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Research Article

Students' Perceptions of a Lopi Sandeq Racing Game Simulation Based on Mandar Local Wisdom Using Gemini Canvas

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ABSTRACT
Although digital simulations and game-based learning have been widely discussed in physics education, limited studies have examined AI-assisted simulations that integrate local wisdom into contextual science learning. This study aims to examine senior high school students' perceptions of a Gemini Canvas-based Lopi Sandeq racing simulation as a contextual physics learning medium based on Mandar local wisdom. This study employed a quantitative descriptive approach using a survey method. The participants consisted of 25 senior high school students who had participated in physics learning activities using the Lopi Sandeq racing simulation. Data were collected through a student perception questionnaire and supported by observation and documentation. The questionnaire data were analyzed using descriptive statistics by calculating the average score and percentage for each assessed aspect. The findings show that students' overall perception of the simulation was categorized as good, with an average score of 3.98 and a percentage of 79.6%. The aspects of relevance to Mandar local wisdom and visual appearance and interactivity were categorized as very good, while ease of use, understanding of physics concepts, and learning motivation and interest were categorized as good. These findings suggest that the simulation was positively received as a supplementary medium for contextual physics learning. The study contributes to educational technology and science education by showing the potential of integrating AI-assisted simulation, game-based learning, and local wisdom in developing culturally meaningful physics learning media. However, teacher guidance remains necessary to help students connect simulation activities with formal physics concepts and mathematical reasoning.

Keywords: *Artificial Intelligence; Gemini Canvas; Game-Based Learning; Local Wisdom; Physics Learning*

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1. Introduction

Physics learning at the senior high school level requires instructional approaches that can help students understand abstract concepts in more concrete, contextual, and meaningful ways. Physics is not only aimed at helping students understand natural laws and scientific concepts, but also at developing logical, analytical, and systematic thinking skills. However, physics is often perceived by students as a difficult subject because it involves abstract concepts, mathematical symbols, and complex equations (Badmus & Jita, 2024; Karim & Karim, 2024). This perception may reduce students' interest and motivation, which can ultimately affect their engagement and learning outcomes in physics.

Problems in physics learning are also closely related to the teaching methods and instructional media used in the classroom. Learning that is dominated by lecture-based methods and textbook use tends to make students passive and less engaged in the learning process. Budiarto and Jazuli (2021) and Wangchuk et al. (2023) emphasized that learning that lacks variation and interaction can reduce students' learning motivation. Therefore, instructional innovations are needed to actively involve students and help them understand physics concepts in a more concrete and meaningful way.

One effort to address these problems is the use of technology-based instructional media. Technology-based learning media have great potential to present learning materials in visual, interactive, and contextual forms, thereby helping students understand abstract physics concepts (Masri et al., 2024; Sastradika et al., 2021). Simulations and educational games are among the forms of digital instructional media that have been widely developed in physics education. Simulations allow students to observe physical phenomena virtually, conduct experiments by modifying certain variables, and directly observe the effects of these changes. Through simulations, students can learn exploratively and constructively, in accordance with constructivist learning principles, which emphasize that knowledge is constructed through direct experience and active interaction with the learning environment (Akingbola et al., 2024; Liswar et al., 2023).

Educational games also have advantages in increasing students' motivation and engagement in physics learning. Hasanah et al. (2025) stated that educational games can create enjoyable and challenging learning environments that encourage active student participation. Elements of competition, challenge, feedback, and exploration embedded in games can enhance students' learning interest and reduce the perception that physics is a boring subject. However, digital media in physics learning should not only be interactive, but also contextually relevant to students' real-life experiences and cultural backgrounds.

In addition to the use of technology, physics learning should also consider students' social and cultural contexts. Learning that is detached from students' daily lives tends to be less meaningful and more difficult to understand. Therefore, integrating local wisdom into learning becomes important to enhance the relevance and meaningfulness of instruction. Local wisdom refers to values, knowledge, and cultural practices that develop within a community and are passed down from generation to generation (Aulia et al., 2024). Learning based on local wisdom can help students understand scientific concepts through phenomena that are closely related to their daily lives.

In West Sulawesi, particularly among the Mandar community, one form of local wisdom that has strong educational potential is Lopi Sandeq. Lopi Sandeq is a traditional sailing boat known for its cultural, historical, and technological value. From a physics perspective, Lopi Sandeq embodies various concepts such as linear motion, velocity, acceleration, wind force, balance, and energy. Therefore, Lopi Sandeq can be used as a contextual physics learning object, especially for students who live in regions with strong cultural ties to the Mandar community. The use of Lopi Sandeq as a context for physics learning is aligned with the contextual teaching and learning approach, which emphasizes the importance of connecting learning materials with students' real-life experiences (Masri et al., 2025). Through this approach, students are expected not only to learn physics concepts theoretically, but also to understand their applications in daily life and local culture.

The development of a Lopi Sandeq racing simulation game as a physics learning medium represents an effort to integrate technology, local wisdom, and scientific concepts into a unified learning experience. Through simulation games, students can learn physics concepts in a more engaging and interactive manner. However, the development of simulation-based instructional media often faces challenges, particularly related to teachers' limited technical skills in programming and digital media design (Sanusi et al., 2025). This condition makes it difficult for many teachers to independently develop innovative digital learning media that are both pedagogically meaningful and technically functional.

Advances in artificial intelligence technology provide new opportunities for overcoming these challenges. One technology that can be utilized is Gemini Canvas, an artificial intelligence-based platform that enables users to create interactive content through a natural language or prompt-based approach. With Gemini Canvas, teachers can develop learning simulations by composing clear and structured prompts without having to master complex programming languages. This is consistent with Lailiyah et al. (2024) view that ease of media design is essential so that teachers can focus more on pedagogical aspects rather than technical issues. In this context, Gemini Canvas can be positioned as a teacher-friendly AI-assisted platform that may reduce technical barriers in developing contextual and interactive physics learning media.

Although simulations, educational games, and local wisdom-based learning have been discussed in physics education, previous studies have generally examined these elements separately. Many physics simulations remain generic and are not specifically designed around local cultural objects that are familiar to students' lived experiences. At the same time, the use of AI-assisted tools such as Gemini Canvas for developing culturally contextualized physics simulations remains underexplored. Therefore, limited empirical evidence is available on how students perceive AI-assisted, game-based physics simulations that integrate local wisdom into science learning.

The novelty of this study lies in the integration of Mandar local wisdom represented by Lopi Sandeq, game-based physics simulation, and AI-assisted media development using Gemini Canvas. This integration is expected to contribute to the development of contextual physics learning media that are not only interactive and visually engaging, but also culturally meaningful for students. Since the success of technology-based learning media is strongly influenced by students' perceptions, examining students' responses is important to determine the extent to which the media are accepted and can be meaningfully used in learning. Students' perceptions reflect how they evaluate, accept, and respond to instructional media in the learning process. Positive perceptions can enhance students' motivation and engagement, whereas negative perceptions can hinder the optimal use of learning media (Vhalery et al., 2021).

Based on these considerations, this study aims to examine senior high school students' perceptions of a Gemini Canvas-based Lopi Sandeq racing simulation as a contextual physics learning medium based on Mandar local wisdom. Specifically, this study explores students' perceptions of the simulation in terms of visual appearance and interactivity, ease of use, understanding of physics concepts, relevance to Mandar local wisdom, and learning motivation and interest. This study is expected to provide initial empirical evidence on the acceptability of AI-assisted, game-based, and culturally contextualized physics learning media.

2. Method

This study employed a quantitative descriptive approach using a survey method. This approach was selected because the objective of the study was to obtain an objective description of senior high school students' perceptions of the use of a Lopi Sandeq racing simulation game based on Mandar local wisdom, developed using Gemini Canvas as a physics learning medium. Students' perceptions were measured through quantitative data collected using a questionnaire and analyzed using descriptive statistics to identify trends in students' attitudes and responses toward the instructional media.

The study was conducted at a senior high school located in West Sulawesi, a region with strong cultural ties to the Mandar community. The selection of the research site was based on the relevance of Lopi Sandeq to students' daily lives and local culture. The research was carried out during the second semester of the current academic year, beginning with instrument preparation, media implementation, data collection, data analysis, and reporting of the research findings.

The research participants consisted of 25 senior high school students who had participated in physics learning activities using the Lopi Sandeq racing simulation game developed with Gemini Canvas. The participants were selected using total sampling because all students belonged to the same class and had received uniform learning experiences using the instructional media. The object of this study was students' perceptions of the Lopi Sandeq racing simulation game in physics learning, particularly in relation to motion, velocity, force, energy, and the influence of wind on object motion.

In physics learning, the Lopi Sandeq racing simulation game was used as an instructional medium to assist students in understanding abstract concepts in a contextual manner. The movement of the Lopi Sandeq in the simulation was linked to velocity, acceleration, wind force, boat mass, and energy. By modifying physics variables within the simulation, students were able to observe their effects on the speed and stability of the boat, thereby making the learning process more meaningful and easier to understand. The display of the Gemini Canvas-based Lopi Sandeq racing simulation used in this study is presented in Figure 1.

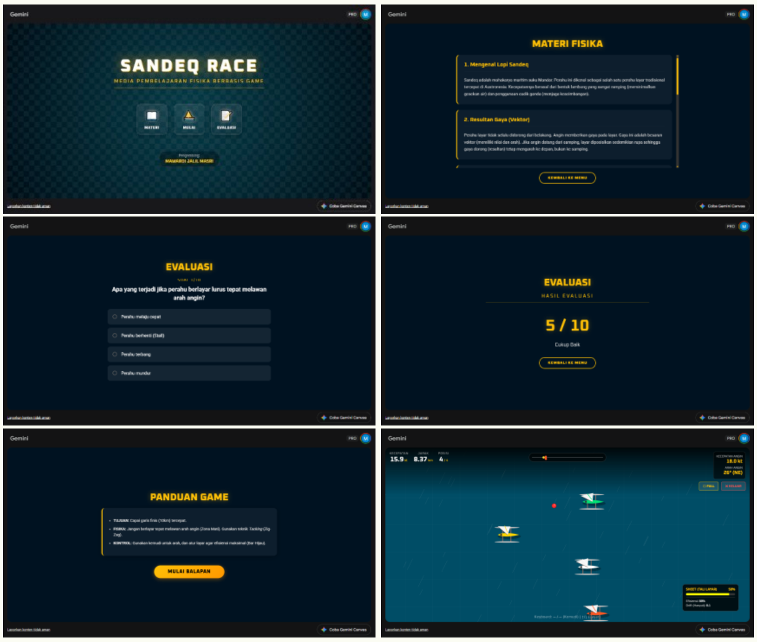

Figure 1. Display of the Gemini Canvas-based Lopi Sandeq racing simulation used as a contextual physics learning medium

The research instrument used in this study was a student perception questionnaire developed based on indicators of perceptions toward game-based instructional media. The questionnaire employed a five-point Likert scale ranging from strongly disagree to strongly agree. The questionnaire covered five main aspects: visual appearance and interactivity, ease of use, understanding of physics concepts, relevance to Mandar local wisdom, and learning motivation and interest.

Prior to its implementation, the questionnaire was validated by a physics content expert and an instructional media expert to ensure content validity and linguistic clarity. The physics content expert reviewed the relevance of the questionnaire to physics concepts, while the instructional media expert reviewed the clarity, readability, and suitability of the questionnaire for evaluating game-based instructional media. Revisions were made based on the experts' suggestions to improve the clarity and alignment of the questionnaire with the research objectives.

Data were collected using observation, questionnaires, and documentation techniques. Observations were conducted during physics learning activities to examine students' engagement, learning enthusiasm, and responses to the Gemini Canvas-based media. The questionnaire was administered to 25 students after the completion of the learning process to obtain direct data on students' perceptions. Documentation served as supporting data in the form of photographs of learning activities, screenshots of the simulation game, and records of the research implementation process.

The research procedure began with a preparation stage, which included a literature review on game-based physics learning, Mandar local wisdom, and digital technology in education. Subsequently, the researchers developed the Lopi Sandeq racing simulation game using Gemini Canvas and prepared the research instruments. During implementation, the teacher and researcher introduced the simulation, explained the physics learning objectives, and guided students in exploring the simulation by modifying the available physics variables. After the learning activity, students completed the perception questionnaire. The final stage involved data analysis and research reporting.

The questionnaire data were analyzed using descriptive statistical techniques. Scores from each response were summed to obtain the total student perception score, after which mean values and percentages were calculated for each indicator. The percentage score was calculated by comparing the obtained score with the maximum possible score and multiplying it by 100. The score classification used in this study was as follows: 81–100% = very good, 61–80% = good, 41–60% = fair, 21–40% = poor, and 0–20% = very poor.

Ethical considerations were addressed during the study. All students participated voluntarily, respondents' identities were kept confidential, and the data collected were used solely for research purposes. Students were also informed that their questionnaire responses would not affect their academic grades.

3. Results

The findings of this study were obtained from students' perception questionnaire responses after participating in physics learning activities using the Gemini Canvas-based Lopi Sandeq racing simulation. The questionnaire was administered to 25 senior high school students who had used the simulation as a contextual physics learning medium. The data were analyzed descriptively by calculating the average score and percentage for each assessed aspect.

The results show that students' overall perception of the Lopi Sandeq racing simulation was categorized as good. The overall average score was 3.98, with a percentage of 79.6%. This result indicates that the simulation was generally perceived positively by students as a physics learning medium based on Mandar local wisdom.

Table 1. Students' Perceptions of the Gemini Canvas-Based Lopi Sandeq Racing Simulation

No.	Assessed Aspect	Average Score	Percentage (%)	Category
1	Visual appearance and interactivity	4.1	82%	Very Good
2	Ease of use	3.8	76%	Good
3	Understanding of physics concepts	3.7	74%	Good
4	Relevance to Mandar local wisdom	4.4	88%	Very Good
5	Learning motivation and interest	3.9	78%	Good
	Overall average	**3.98**	**79.6%**	**Good**

Based on Table 1, the highest score was found in the aspect of relevance to Mandar local wisdom, with an average score of 4.4 and a percentage of 88%, which falls into the very good category. This was followed by visual appearance and interactivity, which obtained an average score of 4.1 and a percentage of 82%, also categorized as very good.

The other three aspects were categorized as good. Learning motivation and interest obtained an average score of 3.9, with a percentage of 78%. Ease of use obtained an average score of 3.8, with a percentage of 76%. Meanwhile, understanding of physics concepts obtained the lowest score among the five aspects, with an average score of 3.7 and a percentage of 74%.

These results indicate that students gave the strongest response to the cultural relevance of the simulation, followed by its visual and interactive features. The results also show that although the simulation was perceived positively in supporting physics learning, the aspect of physics concept understanding received the lowest percentage compared to the other assessed aspects.

Observational findings during the learning activity supported the questionnaire results. Students appeared interested when the simulation was introduced and actively explored the available features. During the activity, students modified several simulation variables, such as wind speed and boat mass, and observed their effects on the movement of the Lopi Sandeq. Students also engaged in discussions about how changes in the simulation variables influenced the racing outcomes.

However, observations also showed that some students still required teacher guidance to connect the simulation results with formal physics concepts and equations. This was particularly evident when students attempted to relate the movement of the Lopi Sandeq to concepts such as force, velocity, acceleration, and energy. Therefore, the findings suggest that the simulation was positively received by students, but teacher support remained important during its implementation in physics learning.

4. Discussion

The findings indicate that the Gemini Canvas-based Lopi Sandeq racing simulation was positively perceived by senior high school students as a contextual physics learning medium. The overall perception score, which was categorized as good, suggests that students were generally able to accept the simulation as part of physics learning. However, the variation across the assessed aspects shows that students' acceptance was not uniform. The highest perception was found in the relevance to Mandar local wisdom, while the lowest score was found in the understanding of physics concepts. This pattern indicates that the simulation was particularly strong in providing cultural relevance and visual engagement, but still required teacher guidance to support deeper conceptual and mathematical understanding.

The high score in the visual appearance and interactivity aspect suggests that the simulation was able to present physics phenomena in a visually engaging and interactive form. The visualization of the Lopi Sandeq, wind direction, and racing movement helped students observe the relationship between variables such as wind force, boat mass, and velocity. In this context, Gemini Canvas appeared to support the development of visual and interactive simulation features through prompt-based instructions. This finding is in line with Wang et al. (2022), who emphasized that visual interfaces and natural language-based systems can reduce technical barriers in developing digital visualizations. In addition, the finding also supports Fyfield et al. (2022), who argued that the effectiveness of multimedia learning is strongly influenced by the clarity of presentation and the alignment between media design and instructional objectives.

The ease of use aspect, although categorized as good, did not reach the very good category. This indicates that while students could use the simulation, some still needed initial guidance to understand the available features and physics variables. This finding suggests that an AI-assisted simulation does not automatically guarantee independent student use without instructional support. In game-based learning, ease of use must be balanced with meaningful learning content so that the media are not only attractive but also pedagogically useful. This is consistent with Gui et al. (2023) and Selvi et al. (2025), who emphasized that game-based instructional media should combine usability, engagement, and content depth. Therefore, teacher scaffolding remains important, especially at the early stage of simulation use.

The aspect of understanding physics concepts received the lowest score among the five assessed aspects, although it was still categorized as good. This finding is important because it shows that the simulation was perceived as helpful, but not sufficient as a stand-alone medium for mastering physics concepts. Students could observe the effects of wind speed, boat mass, and movement in the simulation, but they still needed teacher explanations to connect these observations with formal physics concepts and equations. This supports the view that simulations can facilitate conceptual understanding when they are accompanied by appropriate instructional strategies. Jafari Ghalehkohneh et al. (2025) and Kaldaras and Wieman (2023) emphasized that computer simulations in physics learning need to be integrated with instructional models that help students make sense of mathematical and scientific relationships. Therefore, in this study, Gemini Canvas-based simulation should be understood as a supporting medium, not as a replacement for teacher explanation.

The highest score was found in the relevance to Mandar local wisdom aspect. This indicates that students responded strongly to the use of Lopi Sandeq as a familiar cultural object in physics learning. The integration of Lopi Sandeq helped connect abstract physics concepts with students' local context and lived experiences. This finding confirms the importance of culturally contextualized learning media, particularly in science education. Contextual learning linked to students' real-life experiences can enhance learning relevance and support understanding, as noted by Tampubolon et al. (2025). In this study, Lopi Sandeq functioned not only as a cultural symbol but also as a contextual bridge for explaining motion, force, wind effects, balance, and energy in physics learning.

The motivation and learning interest aspect was also categorized as good. This suggests that the racing simulation created a more engaging learning atmosphere by incorporating elements of challenge, competition, exploration, and interaction. Students were encouraged to explore the simulation by modifying variables and observing their effects on the racing outcomes. Such activities can increase curiosity and participation in learning. This finding is consistent with Baharuddin et al. (2024), who noted that learning motivation can be enhanced through engaging instructional methods that actively involve students. In this study, the game-based format helped reduce the impression that physics learning is limited to formulas and textbook explanations.

Observational findings also showed that students actively experimented with different simulation scenarios, such as modifying wind speed and boat mass to observe their effects on the movement of the Lopi Sandeq. These activities encouraged exploration, peer discussion, and collaborative meaning-making during the learning process. This suggests that prompt-based simulations can create opportunities for student interaction when the learning activity is properly guided. In relation to AI-assisted learning, Alnasib and Alharbi (2024) also highlighted that Gemini-based learning environments can influence student engagement and classroom interaction. However, student interaction needs to be supported by clear learning instructions so that exploration remains connected to the intended physics concepts.

The findings also highlight the pedagogical role of prompts in AI-assisted instructional media development. Gemini Canvas allows teachers to generate interactive simulations through natural language prompts, but the quality of the resulting media depends on how the prompts are designed. Prompts should not only describe visual objects or game scenarios, but also reflect learning objectives, physics variables, student activities, and expected conceptual connections. Therefore, prompt design becomes an important pedagogical skill for teachers who intend to use AI-based platforms in science learning. In this sense, Gemini Canvas can support teachers in developing contextual and interactive physics media, provided that the prompt design is aligned with instructional goals.

Despite these positive findings, the study has several limitations. First, the study involved only 25 students from one senior high school, so the findings cannot be generalized to broader student populations. Second, the study focused on students' perceptions and did not measure learning achievement through pre-test and post-test data. Therefore, the results cannot be used to claim that the simulation significantly improved students' physics learning outcomes. Third, the study did not examine teachers' experiences in developing the simulation using Gemini Canvas, even though the discussion suggests that Gemini Canvas may support teacher-friendly media development. Future research should involve larger and more diverse samples, apply experimental or quasi-experimental designs, and examine the impact of Gemini Canvas-based simulations on students' conceptual understanding, motivation, and learning achievement. Further studies may also explore teachers' prompt design practices in developing AI-assisted, culturally contextualized instructional media.

Overall, the discussion shows that the Gemini Canvas-based Lopi Sandeq racing simulation has potential as a contextual physics learning medium that integrates artificial intelligence, game-based learning, and Mandar local wisdom. The main contribution of this study lies in showing that culturally familiar objects can be combined with AI-assisted simulation tools to create learning media that are visually engaging, locally meaningful, and pedagogically relevant. However, the use of such media should be accompanied by teacher guidance, clear instructional design, and carefully formulated prompts to ensure that students' engagement with the simulation leads to meaningful physics learning.

5. Conclusion

This study examined senior high school students' perceptions of a Gemini Canvas-based Lopi Sandeq racing simulation as a contextual physics learning medium based on Mandar local wisdom. The findings show that students' overall perceptions were categorized as good, indicating that the simulation was positively received as a supplementary medium in physics learning. The aspects of visual appearance and interactivity, as well as relevance to Mandar local wisdom, were categorized as very good, while ease of use, understanding of physics concepts, and learning motivation and interest were categorized as good. These findings suggest that the integration of AI-assisted simulation, game-based learning, and local wisdom can provide a meaningful learning experience for students. The Lopi Sandeq racing simulation helped present physics concepts in a more visual, interactive, and culturally relevant form. However, the finding on physics concept understanding also indicates that the simulation should not be used as a stand-alone learning medium. Teacher guidance remains necessary to help students connect simulation activities with formal physics concepts, formulas, and mathematical reasoning.

The main contribution of this study lies in demonstrating the potential of Gemini Canvas as a teacher-friendly AI-assisted tool for developing contextual physics learning media through prompt-based design. By integrating Mandar local wisdom into a digital simulation, this study also contributes to the development of culturally contextualized science learning media that connect abstract physics concepts with students' local cultural experiences. This study has several limitations. First, it involved only 25 students from one senior high school, so the findings cannot be generalized to broader student populations. Second, the study did not specifically examine teachers' experiences in designing prompts or developing the simulation using Gemini Canvas. Future research should involve larger and more diverse samples, apply experimental or quasi-experimental designs, and examine the effects of Gemini Canvas-based simulations on students' conceptual understanding, motivation, and physics learning outcomes. Further studies may also explore teachers' prompt-design practices in developing AI-assisted and local wisdom-based instructional media.

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