



Validating Educational Game Development to Foster Learning Motivation in Elementary School Students

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ABSTRAK

Salah satu penyebab rendahnya motivasi belajar siswa adalah guru belum mengembangkan media pembelajaran yang menarik dan sesuai dengan kebutuhan pada mata pelajaran tertentu. Game edukatif mampu memunculkan motivasi intrinsik dengan menstimulasi keingintahuan siswa, sehingga dapat mendukung proses belajar mengajar di lingkungan pendidikan formal. Penelitian ini bertujuan untuk menganalisis validitas pengembangan game edukatif yang dirancang untuk meningkatkan motivasi belajar siswa melalui uji validitas. Pengembangan ini menggunakan model penelitian dan pengembangan (R&D) yang direkomendasikan oleh Borg & Gall. Instrumen pengumpulan data mencakup lembar validasi oleh ahli media pembelajaran, ahli materi, dan ahli bahasa, buku panduan penggunaan media, pedoman observasi penggunaan media dalam pembelajaran, serta pedoman wawancara dengan guru dan siswa. Selain itu, instrumen motivasi siswa juga digunakan dalam penelitian ini. Teknik analisis data yang digunakan adalah teknik analisis deskriptif kuantitatif. Hasil uji validitas menunjukkan bahwa tingkat validitas media berkategori baik. Kategori kualitas produk dari ahli instrumen menunjukkan nilai sebesar 0,785. Karena nilai Cronbach's Alpha sebesar 0,785 lebih besar dari 0,60, maka dapat disimpulkan bahwa uji reliabilitas instrumen dinyatakan reliabel. Dengan demikian, media game edukatif yang dikembangkan dapat dikategorikan layak dan efektif digunakan untuk meningkatkan motivasi belajar siswa di sekolah dasar.

ABSTRACT

One of the causes of low student learning motivation is the lack of engaging and need-based instructional media developed by teachers for specific subjects. Educational games can foster intrinsic motivation by stimulating students' curiosity, thereby supporting the teaching and learning process in formal educational environments. This study aims to analyze the validity of an educational game developed to enhance students' learning motivation through a validity test. The development process employed the Research and Development (R&D) model recommended by Borg and Gall. Data collection instruments included validation sheets from media, material, and language experts, a media usage guidebook, observation guidelines for media implementation in learning, interview guidelines for teachers and students, and a student motivation instrument. The data analysis technique used was descriptive quantitative analysis. The validity test results indicated that the media's validity level was categorized as good. The product quality category from the instrument experts showed a score of 0.785. Since the Cronbach's Alpha value was 0.785, which is greater than 0.60, it can be concluded that the reliability test was deemed reliable. Therefore, the educational game developed is considered feasible and effective for improving students' learning motivation in elementary schools.

1. INTRODUCTION

Education plays a crucial role in preparing high-quality human resources capable of competing in the ever-evolving fields of science and technology (Ulfah et al., 2020; Wahyuni & Yuliana, 2023). Through education, students acquire fundamental knowledge, develop essential skills such as critical thinking and digital literacy, and are directed towards a lifelong learning trajectory (Al-Zou'bi, 2021; Ma'dan et al., 2020; Seng, 2018). Education also fosters innovation and creativity, promotes social development, and serves as a driving force for economic growth (Portuguez Castro et al., 2019; Wu et al., 2023). Furthermore, education empowers individuals to become self-reliant and competent amidst the rapid developments in science and

technology (Broom, 2015; Pettersson, 2018). The role of teachers is crucial in the implementation of education. One significant role of teachers in education is that of facilitators who provide services or facilities to students in the learning process. Teachers not only act as facilitators but also serve as motivators, playing a role in fostering students' learning motivation (Ramey & Stevens, 2023; Xu et al., 2020).

Motivation is a psychological aspect that significantly influences learning in the classroom. Motivation is commonly defined as a process that stimulates an individual's behavior or arouses oneself to take action (Karimi & Sotoodeh, 2020; Purwati & Akmaliah, 2016). From this explanation, it can be inferred that motivation can instill a self-driven enthusiasm for accomplishing tasks, particularly in the context of learning activities. Students who are motivated to learn are likely to exhibit engaged learning activities within the learning process. The psychological aspects of students serve as a reference for teachers in delivering instruction (Cents-Boonstra et al., 2021; Frenzel et al., 2021; L. Yang et al., 2021). This aspect needs careful preparation to make the learning process meaningful and enjoyable for students. The role of motivation is to clarify learning objectives closely related to the meaningfulness of learning (Bakhtiar & Hadwin, 2022; Filgona et al., 2020). Students become interested in learning something once they understand what will be learned and enjoy its benefits (Acquah & Katz, 2020; Harackiewicz et al., 2016). Knowing the meaning behind learning enhances students' motivation to learn. Various studies on motivation indicate that high motivation helps students to focus more and concentrate on learning (Albahiri & Alhaj, 2020; Jiang et al., 2020; Lazarides et al., 2019). Such students tend to be more diligent in completing challenging mathematical tasks because they have a passion for understanding and succeeding in mathematics (DiNapoli & Miller, 2022; Wilkinson et al., 2018). Therefore, teachers need to create a conducive learning environment that allows students to be motivated to learn effectively (Cassidy et al., 2022; Chan-anteza, 2020; Heyder et al., 2020).

The teacher's understanding of the psychological conditions of students will lead the teacher to develop instructional media that can enhance students' learning motivation. This is because learning motivation is inseparable from students' learning activities in the classroom (Filgona et al., 2020; Zajda, 2018). Learning motivation is an internal process that causes an individual to objectively understand learning activities and spontaneously sustain those activities to achieve learning goals (Eccles & Wigfield, 2020; Filgona et al., 2020). If the teacher can design appropriate instructional media, students will be motivated to focus on their learning activities, thereby achieving the learning objectives. Meaningful learning occurs when students use more mental and emotional energy (Bryce & Blown, 2023; Salhab & Daher, 2023). Learning progresses effectively when there are supportive student activities, such as active questioning and expressing opinions. The teacher, as a guide, also plays an active role in the learning process. During active learning, students engage in various activities. They use their brains to understand ideas, solve problems, and apply what they have learned (Desoete & De Craene, 2019; Fredricks et al., 2004).

Based on observations and interviews conducted with sixth-grade students, parents, and teachers at SD Negeri 1 Kadibolo, SD Negeri 1 Bareng, and SD Negeri 2 Baran, it was found that students' learning motivation is relatively low. This is evident in students' lack of focus during classroom instruction. Students often divert their attention to classmates or engage in their own activities, showing limited curiosity about the subject matter. Students appear unenthusiastic about participating in the learning process and readily give up when faced with perceived challenging tasks, displaying a lack of effort in completing assignments. One contributing factor to the low motivation is that teachers have not developed engaging and subject-specific instructional media. The use of less innovative and creative instructional media places students in a passive role. In delivering science lessons on the topic of "Earth and its movements" in the sixth-grade class, teachers use visual media such as presentation slides with explanations and images, which do not stimulate student engagement. This makes the learning process less interesting and enjoyable. Therefore, innovative instructional media are crucial to stimulate student engagement in the classroom. Efforts by teachers to enhance student motivation and participation are closely tied to the learning activities. Therefore, teachers must innovate by developing engaging and effective instructional media as a prerequisite for successful learning processes. Teachers are obligated to facilitate students' learning needs to enable them to quickly and easily recall and retain information. Teachers need media that function to bridge abstract concepts for students and make them more concrete.

The science curriculum in primary schools involves systematically exploring nature. Science is essential in daily life to address human needs through the identification and resolution of identifiable problems (Niles & Tachimoto, 2018; Vincent-Ruz & Schunn, 2018). Students are expected to articulate natural phenomena and relate them to everyday life, making the learning experience meaningful (Ardoin & Heimlich, 2021; Wicaksono & Rahman, 2022). Science education in elementary school encompasses objects, living things, and natural events that are observable, measurable, and interconnected. Students are encouraged to gain direct experience in uncovering scientific objects and issues using scientific methods

and appropriate scientific attitudes (Akerson et al., 2019; Curran & Kitchin, 2019). To create these experiences, students require an intermediary medium, and one such medium is educational games (Al-Ansi et al., 2023; Marpanaji et al., 2018). That one feature of games is motivation, which plays a role in exploring aspects through relevant student experiences, thereby shaping specific skills (Al-Ansi et al., 2023; Pellas et al., 2019).

One of the uses of media here is to convey messages in a less verbalistic manner. One media form that can be employed in the learning process is educational games. Previous study explain that a fundamental principle in educational games is the presence of motivation and active learning (Moyer-Packenham et al., 2019). Games involve players in achieving the ultimate goal of a game, and the rewards provided at the end of the game serve to motivate students to engage in the gaming activity (Amrulloh et al., 2019; Krath et al., 2021). In addition to motivation, educational games embody the principle of active learning. Games can create an environment conducive to discovery and the acquisition of new knowledge. The realization of new discoveries and knowledge occurs through student activities that support the learning process (Pellas et al., 2019; Yu et al., 2021). Previous study explain that digital games have the potential to serve as a learning environment because games are a form of play, and one of their elements is motivation (Hallifax et al., 2020). Furthermore, games offer diverse activities for learning by doing, including competition, rules, challenges, objectives, curiosity, feedback, interaction, interest, fantasy, motivation, flow, control, and narrative. In other words, games have the allure to motivate students to engage in learning activities. The stage of concrete operational thinking (Babakr et al., 2019; Börnert-Ringleb & Wilbert, 2018). One strategy that can be employed in teaching is the use of concrete objects and visual aids (Micallef & Newton, 2024; Othaman et al., 2017). The solar system topic does not allow students to observe celestial objects directly. Therefore, teachers require media that serve as visual aids and are in line with the characteristics of students in the concrete operational stage (Supriatna et al., 2019; Zahara et al., 2020). Children in elementary school, while in the concrete operational stage of development, find pleasure in using their imagination and take part in games as one of the activities that captivate them (Mikropoulos & Papachristos, 2021; Yeh et al., 2023).

Play is vital for the psychological, social, and intellectual development of children in particular (Gibson et al., 2021; Lu et al., 2020). One of the activities in play can motivate intrinsically. Games or play activities can elicit intrinsic motivation by stimulating a child's curiosity (Hartmann & Gommer, 2021; Ryan & Deci, 2020). The educational game produced in this study is expected to enhance student learning motivation (Kalogiannakis et al., 2021; Yu et al., 2021). Other study explain that games are used to support the teaching and learning process in a formal educational environment (Kalogiannakis et al., 2021). When students engage in a task within a game, they learn by doing. In this case, the learning process is active learning. Through playing a game, an individual will act and think to achieve a specific goal. Video games teach students to strategize, consider alternatives in solving a problem, and think flexibly in any situation (Hartt et al., 2020; Kalogiannakis et al., 2021). The use of computer technology in creating educational games has rapidly evolved. In this study, the development of educational games also considers various features incorporating text, images, sound, and animations. The visually appealing design of the educational game aims to stimulate students' curiosity, thereby eliciting intrinsic motivation. The developed educational game includes multiple levels that students must complete to achieve the highest score. Students aiming for the highest score actively engage in playing the game. The challenges presented in the game require students to demonstrate their abilities in completing each level. With challenging game levels, students will actively participate in learning about the "Solar System." Based on this description, the aim of this research is to analyze the validity of developing an educational game on the "Solar System" topic to enhance student motivation. As with most research, it is hoped that this study will be beneficial to the field of education, particularly in the context of learning.

Although many studies have shown the benefits of educational games in increasing student learning motivation previous research tends to lack in-depth evaluation of the measurement instruments used in these games to measure student learning motivation on the topic of the Solar System at the elementary school level (Acquah & Katz, 2020; Kalogiannakis et al., 2021; X. Yang et al., 2021). On the other hand, research on the validity and reliability of measurement instruments specifically tailored to the elementary school context is still scarce. Therefore, further research is needed to fill this research gap and develop valid and reliable measurement instruments that accurately measure student learning motivation on the topic of the Solar System at the elementary school level in the context of using the educational game 'TARA.'

2. METHOD

This research employs the Research and Development (R&D) method, a methodology utilized to produce and assess the effectiveness of a product. The development method in this research follows the R&D stages recommended by Borg & Gall, consisting of 10 phases: a) Research and information collecting, b) Planning, c) Develop preliminary form of product, d) Preliminary field testing, e) Main product revision, f) Main field testing, g) Operational product revision, h) Operational field testing, i) Final product, j) Dissemination and implementation. This article provides an explanation focusing on the validity of the instrument, which is a process to ascertain whether the developed media meets expectations and is suitable for use or not. Data collection techniques in the preliminary stages of development research include literature review, document analysis, observation, and interviews. The data collection instruments comprise a grid of instructional media expert instruments, subject matter expert instruments, language expert instruments, a guidebook for media use by experts, guidelines for observing media use in teaching, teacher interview guidelines, student interview guidelines, and student motivation instruments.

Data analysis techniques Data analysis techniques are employed to analyze data from media experts, subject matter experts, and language experts using a Likert scale. The data analysis with the Likert scale is based on the following criteria: excellent = 5; good = 4; sufficient = 3; poor = 2; very poor = 1. Data analysis techniques, apart from being categorized in tables, are also interpreted using the mode, the mode can be used to interpret data obtained from data collection using a Likert scale. The validation of the learning motivation instrument employs the content validity of the items. In this stage, there are two answer scores: a wrong answer receives a score of 0, and a correct item answer receives a score of 1. The scores from the questionnaire items are analyzed using SPSS 25. The results of the validity test of the research instrument are summarized in a table. Reliability refers to the understanding that an instrument is reliable enough to be used as a data collection tool because the instrument is already good (Suharsimi Arikunto, 2021). An instrument is considered reliable if it produces consistent results regardless of who and when it is administered. The reliability test is processed based on field data, namely the applied trial. After conducting the validity test and obtaining a certain number of valid questions, the next step is to conduct a reliability test using Cronbach's Alpha with SPSS version 25.

3. RESULT AND DISCUSSION

Result

The Development of the Product Draft is based on findings and real descriptions from the preliminary study phase, which includes literature review, document analysis, observation, and interviews. The process of developing the prototype begins with material preparation, framework development, content development, improvement, discussions with classroom teachers, consultations with experts, and revisions based on feedback from teachers and education experts. The focus of product development is an educational game medium centered around the topic "Solar System." The developed product is software packaged in a compact disk (CD) containing integrated "Solar System" material with an educational game. This game is designed with visually appealing displays, sound effects, and animations. The content within this educational software refers to the Core Competencies of the Science subject regarding the Solar System in the sixth grade of elementary school, with specific adjustments. This educational game presents images, sound effects, and animations designed to make learning more engaging and interactive. The game is installed on computers in schools, allowing students to play individually. The minimum specifications required to play this educational game include various types of PCs or laptops with the following requirements: Intel 1.5 GHz Processor, 1GB RAM; 900 MB empty hard drive capacity; and operating systems such as Windows XP, Windows Vista, Windows 7, Windows 8, Windows 10, or Linux. This game can also be played on various devices that support flash-based games, such as DVD players and televisions with suitable applications. The validation results from media experts and education experts are presented in relevant tables to support the reliability and quality of the developed product. Validation results from media expert is show in Table 1.

Table 1. Validation Results from Media Expert

No	Aspect	Results			Mode	Qualification
		V1	V2	V3		
1	Language	4	5	4	4	Good
2	Presentation	4	4	4	4	Good
3	Media effects on learning strategies	5	5	4	5	Very good
4	Appropriateness appearance comprehensive	4	4	5	4	Good
Category quality product from learning media expert						Good

Based on the evaluation results from learning media experts, product quality in the Language aspect received a score of 4 in the first evaluation (V1), a score of 5 in the second evaluation (V2), and a score of 4 in the third evaluation (V3), with mode 4 and the qualification "Good." The Presentation aspect shows a consistent score of 4 in all three evaluations (V1, V2, V3) with mode 4 and the qualification "Good." In the Media effects on learning strategies aspect, this product received a high score, namely 5 in V1 and V2, and 4 in V3, with mode 5 and the qualification "Very Good." Meanwhile, the Appropriateness appearance comprehensive aspect obtained a score of 4 on V1 and V2, and 5 on V3, resulting in mode 4 and the qualification "Good." Overall, the product quality of this learning media is categorized as "Good." Validation Results from expert material, presented in the [Table 2](#).

Table 2. Validation Results from Expert Material

No	Aspect	Results			Mode	Qualification
		V1	V2	V3		
1	Material suitability with competence base	4	4	3	4	Good
2	Suitability material with indicator	3	4	4	4	Good
3	Material suitability with objective learning	5	5	5	4	Very good
4	Participant interactivity educate with material	5	5	5	4	Very good
5	Growth motivation Study	4	4	3	4	Good
6	Suitability reading with theme	4	4	3	4	Good
7	Educational game "Solar System" relate with material push participant educate for think critical	5	5	5	4	Very good
8	Completeness scope reading	5	5	5	4	Very good
9	Level difficulty understanding material	4	4	3	4	Good
10	Variation material	5	5	5	4	Very good
11	Material in accordance with development participant educates	5	5	5	4	Very good
12	Material attractiveness Which served	4	4	3	4	Good
13	Truth to material Which served	4	4	3	4	Good
14	Collapse presentation material	4	4	3	4	Good
15	Clarity of language Which used in reading	5	5	5	4	Very good
16	Clarity instruction Study	5	5	5	4	Very good
17	Truth material in accordance theory and draft	4	4	3	4	Good
18	Accuracy use Language write	5	5	5	4	Very good
19	Accuracy making appropriate questions with material	4	4	3	4	Good
20	Providing bait come back to results processing with educational games	4	4	3	4	Good
Category quality product from expert material learning						Good

[Table 2](#) presents an evaluation of educational material quality across various aspects, with results assessed by three validators (V1, V2, and V3). Most aspects, including material suitability with competence base, growth motivation, and truthfulness of material presented, achieved a "Good" rating, with the mode score generally being 4. Higher ratings, classified as "Very Good," were given for aspects such as alignment of materials with learning objectives, participant interactivity, critical thinking stimulation through educational games, completeness of reading scope, material variation, and clarity of instructional language. Overall, the material quality category as evaluated by the expert is rated "Good." Validation results from Linguist, presented in [Table 3](#).

Table 3. Validation Results from Linguist

No	Aspect	Results			Mode	Qualification
		V1	V2	V3		
1	Suitability with EYD	5	5	5	5	Very good
2	Language effective and efficient	4	4	5	4	Good

No	Aspect	Results			Mode	Qualification
		V1	V2	V3		
3	Suitability with level development participant educates	4	4	4	5	Good
4	Communicative	5	5	5	5	Very good
5	Collapse And unity idea	5	5	4	5	Very good
Category quality product from Linguist						Very good

Table 3 shows that the product's overall linguistic quality is rated as "Very Good." Specifically, the product received "Very Good" ratings for suitability with EYD, communicative aspects, and the coherence and unity of ideas, with mode scores of 5 across these categories. The language's effectiveness and efficiency, as well as its suitability with the developmental level of the target audience, were rated as "Good," with mode scores of 4, indicating minor areas for improvement. Overall, the product demonstrates strong alignment with linguistic standards and communicative clarity. The validation results of the product usage by experts are presented in the Table 4.

Table 4. Validation Results of the Expert Evaluation on the Product Usage

No	Aspect	Results			Mode	Qualification
		V1	V2	V3		
1	Contents _	4	5	5	5	Very good
2	Systematic Presentation	4	4	5	4	Good
3	Language	5	4	4	4	Good
Category quality of the Expert Evaluation on the Product Usage						Good

Base on Table 4, the expert evaluation results indicate that the product content received the highest rating, achieving a mode of 5 and classified as "Very Good," reflecting strong approval of the content's quality. Systematic presentation and language aspects were rated slightly lower, both with a mode of 4, resulting in a "Good" qualification. Overall, the expert assessment categorizes the product usage quality as "Good," suggesting that while the content is highly regarded, there is moderate room for improvement in presentation and language. The validation results of the observation guide for media usage by experts are presented in Table 5.

Table 5. Validation Results of the Expert Evaluation on the Observation Guide for Media Usage

No	Aspect	Results					Mode	Qualification
		V1	V2	V3	V4	V5		
1	Learning	5	5	5	4	4	5	Very good
2	Response Student	4	4	4	5	5	4	Good
3	Teacher Response	5	5	5	5	5	5	Very good
Quality category of the observation guide for media usage by experts								Very good

Base on Table 5, the data analysis reveals that the observation guide for media usage, as evaluated by experts, falls within the "Very Good" category. This is evident across various aspects assessed, where the "Learning" aspect scored predominantly "Very Good" with a mode of 5, indicating consistent high ratings with scores of 5 across most indicators and only slight variation. The "Student Response" aspect received a "Good" qualification, with a mode of 4, showing favorable but slightly varied responses. Lastly, the "Teacher Response" achieved a unanimous rating of 5 across all indicators, resulting in a "Very Good" qualification, underscoring the effectiveness and positive reception of the media usage observed in this study. Validation Results guidelines teacher interview from the expert presented in Table 6.

Table 6. Validation Results of teacher interview guidelines from the expert

No	Aspect	Results					Mode	Qualification
		V1	V2	V3	V4	V5		
1	Media	4	4	4	5	4	4	Good
2	Material	4	5	5	5	4	5	Very good
3	Learning	4	4	5	5	4	5	Good
Category Quality teacher interview guidelines from the expert								Good

Table 6 presents an evaluation of teacher interview guidelines across three aspects: Media, Material, and Learning. For the Media aspect, scores of 4, 4, 4, 5, and 4 yield a mode of 4, classifying it as "Good." The Material aspect received scores of 4, 5, 5, 5, and 4, with a mode of 5, categorizing it as "Very Good." Lastly, the Learning aspect scored 4, 4, 5, 5, and 4, with a mode of 5, rated as "Good." Overall, the expert assessment qualifies the teacher interview guidelines in the "Good" category. Validation Results guidelines interview student from expert, presented in Table 7.

Table 7. Validation Results guidelines interview student from expert

No	Aspect	Results					Mode	Qualification
		V1	V2	V3	V4	V5		
1	Media	4	4	4	4	4	4	Good
2	Material	5	5	5	5	4	5	Very good
3	Learning	4	4	4	5	4		Good
Category Quality guidelines interview student from expert								Good

Table 7 show the evaluation results show that the media used received a mode of 4, which qualifies it as "Good." The material aspect performed slightly better, achieving a mode of 5 and qualifying as "Very Good," reflecting high student and expert satisfaction with the materials provided. The learning aspect received mostly 4s, with one score of 5, resulting in an overall mode of 4 and a "Good" qualification. In summary, based on expert interviews and student feedback, the learning tools meet a "Good" quality standard, with particular strengths noted in the materials provided. The results of the validation test for the student learning motivation instrument are presented as show in Table 8.

Table 8. Results of the Validation Test for The Student Learning Motivation Instrument

Variable	Initial Item Count	Dropped Item Count	Numbers Dropped	Valid Item Count
Motivation to learn	23	0	0	23

Base on Table 8, the reliability test was processed based on field data, namely the applied trial. After conducting the validity test and obtaining 23 valid questions, the next step was to perform the reliability test using Cronbach's Alpha in SPSS version 25. The reliability test results for the instrument can be seen in Table 9.

Table 9. Reliable Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.785	0.781	23

Based on Table 9, it is known that there are a total of 23 questions or items. The Cronbach's Alpha value is 0.785; since the Cronbach's Alpha value is $0.785 > 0.60$, it can be concluded that the reliability test for the 23 item questions is considered reliable. Therefore, it can be concluded that the item questions are reliable.

Discussion

The quality categories of the product, as assessed by learning media experts, are considered good. The quality categories assessed by subject matter experts are also considered good. The quality categories evaluated by language experts are considered very good. The quality category for the user guide, as evaluated by experts, is considered good. The quality category for the observation guide on media usage in learning, as assessed by experts, is considered very good. The quality category for the interview guide for teachers is considered good. The quality category for the interview guide for students is considered good. The quality category for the motivation instrument guide from the 23 questions reveals that there are 0 invalid questions, making a total of 23 valid questions. Then, based on the table, it is known that there are a total of 23 questions or items. The Cronbach's Alpha value is 0.785, and since the Cronbach's Alpha value is $0.785 > 0.60$, it can be concluded that the reliability test for the 23 item questions is considered reliable. Therefore, it can be concluded that the item questions are reliable.

Overall, based on expert opinions, the research instrument is deemed suitable for use in the study. Subsequently, the items are considered reliable, allowing them to proceed to the next stage of the research

to assess the limited and extensive testing of the "Solar System" educational game development. With the development of this educational game, it is hoped to enhance students' learning motivation in the classroom. This aligns with the views who state that media is anything that conveys information between the source and the information receiver (Moyer-Packenham et al., 2019). The information source referred to is the role of the teacher or media, while students act as information receivers. Therefore, media, in this context, can aid students' activities and interactions with the teacher in the learning process. Media plays a crucial role in the classroom learning process. Teachers require media to make learning more meaningful for students. Furthermore, other study also mention the concept of media in the teaching and learning process as anything that can be used to convey messages or information to stimulate students' attention and interest in learning (Bryce & Blown, 2023; Portuguese Castro et al., 2019). Educational media is a message carrier technology used for learning purposes; it is a physical means to deliver instructional material. Educational media is a communication tool in print or visual form, including hardware technology. This perspective implies that hardware technology is included in the media used for communication purposes. The media can be in the form of print or audiovisual media. It classifies educational media as a technology that functions as a message carrier in the learning process.

Educational media must meet specific criteria to be considered high-quality. Previous study propose three aspects to assess the quality of educational media, including 1) method, referring to the techniques and procedures used in learning; 2) media, encompassing elements used in learning to capture students' interest, such as multimedia, video, text, images, and animations; and 3) material, comprising the learning content involving motivation, orientation, information, application, and evaluation (Nicolaou et al., 2019). According to this perspective, educational media is deemed of good quality if it meets criteria related to technical quality, engaging content that captures students' interest, and the intended objectives of the media development. Games with educational content are commonly known as educational games. Other study explain that educational games are digital games designed for educational enrichment, supporting teaching and learning through multimedia technology. Digital games are generally developed using technologies such as computers (Yu et al., 2021).

Engaging learning experiences stimulate students' motivation to learn. This aligns with the notion that motivation contains the power to drive someone to achieve their goals. This driving force or impetus can originate from within the student or external sources. There are two types of motivation: intrinsic motivation and extrinsic motivation (Karimi & Sotoodeh, 2020; Ryan & Deci, 2020). Motivation unveils factors inherent within oneself and intrinsic to the task being undertaken. Intrinsic motivation involves engaging in an activity because it brings pleasure, helps develop perceived essential skills, or is ethically and morally perceived as right to do (Heyder et al., 2020; Monica et al., 2019). Based on comments, suggestions, and critiques provided by expert validators and analysis, emphasis should be placed on the appropriateness of content and discussion questions in the educational game media, aligning with the learning objectives. The media used should correspond to the content and learning objectives to ensure achievement of the learning goals. This is in line with the principle that instructional media should genuinely serve students' learning, implying that the media used by teachers must be suitable and directed towards achieving learning objectives. Media should not be employed solely for entertainment or merely to facilitate teachers in delivering content; instead, it should genuinely aid students in learning according to the specified objectives. The overall research findings indicate that the developed media is deemed valid and that the test items are considered reliable for advancement to the next stage of development.

This study is supported by other research, including a previous investigation on educational game-based learning media, which stated its highly effective impact on students' enthusiasm and learning interest (Acquah & Katz, 2020; Kalogiannakis et al., 2021). Additionally, the research is corroborated by studies emphasizing the effectiveness and attractiveness of educational games as learning media due to their superior animation features (Eltahir et al., 2021; Yu et al., 2021). Furthermore, studies on PC-based games have been deemed valid, possessing excellent criteria for educational media, particularly for elementary school students, as they are engaging and often perceived as amusing (Hartt et al., 2020; Partovi & Razavi, 2019). Students are more capable of comprehending the material and are simultaneously more motivated to learn. This research has implications, especially in the field of education. Some of the implications arising from the development of the TARA educational game include providing schools with references and guidelines for improving the quality of education at the school level. For teachers, it serves as inspiration for innovating instructional media and as a means to facilitate the teaching-learning process. Additionally, for students, it can be utilized as a learning resource to enhance understanding of the learning material, create an enjoyable learning atmosphere, and boost motivation, especially in science education.

The limitations of this research include the focus on sixth-grade students, which may constrain the generalization of findings to other age groups and educational levels. Additionally, the study's implementation in a specific school context may limit the transferability of results to different school

settings. The reliance on school PCs for game access may hinder accessibility for students at home or using different devices. Furthermore, the research's time constraints may impact the depth of understanding regarding the long-term effects of the educational game on student motivation. The recommendations for future research include exploring diverse age groups to assess the educational game's effectiveness across various educational levels. Developing multiple game versions tailored to different educational levels can enhance the generalizability of findings. Replicating the study in varied schools and educational environments is crucial for a more comprehensive understanding of the educational game's effectiveness. Longitudinal research is suggested for a thorough exploration of the game's impact on student motivation over time. Additionally, creating game variants accessible through various platforms and devices is advised to improve availability and flexibility for student access. These recommendations provide a foundation for further research that is comprehensive and applicable across diverse educational contexts.

4. CONCLUSION

Based on these research findings, it can be concluded that the educational game TARA is validated and can be used to support the teaching and learning process. The educational game TARA on the topic of the solar system in the sixth grade of elementary school, which was developed, falls within the category of being valid and deemed suitable for supporting the teaching and learning process. Recommendations for implementation include utilizing this educational game as a reference for school learning activities, employing it as a tool to enhance the teaching process for educators, and using it as a resource for students to facilitate a better understanding of the learning material.

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