviews and classroom observations to identify existing learning conditions, media limitations, and children's initial science abilities. Curriculum analysis was also carried out to ensure alignment with the Merdeka Curriculum (Foundation Phase). During the design stage, learning objectives, indicators, and content structure were formulated. The SITAYA multimedia was designed to integrate animations, audio narration, and interactive games focusing on solar system concepts, aiming to support observation, questioning, reasoning, and communication skills.

The development stage involved producing the multimedia prototype and its supporting teacher guidebook. The product was validated by media experts and content experts using structured validation instruments. Revisions were made based on expert feedback to ensure content accuracy, visual clarity, usability, and pedagogical suitability. At the implementation stage, the revised product was tested in a limited classroom setting. Teachers received brief guidance on using the multimedia, and learning activities were conducted according to the designed procedures. Finally, the evaluation stage included formative evaluation during implementation and summative evaluation at the end of the learning process to assess validity, practicality, and effectiveness.

Figure 1. ADDIE-Based Development Flow of SITAYA Interactive Multimedia

Data Collection Techniques

Data were collected using observations, questionnaires, and learning outcome assessments. Observations were conducted to examine children's engagement and science-related behaviors during learning activities. Teacher questionnaires were used to measure practicality, usability, and satisfaction with the multimedia and guidebook. Learning outcome data were obtained through pre-test and post-test assessments focusing on children's science abilities.

Research Instruments

The instruments used in this study included expert validation sheets, teacher response questionnaires, and science ability observation sheets. Validation instruments employed a Likert scale (1–4) ranging from "Not Valid" to "Very Valid." Teacher response questionnaires assessed media practicality and perceived benefits, while observation sheets measured children's science abilities across indicators of observation, questioning, reasoning, and communication.

Data Analysis

Data analysis was conducted using both descriptive qualitative and quantitative techniques. Product validity and practicality were analyzed using percentage scores derived from Likert-scale responses. The criteria for validity and practicality followed established percentage-based classifications.

To evaluate effectiveness, children's science ability scores before and after the intervention were compared. Because the sample size was limited and the data were not normally distributed, a non-parametric Wilcoxon Signed-Rank Test was applied using SPSS. This test was used to determine whether there was a statistically significant difference between pre-test and post-test scores within the experimental and control groups.

RESULTS AND DISCUSSION

Results

This section presents the results of the development of SITAYA Interactive Multimedia (Solar System) designed to stimulate science abilities in children aged 5–6 years. The results are described narratively and systematically according to the stages of the ADDIE development model, namely Analysis, Design, Development, and Implementation. In this study, the research process was conducted up to the implementation stage through a limited trial of the developed product. The research subjects consisted of 30 children aged 5–6 years (Group B), three classroom teachers, and one school principal at Aisyiyah Tuppu Kindergarten, selected using purposive sampling to ensure alignment with the research objectives.

Analysis Stage

Based on the needs analysis conducted with Group B teachers, it was found that science learning activities had been supported by printed materials and digital resources obtained from online platforms. However, there was no interactive multimedia specifically designed according to the solar system theme and tailored to stimulate science abilities in early childhood. Teachers reported that the existing media were less interactive and insufficiently engaging, resulting in suboptimal motivation and limited exploration of science concepts among children. Therefore, teachers expressed a strong need for innovative, interactive multimedia that aligns with learning objectives and supports children's scientific exploration.

Table 1. Summary of Teachers' Needs Analysis Related to Science Learning

Indicator	Yes (%)	No (%)
Children show interest in science learning	100	0
Teachers prepare science-oriented learning objectives	100	0
Teachers prepare learning media aligned with objectives	100	0

Based on the data presented in Table 1, all teachers reported positive responses across all indicators, indicating that children's interest in science learning, teachers' preparation of learning objectives, and media readiness were already well established. Therefore, the main issue identified was not the absence of science learning activities but the lack of interactive and theme-specific multimedia capable of optimally stimulating children's science abilities.

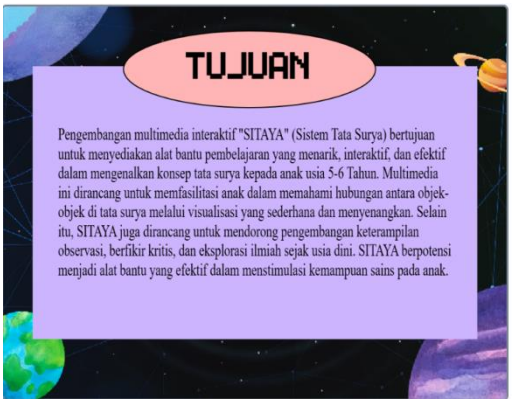
Further analysis revealed that although teachers were familiar with and actively used digital media, none had independently developed interactive multimedia. This condition indicates a clear gap between teachers' pedagogical readiness and their technical capacity to design interactive learning media. Consequently, the development of SITAYA Interactive Multimedia was considered necessary to address this gap.

Design Stage

Based on the results of the analysis stage, SITAYA Interactive Multimedia was designed focusing on the solar system subtheme, aligned with the Foundation Phase Learning Outcomes of the Merdeka Curriculum (2020). The design emphasized children's abilities to

observe, ask questions, reason, and communicate ideas through engaging visual and auditory experiences.

SITAYA was designed as an interactive learning application integrating animated visuals, narration, and simple educational games. Children can explore planets orbiting the sun, recognize celestial objects, and reinforce their understanding through interactive quizzes. The application interface was intentionally designed to be visually attractive, simple to navigate, and suitable for early childhood cognitive and motor development.



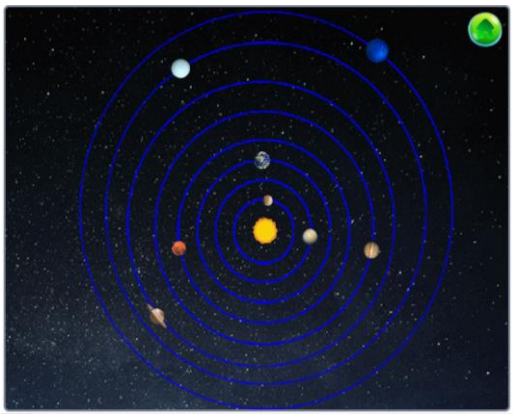


Figure 1. Design of SITAYA Interactive Multimedia Interface

Based on the visual design shown in Figure 1, the application presents clear navigation, child-friendly icons, and colorful illustrations. Therefore, the design supports independent exploration while maintaining teacher guidance, making it appropriate for classroom implementation. In addition to the multimedia product, a teacher guidebook was designed to assist educators in using SITAYA effectively. The guidebook contains learning objectives, step-by-step usage instructions, and pedagogical suggestions to maximize science skill stimulation.

Development Stage

At the development stage, the SITAYA Interactive Multimedia and its supporting instruments were validated by media experts and content experts.

Table 2. Media Expert Validation Results

Aspect	Mean Score	Percentage	Category
Design	4.00	93%	Very Valid
Visual Appearance	4.00	93%	Very Valid
Usability	4.00	93%	Very Valid

Based on Table 2, all assessed aspects achieved a mean score of 4.00 with a validity percentage of 93%, categorized as very valid. Therefore, the multimedia product was considered highly feasible in terms of visual design, layout consistency, and ease of use for early childhood learners.

Table 3. Content Expert Validation Results

Aspect	Mean Score	Percentage	Category
Content Accuracy	3.00	75%	Valid
Science Skill Stimulation	3.00	75%	Valid
Instructional Guidance	3.00	75%	Valid

Based on the data in Table 3, the content validity results indicate that the material presented in SITAYA aligns with learning objectives and adequately supports science skill stimulation. Therefore, although minor improvements were recommended, the content was deemed valid and appropriate for implementation.

Implementation Stage

After validation, the product was tested through a limited implementation to evaluate its practicality and effectiveness. Teacher responses indicated a very high level of agreement regarding visual clarity, color harmony, font size, navigation ease, and overall attractiveness of the multimedia. These findings demonstrate that SITAYA is practical and user-friendly in real classroom settings. To examine effectiveness, children's science abilities were measured using pre-test and post-test assessments in experimental and control groups.

Table 4. Pre-test and Post-test Results of the Experimental Group

Category	Pre-test (%)	Post-test (%)
Beginning (MB)	73.3	20.0
Expected (BSH)	26.7	53.3
Very Good (BSB)	0.0	26.7

Based on Table 4, the post-test results show a substantial improvement in children's science abilities after using SITAYA Interactive Multimedia. Therefore, the proportion of children in the "Beginning" category decreased significantly, while those achieving "Expected" and "Very Good" development increased markedly.

Statistical analysis using the Wilcoxon Signed-Rank Test revealed no significant difference in the control group, while the experimental group showed a significant improvement (Sig. = 0.001 < 0.05). Therefore, the findings confirm that SITAYA Interactive Multimedia had a statistically significant positive effect on stimulating children's science abilities.

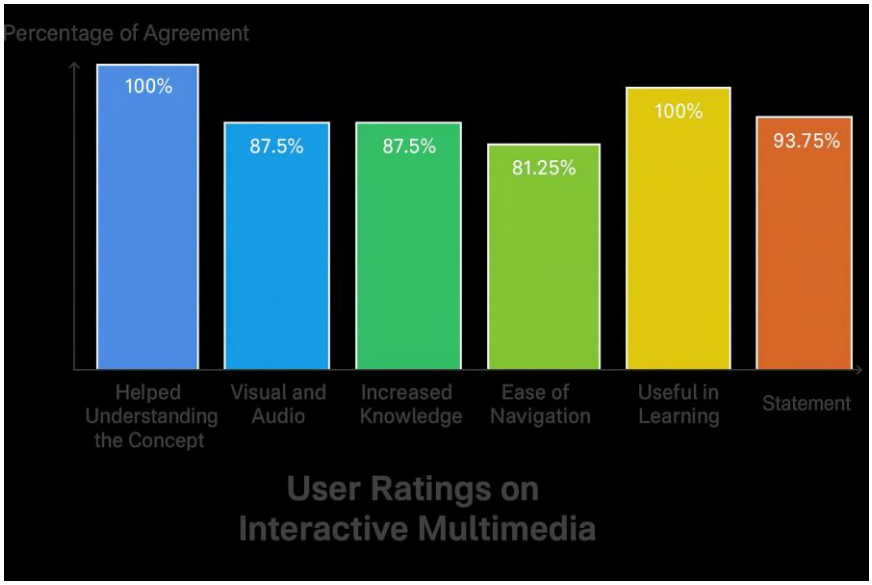


Figure 2. Comparison of Pre-test and Post-test Results in the Experimental Group

Based on Figure 2, a clear upward trend in science ability achievement can be observed following the implementation of SITAYA. Therefore, the multimedia product effectively supports children's engagement, understanding, and scientific reasoning. Furthermore, teacher evaluations of the guidebook and multimedia showed very high satisfaction levels, indicating that both components effectively supported learning objectives and classroom implementation.

Discussion

Based on the results of the data analysis, this section discusses the research findings by referring to several key aspects addressed in this study, namely the analysis of the need for developing the Sitaya interactive multimedia (Solar System) to stimulate science abilities in children aged 5–6 years, the design and development of the Sitaya interactive multimedia, as well as its validity, practicality, and effectiveness. This discussion aims to interpret the results of the development process and to answer the research questions formulated earlier.

This discussion is organized into three main parts: the development needs of the Sitaya interactive multimedia, the feasibility and validity of the multimedia, and its effectiveness in stimulating science abilities among children aged 5–6 years. The research employed a Research and Development (R&D) approach, which resulted in an educational product accompanied by effectiveness testing. The initial stage focused on evaluating media feasibility and instrument appropriateness through expert judgment. Qualitative descriptive data were obtained in the form of comments, critiques, suggestions, corrections, and assessments provided by practitioners and experts, while quantitative data consisted of scores derived from validation and feasibility testing. Data collection techniques included observation, interviews, and documentation.

Development Needs of the Sitaya Interactive Multimedia

The analysis of development needs for the Sitaya interactive multimedia was conducted through classroom observations and the distribution of needs analysis instruments.

Field observations revealed that the limited variation of learning media used in science instruction affected children's developmental outcomes, resulting in suboptimal stimulation of science abilities. The results of the needs analysis instrument further indicated that teachers required learning media that were creatively and innovatively developed and integrated with technology to better support science learning for children aged 5–6 years.

These findings align with the perspective of Hijriati et al. (2024), who argue that rapid technological advancement has significantly influenced various aspects of daily life, including education. Interactive multimedia, as a computer-based system integrating text, sound, and images, provides an interactive learning experience that supports children's engagement and understanding. Learning media thus play a crucial role in optimizing instructional outcomes and achieving learning objectives.

The high level of need for such media led to the development of the Sitaya interactive multimedia along with a user guidebook to support teachers in implementing the media effectively during classroom instruction. This guidebook functions as a practical reference for teachers to facilitate science learning activities that stimulate children's scientific abilities. The overall needs analysis results indicate that teachers require innovative, technology-based learning media that are appropriate for early childhood characteristics and capable of stimulating science abilities effectively.

However, the use of information technology–based learning media for early childhood learners requires careful consideration. Bachtiar emphasizes that content selection and appropriate supervision are essential to ensure that technology is used effectively and safely for young children. This view is consistent with Munawaroh et al. (2021), who highlight that children have diverse learning preferences, including visual, auditory, print-based, and audiovisual modalities. The integration of multimedia in learning accommodates these differences by enabling children to interact directly with learning content through images, sounds, and narratives. Therefore, the development of Sitaya interactive multimedia is considered necessary to support early childhood science learning, particularly within the theme of the universe and the solar system.

Validity and Practicality of the Sitaya Interactive Multimedia

The Sitaya interactive multimedia was developed and evaluated across several aspects validated by two expert validators. The results of the validity test indicated that the multimedia achieved a "valid" category, confirming that the content, design, and instructional components met the required standards. Following the validation stage, a practicality test was conducted to assess the ease of use and applicability of the multimedia in daily teaching practices.

The practicality analysis employed a Teacher Response Questionnaire, which revealed that all participating teachers rated the multimedia in the "strongly agree" category. This finding indicates that the Sitaya interactive multimedia is highly practical and user-friendly for classroom implementation. These results are supported by Firdaus and Prasetyo (2025), who assert that interactive multimedia is an appropriate learning medium for early childhood education and aligns with technological developments in the digital era.

Similarly, Rahmawati and Hendri (2024) emphasize that interactive digital multimedia facilitates the development of scientific skills in early childhood and represents a novel approach to creating engaging and enjoyable learning environments. Wati et al. (2022) further support this finding by stating that simple learning activities using concrete and age-appropriate media can effectively stimulate children's development and foster a positive learning atmosphere. Overall, the results of the validity and practicality tests demonstrate that the Sitaya interactive multimedia is feasible and suitable for stimulating science abilities in children aged 5–6 years.

Effectiveness of the Sitaya Interactive Multimedia

The effectiveness analysis was conducted by examining children's science ability development following the implementation of the Sitaya interactive multimedia. The results showed a noticeable improvement in children's science abilities, with most children reaching the "developing as expected" category and no children remaining in the "not yet developed" category. These findings indicate that the multimedia effectively stimulated science abilities among children aged 5–6 years at Group B at Aisyiyah Tuppu Kindergarten.

In addition to child performance data, effectiveness was also assessed using the Teacher Response Questionnaire, which yielded results in the "strongly agree" category, further confirming the effectiveness of the multimedia. These findings are consistent with Rahayu et al. (2022), who argue that multimedia-based learning creates enjoyable learning environments that increase children's motivation and engagement, ultimately supporting the achievement of learning objectives.

Rahmawati et al. (2024) also emphasize that effective science learning for early childhood requires supporting media that match children's developmental levels. Interactive learning media provide substantial benefits by actively involving children in the learning process and offering enjoyable and meaningful learning experiences. Karimah et al. (2022) further note that the widespread use of multimedia in the era of globalization has introduced a new educational paradigm, particularly in Indonesia. Through the Sitaya interactive multimedia, children not only experience improved science stimulation but also gain increased motivation, confidence, and enthusiasm for learning activities.

Overall, the findings indicate that the Sitaya interactive multimedia offers multiple benefits in stimulating science abilities among children aged 5–6 years, particularly in helping them recognize planet names, understand planetary order, and identify the unique characteristics of each planet. During the implementation phase, several specific findings and advantages emerged, including improved understanding of scientific concepts and vocabulary, increased self-confidence in children's classroom participation, and the versatility of the accompanying guidebook, which can be utilized not only by teachers but also by parents to foster children's interest in literacy and science learning at home.

Despite these strengths, the study was limited to implementation in Group B at Aisyiyah Tuppu Kindergarten within the theme of the universe, specifically the solar system. Nevertheless, the combination of visual elements, animations, colors, audio, and text within the multimedia proved to enhance children's engagement and comprehension, making Sitaya a valuable alternative learning medium for stimulating early childhood science abilities.

CONCLUSION

Based on the research findings and discussion aligned with the research objectives, it can be concluded that the interactive multimedia Sitaya (Solar System) was developed to stimulate the science abilities of children aged 5–6 years through meaningful, enjoyable, and interactive learning experiences. The media presents solar system content through engaging visualizations supported by animations, audio narration, and interactive activities that are appropriate for the developmental characteristics of early childhood learners. The validity test results indicate that the Sitaya interactive multimedia was evaluated by two expert validators and classified as valid. Furthermore, the practicality test showed that both the multimedia and its accompanying guidebook for development and implementation were rated in the "strongly agree" category, indicating that the media is easy to use and suitable for classroom application. In addition, the effectiveness test results demonstrate that the Sitaya interactive multimedia is effective in stimulating the science abilities of children aged 5–6 years. Therefore, this media can be considered a valid, practical, and effective alternative learning tool for science instruction in early childhood education.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the principal, teachers, and Group B students at Aisyiyah Tuppu Kindergarten for their valuable cooperation and active participation throughout this study. Special appreciation is also extended to the research supervisors for their constructive guidance, academic insights, and continuous support during the research and writing process.

REFERENCES

Akollo, J. G., Tarumasely, Y., Surur, M., Kristen, P., Usia, A., Agama, I., & Negeri, K. (2023). Meningkatkan motorik halus anak usia dini melalui teknik kolase berbahan loleba. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 7(1), 358–373. https://doi.org/10.31004/obsesi.v7i1.3748

Darojat, M. A., Ulfa, S., & Wedi, A. (2022). Pengembangan virtual reality sebagai media pembelajaran. Jurnal Inovasi Teknologi Pendidikan, 5(1), 91–99. https://doi.org/10.17977/um038v5i12022p091

Firdaus, T., & Sinensis, R. (2019). Perdebatan paradigma teori revolusi: Matahari atau bumi sebagai pusat tata surya? Jurnal Filsafat Ilmu, 9(1), 23–32.

Firdaus, U. R., & Prasetyo, S. (2025). Effectiveness of using interactive multimedia for early childhood learning. Journal of Early Childhood Education, 7(2), 102–112.

Firdausy, S. (2019). Multimedia interaktif sebagai media visualisasi dasar-dasar animasi. Jurnal Teknologi Pendidikan, 224–229.

Hasmawaty, H., Saman, A., Syamsuardi, S., Rusmayadi, R., Ruswiyani, E., & Sadaruddin, S. (2024). Refleksi pembelajaran dan penelitian tindakan kelas. Madaniya, 5(2), 305–311. https://doi.org/10.53696/27214834.745

Herman, H., Rusmayadi, R., & Herlina, H. (2020). Media pembelajaran berbasis teknologi informasi. Prosiding Seminar Nasional Pendidikan, 557–559.

Hijriati, H., Fajriah, H., & Mulhamah, M. (2024). Pengembangan multimedia interaktif untuk mengenalkan sains pada anak usia 5–6 tahun. Jurnal Pendidikan Anak Usia Dini, 5, 1–10.

Husin, S. H. (2021). Pembelajaran sains anak usia dini. Jurnal Basicedu, 5(2), 581–595.

Karimah, L., Baghiroh, R. N., & Anggareni, D. (2022). Integrasi multimedia pembelajaran interaktif untuk penanaman literasi anak usia dini di Kota Solo. Jurnal PAUD, 2(1), 5–9.

Lestari, S., & Fathiyah, K. N. (2023). Analisis pembelajaran dalam meningkatkan kemandirian pada anak usia 5–6 tahun. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 7(1), 398–405. https://doi.org/10.31004/obsesi.v7i1.3693

Lismayani, A., Asti, A. S. W., & Kurnia, R. (2024). PKM pelatihan pembuatan media pembelajaran menggunakan Canva berbasis artificial intelligence (AI) bagi guru PAUD. Jurnal Pengabdian Masyarakat, 3, 300–307.

Munawaroh, H., Eka, A., Widiyani, Y., & Muntaqo, R. (2021). Pengembangan multimedia interaktif tema alam semesta pada anak usia 4–6 tahun. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 5(2), 1164–1172. https://doi.org/10.31004/obsesi.v5i2.619

Najib, M., Syawaluddin, A., Raihan, S., & Abstrak, A. I. (2023). Pengembangan multimedia pembelajaran interaktif sistem tata surya berbasis literasi sains untuk siswa SD. Jurnal Inovasi Pedagogi dan Teknologi, 1(1), 1–13. http://www.jurnal.arthamaramedia.co.id/index.php/jiptek

Ningtiyas, E. S., Wenda, D. D. N., & Wiguna, F. A. (2024). Pengembangan multimedia interaktif SITAYA (sistem tata surya) untuk siswa kelas VI SD. EDUTECH: Jurnal Inovasi Pendidikan Berbantuan Teknologi, 4(1), 46–59. https://doi.org/10.51878/edutech.v4i1.3018

Rahmawati, A., Setoresmi, A. S., Malau, B., Ayu, D., Ratna, F., & Munawaroh, S. (2024). Pengaruh penggunaan media games interaktif dalam pembelajaran sains untuk meningkatkan kemampuan berpikir kritis anak. Jurnal Pendidikan Anak, 11, 49–61.

Rahmawati, F., & Hendri, E. (2024). Digitalisasi pendidikan melalui pengembangan media digital interaktif tema alam semesta untuk memfasilitasi keterampilan saintifik anak usia dini. Journal of Early Childhood Education, 10(1), 57–69. https://doi.org/10.18592/jea.v10i1.12557

Rahayu, M., Rusdiyani, I., & Sultan, U. A. T. (2022). Efektivitas multimedia pembelajaran interaktif dalam menstimulasi kemampuan berbicara anak. Jurnal Pendidikan Anak Usia Dini, 8(2), 108–114.

Santika, V. V., & Muthohar, S. (2024). Pemanfaatan sampah non-organik sebagai media belajar untuk meningkatkan aspek kognitif anak usia dini. Murhum: Jurnal Pendidikan Anak Usia Dini, 5(1), 267–277. https://doi.org/10.37985/murhum.v5i1.484

Wahid, S., & Suyanto, S. (2015). Pembelajaran sains anak usia dini. Jurnal Pendidikan dan Pemberdayaan Masyarakat, 2(1), 5–6.

Wahyuni, D., & Suryana, D. (2023). Pengaruh pembelajaran sains (bermain air) terhadap kemampuan berpikir kreatif anak usia 5–6 tahun. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 7(4), 4062–4072. https://doi.org/10.31004/obsesi.v7i4.4793

Wati, E. K., Rosita, R., & Jayanti, S. (2022). Pengembangan game sains untuk meningkatkan pemahaman sains anak usia dini. Jurnal Pendidikan Inovatif, 2(3). https://doi.org/10.59818/jpi.v2i3.186