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The Influence of the Team Games Tournament (TGT) Learning Model Assisted by Wordwall on the Scientific Literacy of Class V Elementary School Students

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Abstract: This study aims to present the results of a study that compares the effectiveness of two learning methods, namely the Team Games Tournament (TGT) assisted by Wordwall and conventional learning methods, in improving the science literacy skills of grade V elementary school students. The research method uses a quasi-experimental method by using an experimental class applying TGT assisted by Wordwall, while the control class uses conventional learning methods. Data obtained from both groups of students were analyzed to evaluate the improvement of science literacy skills. The results showed that the experimental class experienced a significant improvement in science literacy skills compared to the control class. Wordwall-assisted TGT approach creates a more interactive, collaborative, and engaging learning environment for students, which encourages active participation and increases their motivation to learn. On the other hand, conventional methods show some students experiencing a decline in ability, highlighting the need for a more varied and interactive approach to learning. These results underscore the importance of innovation in learning methods to improve the quality of science education in primary schools, with great potential to apply the Wordwall-assisted TGT model widely in this context.

Keywords: Cooperative learning; Science literacy; TGT; Wordwall

Introduction

Education in the era of globalization requires innovation in the learning process to prepare a competent generation and able to compete in the global arena. One of the most important competencies is science literacy, which is the ability to understand, evaluate, and apply science knowledge in everyday life (Jamaluddin et al., 2019; Lestari et al., 2021). Science literacy is not only related to factual knowledge, but also includes the ability to think critically, solve problems, and apply scientific concepts. However, based on observations and empirical data, the science literacy ability of students in Indonesia is still relatively low. This is a big challenge for the world of education to find effective learning methods in improving students' science literacy. Innovative and interactive learning models are believed to have a positive impact on students' science literacy skills. One of the learning models that has been widely applied and proven effective is the cooperative learning model. In this model, students work together in small groups to achieve shared learning goals. Among the various types of cooperative learning models, Team Games Tournament (TGT) is one of the most interesting and fun for students. TGT incorporates elements of play and competition in the learning process, which can increase student motivation and engagement (Aranzabal et al., 2022). However, the challenge in applying the TGT model is how to make the game more interesting and

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relevant to the subject matter being taught. This is where the role of technology becomes very important. Wordwall, a digital platform that provides a variety of educational game templates, can be a solution to integrate TGT in science learning. With Wordwall, teachers can create interactive games that suit the subject matter and student needs, making the learning process more fun and meaningful (Cerón-García et al., 2022; Sukmawati, Kadarohman, et al., 2021; Sukmawati, Sari, et al., 2022). Although many studies have shown the effectiveness of cooperative learning models and the use of technology in learning, there are still research gaps that need to be filled. First, research on the use of Wordwall-assisted TGT in science learning at the elementary school level is still very limited. Most research focuses more on higher levels of education or on other subjects. Second, there have not been many studies that specifically measure the impact of the Wordwall-assisted TGT learning model on students' science literacy skills. In fact, science literacy is a very important competency and is one of the indicators of the quality of education at the international level (Sukmawati, Kadarohman, et al., 2022).

This study aims to fill this gap by exploring the influence of the Wordwall-assisted Team Games Tournament (TGT) learning model on the science literacy of grade V elementary school students. This research is expected to make a significant contribution in the field of education, especially in the development of innovative and effective learning methods to improve students' science literacy. In addition, this research is also expected to provide practical guidance for teachers in implementing the Wordwall-assisted TGT learning model in their classrooms (Nurliana et al., 2023; Wahjusaputri et al., 2022). The background of this research starts from the problem of low student science literacy in Indonesia.

Based on the results of the Programme for International Student Assessment (PISA) survey conducted by the Organization for Economic Co-operation and Development (OECD)(OECD, 2018), the science literacy ability of Indonesian students is below the international average. This shows that there are still many students who are not able to understand and apply science concepts in daily life. This low science literacy can be caused by various factors, one of which is less effective learning methods and the lack of use of technology in learning (Fauziah et al., 2023; Fikriyah et al., 2022; Sukmawati et al., 2021). In the context of science learning, an interactive and fun approach is essential to engage students. The TGT learning model offers a solution by combining elements of play and competition, which can increase student motivation and engagement. However, in order for TGT to run effectively, a media is needed that can support the implementation of the game. Wordwall, with its various interactive features, can be a very suitable medium to support TGT learning. This study uses a quantitative approach with an experimental design. The subject of the study was a grade V student at SDN in Jakarta. Data collection was carried out through science literacy tests before and after the implementation of the Wordwall-assisted TGT learning model. In addition, data was also collected through observation and questionnaires to see the level of student engagement and motivation during the learning process.

Data analysis was carried out using statistical tests to see the difference in science literacy skills before and after the implementation of the learning model. The results of this study are expected to provide empirical evidence about the effectiveness of the Wordwall-assisted TGT learning model in improving students' science literacy. The findings of this research are also expected to be the basis for the development of more innovative and technology-based education policies. In addition, this research is also expected to contribute to the development of cooperative learning theory and the use of technology in education. This research not only focuses on improving students' science literacy, but also on the development of more effective and innovative learning methods. This research is expected to make a significant contribution to efforts to improve the quality of education in Indonesia, especially in the field of science. Through this research, it is hoped that a learning model can be found that is not only effective in improving science literacy, but also fun and motivates students to learn.

This research also has important practical implications for teachers. By using the Wordwall-assisted TGT learning model, teachers can create a more interactive and fun learning environment. This is expected to increase students' learning motivation and ultimately improve their learning outcomes. In addition, this research is also expected to be a reference for curriculum developers and policymakers in developing more innovative and technology-based educational programs (Kusnadi et al., 2023; Sukmawati et al., 2023; Wanningrum et al., 2023). This research aims to make a real contribution to efforts to improve students' science literacy in Indonesia. With the application of the Wordwall-assisted TGT learning model, it is hoped that a more effective, interactive, and fun learning process can be created, so that it can improve students' science literacy skills and prepare them to face future challenges. This research is also expected to be a starting point for further research in the field of education, especially in the use of technology and innovative learning methods.

Method

This study uses a quantitative approach with an experimental design to explore the influence of the Wordwall-assisted Team Games Tournament (TGT) learning model on the science literacy of grade V elementary school students. The research design applied is a quasi-experiment with a pretest-posttest control group design. In this design, there are two groups, namely the experimental class and the control class. The experimental class received treatment in the form of applying the Wordwall-assisted TGT learning model, while the control class underwent conventional learning. The population of this study is all grade V students at SDN Baru 02 Pagi. The research sample was selected using the purposive sampling technique, consisting of two classes each containing 30 students, so that the total sample was 60 students. The main instrument used in this study is a science literacy test which is compiled based on science literacy indicators that are relevant to the curriculum. This test consists of multiple-choice questions and descriptions that have been validated by material experts and tested to determine the level of reliability. In addition to tests, observation sheets and learning motivation questionnaires are also used to measure the level of student engagement and motivation during the learning process.

The research procedure begins with preparation which includes the development of a learning implementation plan (RPP) which includes the application of the Wordwall-assisted TGT model, the preparation of science literacy test instruments, observation sheets, and motivational questionnaires, as well as the validation of instruments by material experts and instrument trials. The next stage is the implementation of pretests for both groups (experimental class and control class) to measure students' initial science literacy skills. After that, the experimental class was given treatment in the form of applying the Wordwall-assisted TGT learning model for six weeks, while the control class carried out conventional learning with lecture and question and answer methods. After the treatment, both groups were given a posttest to measure the students' final science literacy skills. Additional data were collected through observation sheets to record student engagement during the learning process in the experimental classroom and questionnaires to measure students' learning motivation in the experimental classroom. Data analysis was carried out using the Rasch model with stacking and racking techniques. The Rasch model was chosen because it is able to provide more accurate and valid estimates for students' abilities (Aisyah et al., 2023; Novianti et al., 2023; Ramadhani et al., 2022).

The stacking technique is used to combine the pretest and posttest data of each student into a single data set, allowing longitudinal analysis to see changes in science literacy abilities over time. The racking technique is used to separate pretest and posttest data by group (experiment and control), allowing for comparative analysis between the experimental group and the control group. Pretest and posttest data from both groups were fed into Rasch analysis software. The stacking technique is used to measure the improvement of students' science literacy skills through pretest and posttest data, while the racking technique is used to measure the difficulty level of questions in both the experimental and control groups (Laliyo et al., 2022; Sumintono, 2018). The results of Rasch's analysis were then interpreted to see the influence of the Wordwall-assisted TGT learning model on students' science literacy. By using the experimental design and data analysis based on the Rasch model, this study is expected to provide an accurate picture of the influence of the Wordwall-assisted TGT learning model on the science literacy of grade V students.

Result and Discussion

The results of data analysis using the Rasch model with racking technique showed that there was a significant difference between the science literacy ability of students in the experimental class and the control class. From Table 1 and Table 2, it can be seen that the average value of the pretest in the experimental class is -0.3533333 with a standard deviation (S.D.) of 2.0365401, while the average value of the posttest is -0.937 with S.D. 1.7766225. Meanwhile, in the control class, the average score of the pretest was 0.257 with S.D. 1.2426535, and the average score of the posttest was -0.386 with S.D. 1.2965534. The difference in the average score of the pretest and posttest in both classes showed that there was a more significant increase in science literacy skills in the experimental class compared to the control class. In the experimental class, although the average score of the posttest was still below zero, the decrease in the score showed an improvement in the initial ability. This can be seen from the decrease in standard deviation, which indicates an increase in the homogeneity of science literacy skills among students (Apriliana et al., 2021; Fitria et al., 2022).

In contrast, in the control class, although the average score of the posttest also decreased, the change was not as obvious as in the experimental class. This shows that the conventional learning methods applied to the control class are less effective in improving students' science literacy skills. In fact, some items showed a more significant decrease in ability in the posttest than in the pretest, indicating a lack of

effectiveness of conventional learning in overcoming students' difficulties in certain items (Sukmawati, 2022; Sukmawati et al., 2021). The treatment in the form of a Wordwall-assisted TGT learning model in the experimental class seems to make a positive contribution in improving students' science literacy. The TGT model encourages students to actively participate in learning through games and tournaments, which can increase student motivation and engagement. The use of Wordwall as a tool also allows for a more interactive and engaging presentation of the material, thus helping students understand science concepts better. From the results of the item analysis, several items show a significant increase in capabilities after the implementation of the Wordwall-assisted TGT model. For example, items 1, 4, and 15 in the experimental class showed a significant increase in posttest scores compared to pretest. Item 4, which had a very high pretest score (5.02) and a lower posttest score (3.14), indicated that students began to understand the concepts better and were able to answer the questions more correctly, although the standard error (S.E.) for this item decreased from 1.03 to 0.52. In contrast, in the control class, some items such as items 4 and 24 showed a decrease in ability on the posttest. Item 24, for example, has a pretest score of -1.37 and posttest -3.78, indicating that students have difficulty understanding the concepts tested by this item. This decline may be due to conventional learning methods that do not provide enough variety and interaction in the learning process, so that students are less motivated to learn and understand the material well.

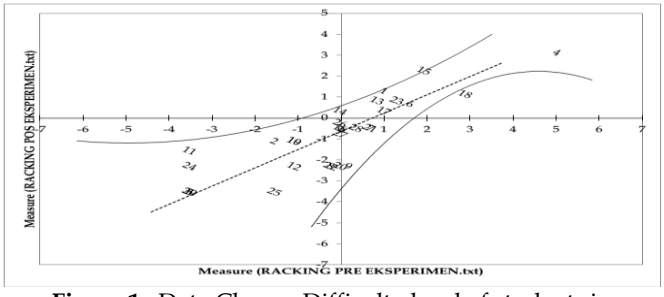

Figure 1. Data Change Difficulty level of students in experimental

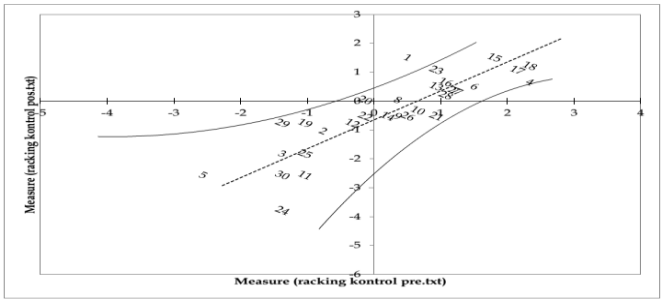

Figure 2. Data change difficulty level of students in control classes

The results of this study show that the Wordwall-assisted TGT learning model is more effective in improving students' science literacy compared to conventional learning methods. The increase in the homogeneity of students' abilities in the experimental classroom also shows that this model not only helps students who have high abilities but also students who previously had low abilities. This shows that the Wordwall-assisted TGT model can be an effective alternative to improve the quality of science learning in elementary schools. However, this study also has limitations that need to be considered. The limited sample size and implementation of the learning model in just a six-week period may not be enough to provide a comprehensive picture of the effectiveness of this model in the long term. Therefore, further research with a larger sample and a longer period is needed to confirm these findings and explore the potential application of Wordwall-assisted TGT models in different learning contexts. For more clarity, you can see in figures 1 and 2.

Table 1. Results of Experimental Class Racking Analysis

Items	Pretest		Posttest	
	Measure	S.E.	Measure	S.E.
1	1	0.39	1.3	0.39
2	-1.55	0.74	-1.09	0.62
3	-3.52	1.83	-3.52	1.83
4	5.02	1.03	3.14	0.52
5	-3.52	1.83	-3.52	1.83
6	1.61	0.4	0.68	0.4
7	0.68	0.4	-0.47	0.51
8	-0.24	0.47	-2.29	1.03
9	0.17	0.43	-2.29	1.03
10	-1.09	0.62	-1.09	0.62
11	-3.52	1.83	-1.55	0.74
12	-1.09	0.62	-2.29	1.03
13	0.84	0.4	0.84	0.4
14	-0.02	0.45	0.35	0.42
15	1.93	0.41	2.27	0.43
16	-0.02	0.45	-0.47	0.51
17	1	0.39	0.35	0.42
18	2.89	0.48	1.15	0.39
19	-1.09	0.62	-1.09	0.62
20	-0.02	0.45	-2.29	1.03
21	0.68	0.4	-0.47	0.51
22	-0.24	0.47	-2.29	1.03
23	1.3	0.39	0.84	0.4
24	-3.52	1.83	-2.29	1.03
25	-1.55	0.74	-3.52	1.83
26	-0.02	0.45	-0.24	0.47
27	-0.02	0.45	-0.75	0.55
28	0.35	0.42	-0.47	0.51
29	-3.52	1.83	-3.52	1.83
30	-3.52	1.83	-3.52	1.83
Mean	-0.3533333		-0.937	
S.D.	2.0365401		1.7766225	

Table 2. Control Class Racking Analysis Results Data

Items	Pretest		Posttest	
	Measure	S.E.	Measure	S.E.
1	0.51	0.38	1.51	0.38
2	-0.76	0.5	-1.03	0.55
3	-1.37	0.62	-1.82	0.74
4	2.34	0.44	0.66	0.38
5	-2.56	1.02	-2.56	1.02
6	1.51	0.38	0.51	0.38
7	1.22	0.38	0.36	0.39
8	0.36	0.39	0.04	0.41
9	0.36	0.39	-0.52	0.47
10	0.66	0.38	-0.32	0.44
11	-1.03	0.55	-2.56	1.02
12	-0.32	0.44	-0.76	0.5
13	0.94	0.37	0.51	0.38
14	0.21	0.4	-0.52	0.47
15	1.81	0.4	1.51	0.38
16	1.08	0.37	0.66	0.38
17	2.15	0.42	1.08	0.37
18	2.34	0.44	1.22	0.38
19	-1.03	0.55	-0.76	0.5
20	-0.13	0.42	0.04	0.41
21	0.94	0.37	-0.52	0.47
22	-0.13	0.42	-0.52	0.47
23	0.94	0.37	1.08	0.37
24	-1.37	0.62	-3.78	1.82
25	-1.03	0.55	-1.82	0.74
26	0.51	0.38	-0.52	0.47
27	1.22	0.38	0.36	0.39
28	1.08	0.37	0.21	0.4
29	-1.37	0.62	-0.76	0.5
30	-1.37	0.62	-2.56	1.02
Mean	0.257		-0.386	
S.D.	1.2426535		1.2965534	

The results of data analysis showed that the average decrease in the difficulty level of the questions in the experimental class was 0.584, while in the control class it was 0.643. Although the control class experienced a slightly greater decrease in question difficulty, it is important to understand the context behind these numbers. The decrease in difficulty levels in both classes reflects an improvement in students' science literacy skills after the learning intervention (Fikriyah et al., 2022b; Sukmawati, 2023; Wati Sukmawati et al., 2023). The Wordwall-assisted Team Games Tournament (TGT) learning model applied in the experimental class was still able to significantly reduce the difficulty level of the questions.

The TGT method encourages student interaction through engaging game activities and competitions, increasing motivation and active participation in learning. The use of Wordwall as an interactive tool allows for a more engaging presentation of the material, helping students understand science concepts better. On the other hand, the control class that used conventional learning methods also showed a decrease in the level of difficulty, but the difference was not too far compared to the experimental class. This shows that conventional methods still have some effectiveness in teaching science literacy, but may be lacking in aspects of student interactivity and engagement. However, the small difference in difficulty between the two classes indicates that other factors may play a role, such as the background of the student's initial ability or the duration and intensity of the learning intervention. Therefore, although the reduction in difficulty level in the experimental class is not as large as expected, the Wordwall-assisted TGT model still shows the potential as an innovative and effective learning method to improve students' science literacy in elementary school. Further studies with larger samples and longer intervention periods are needed to confirm these findings and optimize the application of the TGT method in educational contexts. For more clarity, see figures 3 and 4.

The variation in the difficulty levels of questions between the experimental and control classes can be attributed to the different learning methods employed. In the experimental class, which utilized the Team Games Tournament (TGT) model with Wordwall assistance, students encountered challenges particularly with questions 1, 2, 11, 14, 15, and 24. Conversely, the control class, using conventional learning methods, struggled with questions 1, 19, 20, 23, and 29. These difficulties likely reflect differences in instructional approaches and student engagement.

The TGT method with Wordwall emphasizes interaction, collaboration, and gamified learning, which may aid in grasping basic concepts but falls short in addressing questions that require deeper understanding or complex application. Conventional methods, while potentially less engaging, may still present challenges in simpler yet demanding questions due to lower student motivation and engagement.

Research indicates that cooperative learning models like TGT can boost student motivation and academic performance, but their success hinges on effective student interaction and collaboration. In this study, the discrepancy in question difficulty between the two classes suggests that while the Wordwall-assisted TGT approach enhances participation (Nadrah et al., 2017), it requires refinement to effectively tackle specific problem areas.

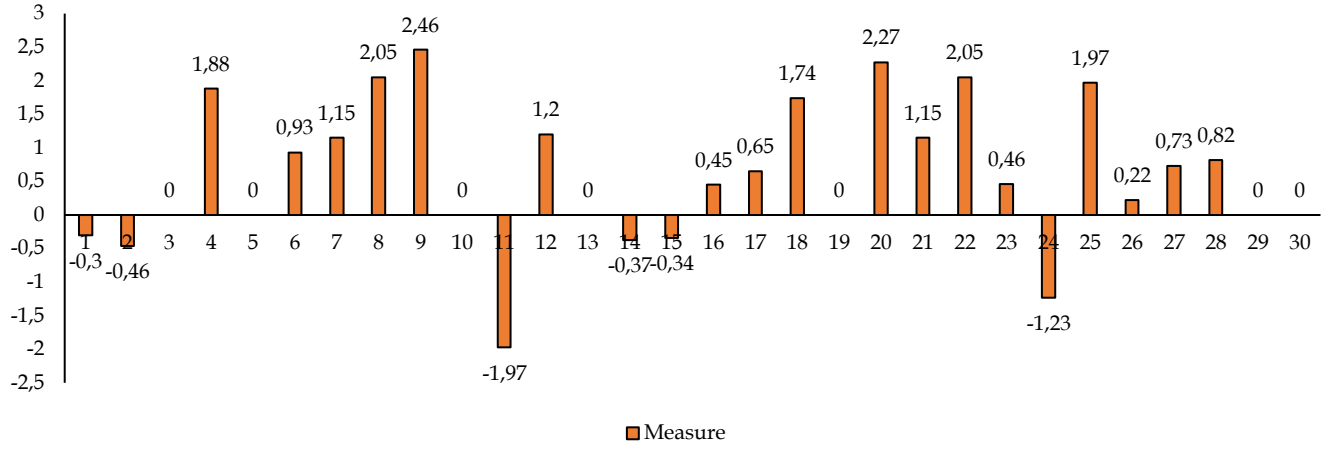

Figure 3. Data change difficulty level of students in experimental

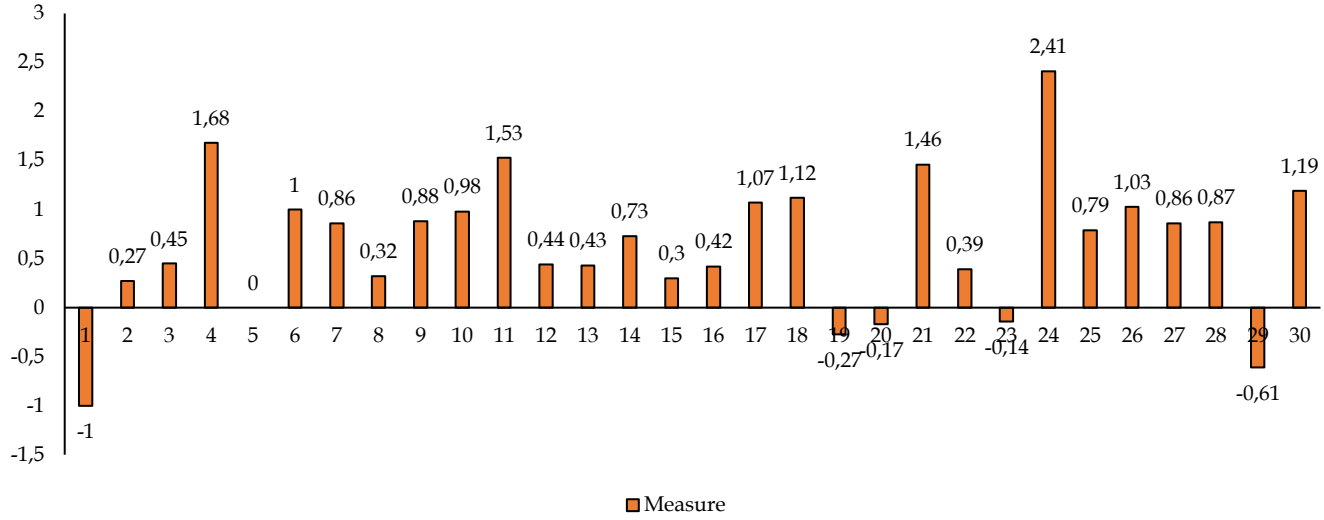

Figure 4. Data change difficulty level of students in control classes

Additionally, research on cooperative learning underscores the importance of student interaction for comprehensive concept understanding, but also highlights the crucial role of teacher guidance in steering discussions and activities. This could explain the experimental class's struggles with certain questions needing targeted guidance. While the Wordwall-assisted TGT method offers numerous advantages, further adjustments and teacher support may be necessary to overcome specific student difficulties. This analysis underscores the need to identify and optimize the strengths and weaknesses of each learning method to meet educational needs effectively.

Data stacking from the experimental and control classes provides in-depth insights into the improvement of students' science literacy skills after the application of different learning methods. In the experimental class, which uses the Team Games Tournament (TGT) learning model assisted by Wordwall, the average pretest measure is -1.09 with a standard deviation of 1.83, while the average posttest measure is -0.19 with a standard deviation of 1.92. This shows an average increase of 0.895, which reflects an improvement in students' science literacy skills after more interactive and collaborative learning interventions.

Table 3. Stacking of Experimental Classes

Person	Pretest		Posttest	
	Measure	S.E.	Measure	S.E.
1	1	0.39	1.3	0.39
2	-1.55	0.74	-1.09	0.62
3	-3.52	1.83	-3.52	1.83
4	3.14	0.52	5.02	1.03
5	-3.52	1.83	-3.52	1.83
6	0.68	0.4	1.61	0.4
7	-0.47	0.51	0.68	0.4
8	-2.29	1.03	-0.24	0.47
9	-2.29	1.03	0.17	0.43
10	-1.09	0.62	-1.09	0.62
11	-3.52	1.83	-1.55	0.74

Person	Pretest		Posttest	
	Measure	S.E.	Measure	S.E.
12	-2.29	1.03	-1.09	0.62
13	0.84	0.4	0.84	0.4
14	-0.02	0.45	0.35	0.42
15	1.93	0.41	2.27	0.43
16	-0.47	0.51	-0.02	0.45
17	0.35	0.42	1	0.39
18	1.15	0.39	2.89	0.48
19	-1.09	0.62	-1.09	0.62
20	-2.29	1.03	-0.02	0.45
21	-0.47	0.51	0.68	0.4
22	-2.29	1.03	-0.24	0.47
23	0.84	0.4	1.3	0.39
24	-3.52	1.83	-2.29	1.03
25	-3.52	1.83	-1.55	0.74
26	-0.24	0.47	-0.02	0.45
27	-0.75	0.55	-0.02	0.45
28	-0.47	0.51	0.35	0.42
29	-3.52	1.83	-3.52	1.83
30	-3.52	1.83	-3.52	1.83
Mean	-1.0926667		-0.1976667	
S.D.	1.8377666		1.922581	

Table 4. Stacking Control Classes

Person	Pretest		Posttest	
	Measure	S.E.	Measure	S.E.
1	1.12	0.44	2.02	0.52
2	0.57	0.42	1.12	0.44
3	-0.31	0.43	1.12	0.44
4	1.32	0.45	1.32	0.45
5	-0.13	0.42	0.75	0.43
6	-0.31	0.43	2.02	0.52
7	0.05	0.42	0.4	0.42
8	0.05	0.42	0.4	0.42
9	1.12	0.44	1.32	0.45
10	0.93	0.43	0.93	0.43
11	1.12	0.44	1.32	0.45
12	2.02	0.52	2.32	0.57
13	1.32	0.45	1.77	0.49
14	2.32	0.57	1.32	0.45
15	0.75	0.43	1.12	0.44
16	-0.87	0.45	1.32	0.45
17	1.54	0.47	3.15	0.75
18	1.32	0.45	1.32	0.45
19	1.12	0.44	2.02	0.52
20	0.4	0.42	0.05	0.42
21	0.57	0.42	1.12	0.44
22	0.4	0.42	1.12	0.44
23	-0.87	0.45	0.57	0.42
24	1.32	0.45	1.77	0.49
25	1.12	0.44	1.77	0.49
26	0.05	0.42	0.93	0.43
27	1.32	0.45	2.02	0.52
28	1.32	0.45	1.77	0.49
28	1.32	0.45	1.54	0.47
30	1.32	0.45	1.32	0.45
Mean	0.7773333		1.368	
S.D.	0.7755812		0.6270428	

On the other hand, in the control class that uses conventional learning methods, the average pretest measure is 0.78 with a standard deviation of 0.78, and the average posttest measure is 1.368 with a standard deviation of 0.62. The average increase of 0.59 in the control class showed that the conventional method was also effective in improving students' science literacy skills, but the increase was not as large as that achieved by the experimental class. This difference can be attributed to the difference in learning approaches. Wordwall-assisted TGT models allow students to learn through fun and interactive activities, which can increase their motivation and engagement in the learning process. Students are more likely to remember and understand science concepts when they are actively involved in games and competitions. In addition, Wordwall as an interactive tool allows for a more engaging and diverse presentation of material, which helps students in overcoming difficulties on more complex concepts.

On the other hand, conventional learning methods tend to focus more on direct instruction from the teacher and individual practice. While effective, these methods may be less able to motivate students and engage them in the learning process in depth. This may result in a smaller increase in science literacy skills, as reflected in the data. Previous research supports these findings, suggesting that cooperative learning can improve student learning outcomes better compared to conventional methods (Salam et al., 2015). Cooperative learning, such as TGT, enhances social interaction and collaboration among students, which can deepen their understanding of the material. Additionally, a more interactive and fun approach can help students to be more engaged and motivated in learning. For more clarity, see figures 5 and 6.

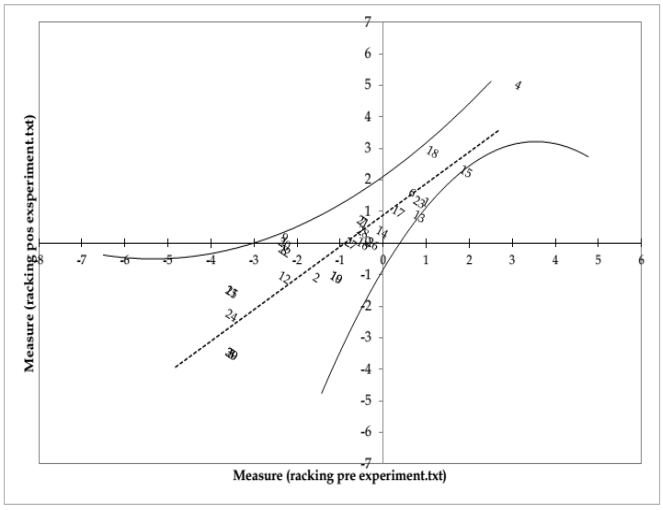

Figure 5. Changes in science literacy in experimental

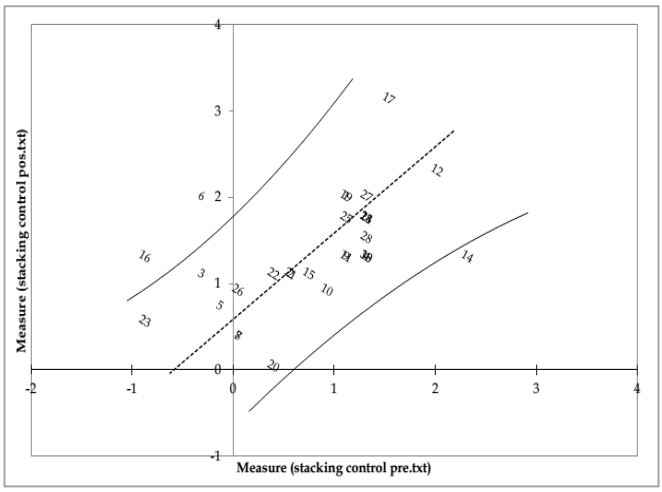

Figure 6. Changes in science literacy in control classes

Data analysis showed that the average increase in science literacy skills in the experimental class was 0.895, while in the control class it was 0.591. The greater increase in the experimental class reflects the effectiveness of the Wordwall-assisted Team Games Tournament (TGT) learning model in improving students' science literacy skills. The Wordwall-assisted TGT method encourages active participation, collaboration, and more engaging game-based learning for students. Interactive and competitive activities such as those presented by TGT, allow students to be more involved in the learning process, increase motivation, and deepen their understanding of science concepts (Ifdaniyah et al., 2024; Wahjusaputri et al., 2022).

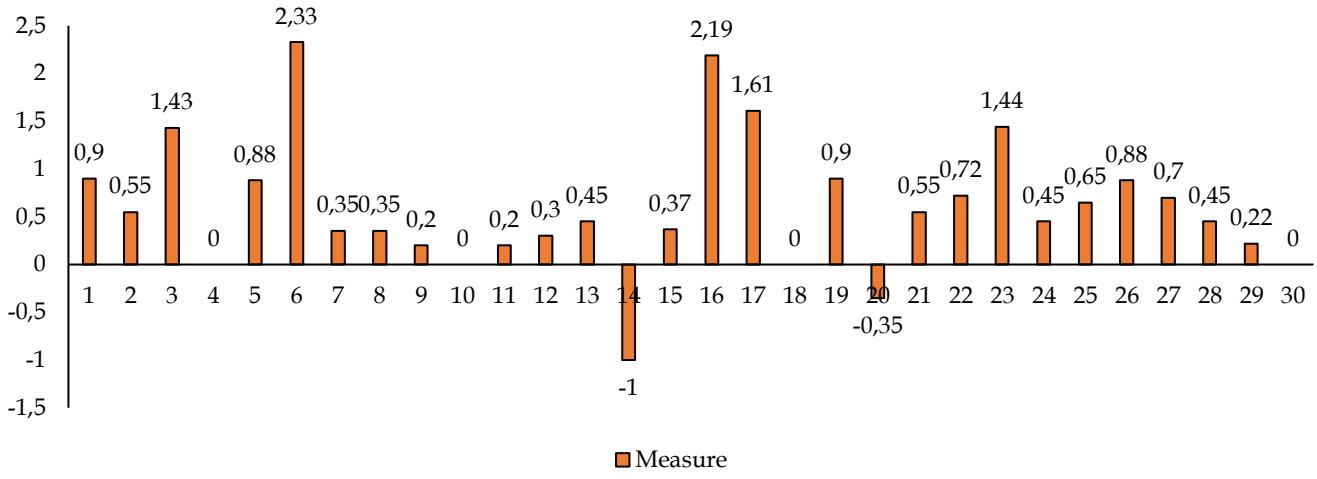

Figure 7. Improving the ability of science literacy of students in control classes

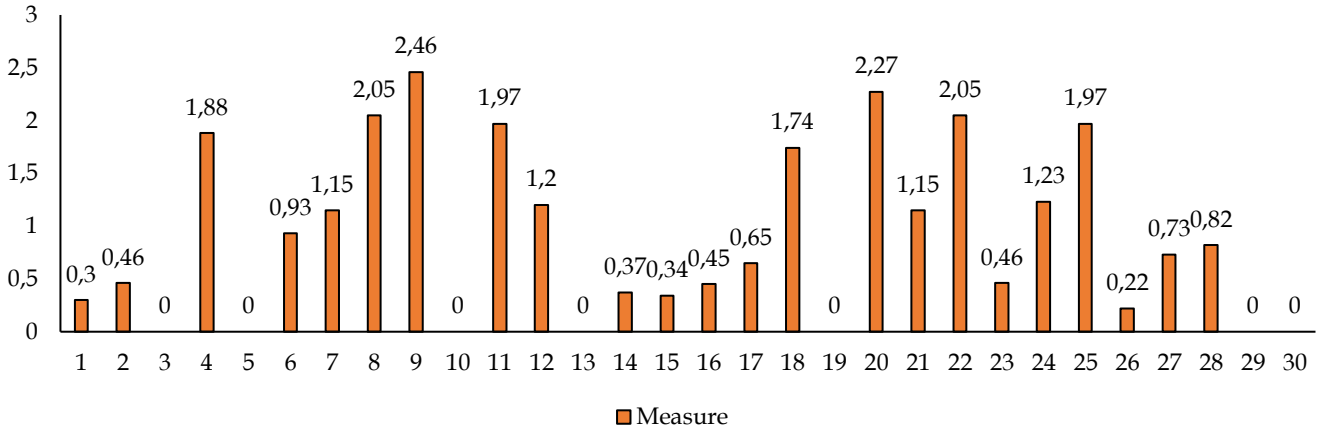

Figure 8. Improving the ability of science literacy of students in experimental

Meanwhile, the improvement of science literacy skills in control classes using conventional learning methods shows that this method also has effectiveness, but lacks in the interactive and engaging aspects of students. Conventional methods tend to focus more on hands-on teaching and individualized exercises, which may not sufficiently motivate students or support collaborative learning that can be helpful in understanding more complex material. Previous research supports the finding that cooperative learning,

such as TGT, can improve student learning outcomes better compared to conventional methods. Cooperative learning promotes social interaction and collaboration, which in turn can deepen students' understanding of the material (Salam et al., 2015). The greater improvement in experimental classrooms suggests that innovative and interactive learning approaches, such as Wordwall-assisted TGT, can provide additional advantages in improving students' science literacy skills (Sukmawati et al., 2018; Sukmawati, Handayani, et al., 2022). This emphasizes the importance of adopting more modern and fun learning methods to achieve better educational outcomes. Thus, learning models that utilize technology and active interaction such as Wordwall-assisted TGT should be considered for wider application in an effort to improve the quality of science education in elementary schools.

The difference in the results of improving science literacy skills between the experimental and control classes provides important insights into the effectiveness of the learning methods used. In the experimental class, all students experienced a significant increase in science literacy skills, which can be attributed to the Team Games Tournament (TGT) learning model assisted by Wordwall (Figure 9).

Figure 9. Learning activity

This model encourages active participation, interaction, and game-based learning, all of which contribute to increased student motivation and engagement. Students who engage in interactive and collaborative learning tend to be more motivated, understand the material better, and enjoy the learning process, which overall improves their learning outcomes. On the other hand, in the control class, two students (numbers 14 and 20) experienced a decrease in science literacy skills (Sukmawati et al.,, 2024; Wahjusaputri et al., 2022, 2024). This decline can be caused by several factors, including a lack of engagement and motivation. The conventional learning methods used may be less appealing to some students, so they are not motivated to learn or actively participate. The lack of variation in teaching methods and limitations in individualization approaches may also contribute to this decline. Students with different learning needs may not get enough attention in traditional learning methods, which focus on hands-on instruction and individual practice without much interaction. In addition, external factors such as students' emotional state and learning environment can also affect their learning outcomes. Students number 14 and 20 may face personal issues or lack of home-study support, which can hinder their ability to study effectively (Ifdaniyah et al., 2024; Kusnadi et al.,2023; Muthi'ah et al., 2023).

Previous research emphasizes the importance of student motivation and involvement in the learning process to achieve optimal learning outcomes (Istiqomah et al., 2023; Izzah et al., 2022; Nurliana et al., 2023). Engaging and interactive learning, such as the one done in Wordwall-assisted TGT models, can help address some of these challenges by providing a more dynamic and supportive learning environment. This emphasizes the need to diversify teaching methods to meet the different learning needs of each student and improve overall learning outcomes.

Conclusion

The study examines the effectiveness of the Wordwall-assisted Team Games Tournament (TGT) learning model compared to traditional methods in enhancing science literacy skills among fifth-grade elementary students. Results indicate that the Wordwall-assisted TGT method significantly outperforms conventional approaches. Students in the experimental group demonstrated a notable increase in science literacy skills, with an average improvement of 0.895 compared to 0.591 in the control group. This highlights the method's success in fostering a more interactive and engaging learning environment through collaborative games and competitions, thereby boosting student motivation and participation. Conversely, the control group, relying on traditional methods, saw declines in some students' science literacy skills, suggesting the limitations of less varied and interactive teaching approaches. The research underscores the benefits of cooperative learning in enhancing educational outcomes and advocates for innovative approaches to improve science education in elementary schools, emphasizing the potential of the Wordwall-assisted TGT model for broader application.

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Author Contributions
For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, A.L.S contributed to the data collection process, data processing, and article writing. W.S contributed to the data processing and article writing.

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The authors declare no conflict of interest.

References

Aisyah, W. N., Novianti, R., Sukmawati, W., & Fikriyah, A. N. (2023). Student Response Conceptual Change Text (CCT) As A Media for Learning Energy Concepts in Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 417–421. https://doi.org/10.29303/jppipa.v9i1.2187

Apriliana, S. M., & Sukmawati, W. (2021). Efektivitas Pembelajaran Daring Pada Minat Belajar Siswa Mata Pelajaran IPA Di Kelas II SDN Lumpang 01. *Elementary School: Jurnal Pendidikan Dan Pembelajaran Ke-SD-An*, *8*(2), 329–335. https://doi.org/10.31316/esjurnal.v8i2.1504

Aranzabal, A., Epelde, E., & Artetxe, M. (2022). Team formation on the basis of Belbin's roles to enhance students' performance in project based learning. *Education for Chemical Engineers*, *38*(September 2021), 22–37. https://doi.org/10.1016/j.ece.2021.09.001

Cerón-García, M. C., López-Rosales, L., Gallardo-Rodríguez, J. J., Navarro-López, E., Sánchez-Mirón, A., & García-Camacho, F. (2022). Jigsaw cooperative learning of multistage counter-current liquid-liquid extraction using Mathcad®. *Education for Chemical Engineers*, *38*(September 2021), 1–13. https://doi.org/10.1016/j.ece.2021.10.002

Fauziah, N., & Sukmawati, W. (2023). *Stacking Analysis of Higher Thinking Skills of Class V Elementary School Students on the Material of Movement Organs Using the RADEC Model*. *9*(1), 1–4. https://doi.org/10.29303/jppipa.v9i7.3926

Fikriyah, A. N., & Sukmawati, W. (2022a). Pengembangan Media Pembelajaran Learning Management System (LMS) Berbasis Moodle pada Materi Perubahan Energi. *Jurnal Ideas*, *8*(1), 191–196. https://doi.org/10.32884/ideas.v8i3.869

Fikriyah, A. N., & Sukmawati, W. (2022b). Pengembangan Media Pembelajaran Learning Management System (LMS) Berbasis Moodle pada Materi Perubahan Energi. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *8*(3), 799. https://doi.org/10.32884/ideas.v8i3.869

Fitria, M. N., & Sukmawati, W. (2022). Analisis Perbedaan Hasil Belajar pada Pembelajaran Matematika Secara Daring dan Luring Siswa Kelas V SDN Tegal Alur 21 Petang. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *8*(3), 833. https://doi.org/10.32884/ideas.v8i3.853

Ifdaniyah, N., & Sukmawati, W. (2024). Analysis of Changes in Students' Science Literacy Ability in Class V Elementary School Science Learning Using the RADEC Model. *Jurnal Penelitian Pendidikan IPA*, *10*(2), 681–688. https://doi.org/10.29303/jppipa.v10i2.3952

Istiqomah, N., & Sukmawati, W. (2023). Stacking Analysis of the Mastery of Science Concepts in the RADEC Learning Model for Grade IV Elementary Students. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 7993–8000. https://doi.org/10.29303/jppipa.v9i10.3999

Izzah, S. I. N., & Sukmawati, W. (2022). Pengaruh Model Problem Based Learning Terhadap Motivasi Belajar Peserta Didik pada Pembelajaran IPS. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *8*(3), 765. https://doi.org/10.32884/ideas.v8i3.852

Jamaluddin, J., Jufri, A. W., Ramdani, A., & Azizah, A. (2019). Profil Literasi Sains dan Keterampilan Berpikir Kritis Pendidik IPA SMP. *Jurnal Penelitian Pendidikan IPA*, *5*(1). https://doi.org/10.29303/jppipa.v5i1.185

Kusnadi, N. F., & Sukmawati, W. (2023). Analysis of Changes in the Level of Difficulty of Elementary School Students in Learning the RADEC Model on the Concept of Energy Transformation Using the Rasch Model. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 1121–1127. https://doi.org/10.29303/jppipa.v9ispecialissue.4036

Laliyo, L. A. R., Sumintono, B., & Panigoro, C. (2022). Measuring changes in hydrolysis concept of students taught by inquiry model: stacking and racking analysis techniques in Rasch model. *Heliyon*, *8*(3), e09126. https://doi.org/10.1016/j.heliyon.2022.e09126

Lestari, H., Ali, M., Sopandi, W., & Wulan, A. R. (2021). Infusion of Environment Dimension of ESD into Science Learning Through the RADEC Learning Model in Elementary Schools. *Jurnal Penelitian*

Pendidikan IPA, *7*(SpecialIssue), 205–212. https://doi.org/10.29303/jppipa.v7ispecialissue.817

Muthi'ah, N. M., & Sukmawati, W. (2023). Racking Analysis Instrument Mastery Test Concepts in Learning Science Using the RADEC Model in Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 1137–1143. https://doi.org/10.29303/jppipa.v9ispecialissue.3976

Novianti, R., Aisyah, W. N., & Sukmawati, W. (2023). Analysis of Student's Answer Error on Understanding of Energy Concept in Conceptual Change Text (CCT)-Based Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(2), 505–508. https://doi.org/10.29303/jppipa.v9i2.2049

Nurliana, N., & Sukmawati, W. (2023). Stacking Analysis on the Application of the RADEC Model to the Creativity of Fifth Grade Elementary School Students on Water Cycle Material. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 5964–5970. https://doi.org/10.29303/jppipa.v9i8.3951

OECD. (2018). PISA. *Japanese Journal of Anesthesiology*, *24*(1), 12–17.

Ramadhani, I. N., & Sukmawati, W. (2022). Analisis Pemahaman Literasi Sains Berdasarkan Gender dengan Tes Diagnostik Three-Tier Multiple Choice. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *8*(3), 781. https://doi.org/10.32884/ideas.v8i3.860

Salam, A., Hossain, A., & Rahman, S. (2015). The Effect of using Teams Games Tournaments (TGT) Cooperative Technique for Learning Mathematics in secondary schools of Bangladesh. *Journal of Research in Mathematics Education*, *4*(3), 271–287. https://doi.org/10.17583/redimat.2015.1519

Sukmawati, W. (2022). *Model Pembelajaran RADEC (Read, Answer, Discuss, Explain and Create) secara Online Berbantuan CCT (Conceptual Change Text) pada Perkuliahan Kimia Dasar Program Studi Farmasi untuk Penguasaan Konsep dan Multi Level Representasi (Triple Johnstone)*. Universitas Pendidikan Indonesia.

Sukmawati, W. (2023). *Dasar-Dasar IPA Untuk Calon Guru Sekolah Dasar*. Eureka Media Aksara

Sukmawati, W., Handayani, S. L., & Yeni, Y. (2022). Is conceptual learning based on conceptual change text (CCT) effectively applied to pgsd students science class? *Jurnal Inovasi Pendidikan IPA*, *7*(2), 171–181. https://doi.org/10.21831/jipi.v7i2.44034

Sukmawati, W., Kadarohman, A., Sumarna, O., & Sopandi, W. (2021). The Relationship Of Basic Chemical. *Journal of Engineering Science and Technology*, 42–48. Retrieved from https://jestec.taylors.edu.my/Special%20Issue%20ASSEEE2021/AASSEEEC2021_06.pdf

Sukmawati, W., Kadarohman, A., Sumarna, O., & Sopandi, W. (2022). The Use of Conceptual Change Text (CCT) Based Teaching Materials to Improve Multiple Ability of Pharmaceutical Chemical Representation Students. In *AIP Conference Proceedings* (Vol. 2468, Issue December, pp. 5–9). https://doi.org/10.1063/5.0102578

Sukmawati, W., Kadarohman, A., Sumarna, O., Sopandi, W., Yusuf, Y., & Fitriani, F. (2023). Item Response Analysis of Understanding Concepts of Material Chemistry With Radec Models in Pharmaceutical Students. *Journal of Engineering Science and Technology*, *18*(4), 2132–2147. Retrieved from https://jestec.taylors.edu.my/Vol 18 Issue 4 August 2023/18_4_23.pdf

Sukmawati, W., Sari, P. M., & Yatri, I. (2022). Online Application of Science Practicum Video Based on Local Wisdom to Improve Student's Science Literacy. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2238–2244. https://doi.org/10.29303/jppipa.v8i4.1940

Sukmawati, W., & Wahjusaputri, S. (2018). Penerapan Permainan Ular Tangga dalam Meningkatkan Kemampuan Berhitung pada Anak Kelompok B TK Aisyiyah Bustanul Athfal 85 Legoso Ciputat Timur. *ISTIQRA*, *5*(2), 231–244. https://doi.org/10.24239/ist.v5i2.260

Sukmawati, W., & Wahjusaputri, S. (2024). *Integrating RADEC Model and AI to Enhance Science Literacy : Student Perspectives*. *10*(6), 3080–3089. https://doi.org/10.29303/jppipa.v10i6.7557

Sukmawati, W., & Wijiastuti. (2021). The effectiveness of cod reduction in tofu waste using active mud and oxygenation methods. *IOP Conference Series: Earth and Environmental Science*, *755*(1). https://doi.org/10.1088/1755-1315/755/1/012052

Sukmawati, W., & Zulherman, Z. (2023). Analysis of Changes in Students' Scientific Literacy Ability After Attending Lectures Using the RADEC Model. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1039–1044. https://doi.org/10.29303/jppipa.v9i3.2846

Sumintono, B. (2018). Rasch Model Measurements as Tools in Assesment for Learning. *Proceedings of the 1st International Conference on Education Innovation (ICEI 2017)*, *173*, 38–42. https://doi.org/10.2991/icei-17.2018.11

Wahjusaputri, S., Nastiti, T. I., Bunyamin, B., & Sukmawati, W. (2024). Development of artificial intelligence-based teaching factory in vocational high schools in Central Java Province. *Journal of Education and Learning (EduLearn)*, *18*(4), 1234–1245. https://doi.org/10.11591/edulearn.v18i4.21422

Wahjusaputri, S., Sukmawati, W., Nastiti, T. I., & Noorlatipah, V. (2022). Strengthening teacher

pedagogical literacy after the Covid-19 pandemic in vocational secondary education in Banten Province. *Jurnal Pendidikan Vokasi*, *12*(2), 181–188. https://doi.org/10.21831/jpv.v12i2.47119

Wanningrum, C. P., & Sukmawati, W. (2023). Pengaruh Model Pembelajaran ARIAS (Assurance, Relevance, Interest, Assessment, and Satisfaction) dalam Meningkatkan Hasil Belajar IPA Siswa di Sekolah Dasar. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *9*(1), 43. https://doi.org/10.32884/ideas.v9i1.1205