



Enhancing Students' Collaboration Skills Through Tic-Tac-Toe in Think Pair Share Strategy of Global Warming Concepts

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Abstract

Developing students' collaboration skills is important in today's 21st-century education. Global warming is one of the important issues in physics learning that is interesting to study. This study aims to improve students' collaboration skills by integrating Tic-Tac-Toe game with Think-Pair-Share (TPS) strategy in physics learning on the concept of global warming. This research adopted the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) conducted at MA Al Iman Bulus Purworejo, starting with a limited trial involving 5 students and continuing to implementation with 34 students. The research instruments included validation sheets for developing student worksheets, observation sheets for collaboration skills, and student response questionnaires to collect comprehensive data on the effectiveness of the intervention. The data analysis results showed that the electronic worksheet's validity obtained a score of 3.86 with a valid category, and the practicality of the electronic worksheet based on the student response questionnaire obtained an average of 84.1% with a very practical category. The research findings revealed that integrating Tic Tac-Toe with TPS strategy can improve students' collaboration skills from the observation score of 44.5 to 87.3. The N-gain was 0.8, which is included in the high category. Using games in learning with cooperative learning strategies such as TPS accompanied by worksheets is proven to provide students with an interactive and fun approach to mastering collaboration skills and global warming concepts.

Keywords: collaboration skills; global warming; think pair share; Tic-Tac-Toe

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INTRODUCTION

Learning in the 21st century must prepare generations of Indonesian people to face advances in information and communication technology in social life (Sarumaha et al., 2023; Tarbiyah et al., 2018). 21st century learning is actually an implication of societal developments from time to time. Therefore, students

need 21st-century skills, which are abbreviated as 4C, namely critical thinking, collaboration, creativity, and communication groups, so that information transfer occurs, resulting in changes in knowledge, attitudes and *skills* (Agustini et al., 2022; Muaddib, 2024).

Social constructivism theory emphasizes that students will gain



knowledge when carrying out social interactions where they are, and motivation theory explains what a teacher does to encourage students to develop their abilities optimally, including developing collaboration skills.

Collaboration ability is a student's ability to interact with other students to exchange ideas, solve problems, and work together to create a project (Adi et al., 2022; Nugraha & Haji, 2022; Sirait & Amnie, 2023). The ability to collaborate in the physics learning process has more value than the ability to study physics individually. Involving students' collaboration skills in learning will provide learning goals from just conveying information to constructing knowledge by individuals through group learning.

Based on the results of interviews with teachers in Madrasah Aliyah Al Iman Bulus Purworejo, students still lack collaboration skills. In the group learning process, students still behave individually. Most students do not want to join other students they don't like and prefer to be in groups with students they only like.

TPS type cooperative model is a learning model that allows students to work alone and collaborate with their classmates, be responsible for assignments, give and receive input, and have confidence in expressing opinions during learning (Anugrah et al., 2023; Lasnami, 2015; Sriyani, 2023). TPS can design discussion activities that can improve students' communication skills and stimulate their participation in learning to increase student learning outcomes. This learning model makes it easier for students to understand the material taught by the teacher. TPS strategy can give students more time to think, respond and help each other.

Games as a learning medium involve students in the experience process and at the same time, appreciate the challenges, get inspiration, are encouraged to be

creative and interact in activities with fellow students in playing this game (Kurniawan et al., 2019; Sanusi & Hasyda, 2021). Tic-Tac-Toe is a fun and challenging game because this game requires certain strategies to win the game. This game was chosen because its competitive nature can encourage students to be more enthusiastic in learning (Tsng et al., 2021).

Electronic student worksheets are a form of presenting independent learning materials that are systematically arranged into the smallest learning units. They achieve certain learning goals, and the format includes animation, audio, and navigation, which makes users more interactive with the program (Prayogi et al., 2023; Syaidah & Faizah, 2021). These media can also direct students to understand and raise self-confidence during learning activities (Cintari et al., 2024; Pratiwi & Margunayasa, 2022).

One such challenging topic in physics learning is global warming, a pressing issue that requires both individual and collective action to mitigate its impact (Eilam, 2022; Fajrin et al., 2024; Supriatna et al., 2024). Teachers need to seek innovative methods to teach global warming and other scientific concepts. There is a growing need to explore pedagogical strategies that foster student collaboration while enhancing their understanding of these issues. Understanding its causes, effects, and potential solutions requires cognitive engagement and collaborative problem-solving (Suryansyah et al., 2021; Baucal et al., 2023).

Unlike traditional applications of TPS, which typically emphasize individual processing and paired discussions (Azizah & Kuswanti, 2022; Syarif et al., 2021), the Tic-Tac-Toe adaptation encourages more dynamic, competitive teamwork. The combination in this study not only fosters a deeper understanding of the concept of global warming but also fosters critical thinking and peer

interaction in a fun and structured format. This innovative approach uses game-based learning elements to transform collaborative learning in environmental science topics.

The aim of this research is to determine the validity, practicality, and effectiveness of an electronic student worksheet on global warming based on the TPS strategy, using the Tic-Tac-Toe game to improve students' collaboration skills.

METHOD

The product developed in this research is a physics electronic worksheet based on TPS through the Tic-Tac-Toe game to improve students' collaboration skills. The development model used is the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Setiawan et al., 2021). The steps of the ADDIE development design are presented in Figure 1.

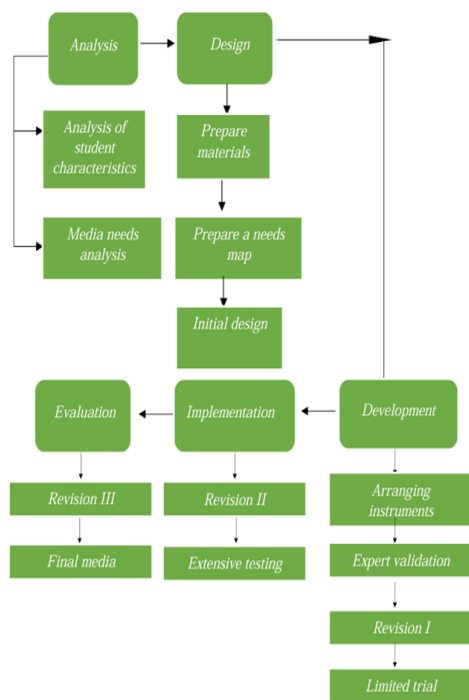


Figure 1 ADDIE model development design

The research subjects were class X students at Senior High School at Purworejo, with a sample of 34 students at the extensive trial stage. In this research, the data collection methods used were observation, validation sheets, questionnaires, and documentation. Data analysis techniques include validity testing, observation, and questionnaire. Two observers assess the guidelines for assessing students' collaboration skills on the sheet that has been provided.

RESULT AND DISCUSSION

The research aims to enhance students' collaboration skills by integrating the Tic-Tac-Toe game within the TPS strategy, particularly in the context of learning about global warming concepts. Below is a detailed account of the results and discussion, organized according to the ADDIE model.

Analysis

The analysis phase of this research focused on identifying the specific educational needs related to content knowledge and skill development. Collaboration skills were identified as a critical 21st-century competency that students must develop. Some aspects of collaboration skills used in this study are positive interdependence, personal responsibility, communication, teamwork, and teamwork (Adi et al., 2019; Balqist et al., 2019; Lelasari et al., 2017).

A needs analysis was conducted through discussions with teachers to review the student's current science and collaboration-based activities performance. It was found that while students were moderately aware of global warming as a concept, they needed more depth in their understanding and struggled with working effectively in groups. Due to its relevance and interdisciplinary nature, global warming is the subject matter, which requires students to think critically and work

together to understand various environmental and social issues (Eilam, 2022; Kurup et al., 2021; Widiyawati, 2020).

Design

The design phase focused on creating a learning module integrating the Tic-Tac-Toe game with the TPS strategy to promote collaboration. Tic-Tac-Toe was selected because it is a simple yet flexible game that can be adapted to various educational purposes.

The learning materials including the electronic worksheet were designed to guide students through the TPS strategy. The game's content was directly tied to the global warming concepts, and students had to work together to solve the questions before placing their marks on the worksheet. This game-based approach was meant to make learning engaging while encouraging the active participation of all group members (Hilliard & Kargbo, 2017; Topsakal & Harper, 2024). The electronic worksheet with steps of TPS strategy can be seen in Figure 2.

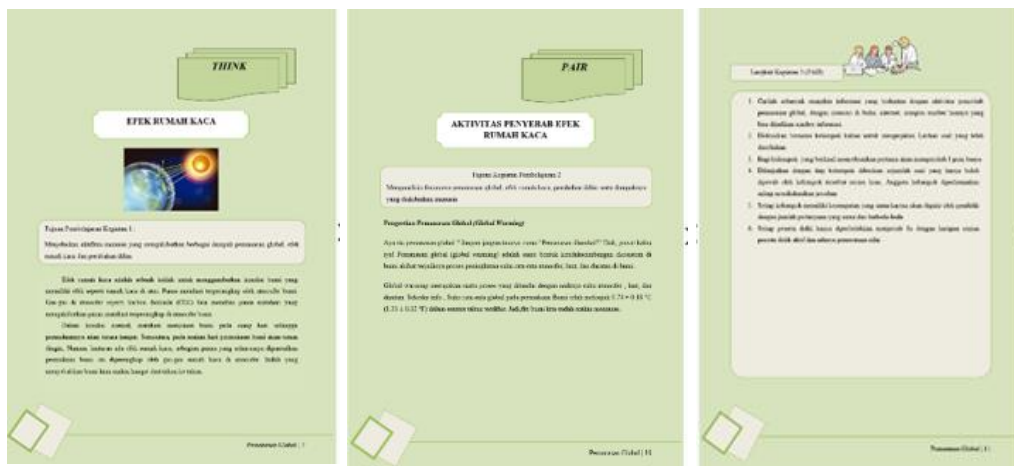


Figure 2 Display of electronic worksheet according to think pair share strategy

The electronic worksheet contains material accompanied by the thinking stage. Namely, students think to answer the questions given, pair up, group into 6 groups, hold discussions, and share; each group competes to answer questions.

Development

The development stage consists of assessments by material expert and media expert validators. The draft that has been validated and has gone through the revision stage is tested in schools.

Table 1 shows the validation results of the media expert and Table 2 shows the validation results of the material expert.

Table 1 Validation of media expert

No.	Validated Aspects	Score		Average Score	Reliability
		Expert 1	Expert 2		
1	Ease of use	8	8	8	100%
2	Design	20	16	18	88,3%
3	Media interaction	8	8	8	100%
	Total Score	3	32	34	94,2%

Table 2 Validation of material expert

No.	Validated Aspects	Score		Average Score	Reliability
		Expert 1	Expert 2		
1	Eligibility of content	7	7	7	100%
2	Think	8	6	7	85,8%
3	Pair	4	4	4	100%
4	Share	27	27	27	100%
	Total Score	46	44	45	78%

The results in Table 1 and 2 show that the TPS-based electronic worksheet through the Tic-tac-Toe game that the researcher has developed is suitable for use with the assessment of the validator included in the good category. The validation results in terms of material show that the feasibility and interaction of the media obtained a high score because it is in accordance with the competency standards. The validity of the TPS-based electronic worksheet through the Tic Tac Toe game in terms of media as a whole is considered suitable for use. This study is in line with research conducted by (Ricky Ardiansah & Zulfiani, 2023; Widianingrum, 2023; Zahroh & Yuliani, 2021) that the learning products

developed already have a quality that is suitable for use using the basis of the validation results of material and media experts.

Implementation

The implementation stage aims to determine the improvement in students' collaboration skills. Observation data on collaboration skills in learning activities were obtained through observations by two observers during the learning process until the completion of the learning activity using an observation sheet. The result of students' collaboration skills obtained from the observation during the learning process is presented in Table 3.

Table 3 Observation Results of Collaboration Skills

No.	Aspect	Average Score Observers		N-Gain	category
		Initial	Final		
		1	Positive Interdependence		
2	Personal Responsibility	46.5	84.5	0.7	Moderate
3	Communication	45.6	85.3	0.7	Moderate
4	Teamwork	44.1	94.1	0.9	Moderate
	Average	45.5	87.3	0.8	High

The teamwork aspect scored the highest compared to other aspects; this can be seen in students discussing with each other. This is also encouraged by the Think Pair Share learning model because students are required to discuss with each other. The results of similar studies on students' collaboration skills were also found to increase through other models, namely project-based learning using

Zoom on ecosystem material (Alfaeni et al., 2022; Fawwaziara et al., 2024).

Evaluation

The questionnaire data of the students' responses were obtained after completing the learning activities with TPS through the Tic-Tac-Toe game. The response data can be seen in Table 4.

Table 4 Student response questionnaire data

No.	Aspect	Percentage	Criteria
1	Ease of content	82.30%	Practical
2	Design	86.90%	Very practical
3	Media interaction	88.90%	Very practical
	Average	86.03	Very practical

Student feedback from the questionnaires also revealed that most students found the game enjoyable and felt it helped them better understand global warming concepts. Additionally, the observation sheets confirmed that students were more engaged in learning than traditional lecture-based methods.

Integrating Tic-Tac-Toe and the Think-Pair-Share strategy in learning global warming concepts proved to be an effective approach for enhancing students' collaboration skills. The game-based learning environment fostered interaction and teamwork, while the structured TPS strategy ensured that all students could participate in meaningful discussions. This combination of methods supports the social learning theory, which emphasises collaboration's role in cognitive development.

CONCLUSION

This study showed the effectiveness of integrating Tic-Tac-Toe game with TPS strategy in improving students' collaboration skills while learning the concept of global warming. The results showed improved students' collaboration skills, with an average observation score of 45.5 to 87.3. It has an N-gain of 0.8, indicating a high level of improvement. Using game-based learning, combined with cooperative learning strategies such as TPS accompanied by worksheets, provided students with an interactive and fun approach to mastering collaboration skills and the concept of global warming. Future research can explore the application of this method to other scientific topics and the overall development of student's skills.

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