Tadris: Jurnal Keguruan dan Ilmu Tarbiyah 7 (1): 15-24 (2022)
DOI: 10.24042/tadris.v7i1.8910

TADRIS: JURNAL KEGURUAN DAN ILMU TARBIYAH
(Tadris: Journal of Education and Teacher Training)
P-ISSN: 2301-7562 | E-ISSN: 2579-7964
ejournal.radenintan.ac.id/index.php/tadris/index

The Effects of Token Arends Learning Model on Communication and Physics Learning Outcomes

Widayanti*, Ela Nurviana, Alimatu Fatmawati
Department of Physics Education, Universitas Nurul Huda, Indonesia

Article History:
Received: May 28th, 2021
Revised: October 4th, 2021
Accepted: March 2nd, 2022
Published: June 29th, 2022

Keywords:
Arends learning model,
Cognitive learning outcomes,
Conventional model,
Time token

***Correspondence Address:**
widayanti@stkipnurulhuda.ac.id

Abstract: This research aims to determine whether the Time Token Arends learning model affects communication and physics learning outcomes. All tenth-grade students in one of the high schools in Ogan Komering Ulu Timur became the population, and the sample was determined by random cluster sampling. The research design was the pretest-posttest control group design. The subjects of this research consisted of 58 students. The experimental class implemented the Time Token Arends model, and the control class implemented the conventional model (lecturing and questions and answers). The researchers performed the hypothesis testing using the t-test. Based on the pretest and posttest results, the mean score of the experimental class was higher than the control class. The pretest means a score of the experimental class was 37 and the mean score of the control class was 36. Furthermore, the posttest means a score of the experimental class was 79, and the control class was 64. The mean scores difference indicated a significant effect of the Time Token Arends learning model. The results were supported by the $t_{observed}$ value greater than the $t_{critical}$ value, namely 22.02 greater than 1.67. Therefore, H_0 was rejected, and Ha was accepted. The percentage of student communication increased significantly after the Time Token Arends model was applied. Future researchers need to develop appropriate instruments to measure scientific communication and student learning outcomes during the current pandemic. During the coupons distribution session, it is necessary to ensure that all students receive coupons without exception.

INTRODUCTION

Education is one of the right means of obtaining quality human resources (Nurwati, 2017). Education is realized by conscious and planned efforts to achieve quality human beings (Tadjuddin et al., 2020). Education includes many disciplines, one of which is science. Science is divided into several topics, including biology, chemistry, and physics (Serway & Jewett, 2017). Physics discusses theories and concepts obtained through the scientific method. All the things done in everyday life are always related to physics.

Physics learning is considered a difficult subject (Erviani et al., 2016). Physics learning is designed to make students active in the learning process in the classroom (Indraswati et al., 2021; Rofiqah et al., 2020). (Erviani et al., 2016)As a result, some active students' learning in class tends to be dominated while other students just stay quiet and listen during lessons (Ott et al., 2018). There needs to be a change in learning to overcome this, one of which is applying a

learning model (Hastuti et al., 2020). Learning models that can be applied is the Project-Based learning model (Fini et al., 2018; Widayanti et al., 2018), the problem-based learning model (Darlis et al., 2020; Nuralita et al., 2020), the discovery learning model (Lestari et al., 2020; Syarofah et al., 2019), the inquiry model (Hastuti et al., 2020; Lusidawaty et al., 2020), and the Time Token Arends model (Hidayah et al., 2021; Indraswati et al., 2021; Susanty & Panjaitan, 2021).

Some of these models are applied according to learning needs. In this research, the Time Token Arends model is applied because this model directs students to learn actively in expressing opinions (Aqil et al., 2020; Daulay et al., 2018). One of the problems that occur to students is the low level of communication, and it is difficult to express their thoughts because of teacher-centered learning. Therefore, students tend only to be spectators and have little contribution to learning. Student learning outcomes are low, so it is necessary to have a model that caters to the needs of these students. One of the recommended models in this research is the Time Token Arends learning model, which distributes speaking coupons to all students. Each time coupon has a duration of ± 30 seconds. Students who wish to speak must submit coupons first. Students who run out of coupons cannot speak, while students who still have coupons must speak until the coupons run out (Githa et al., 2019; Siregar, 2019).

Giving time coupons indirectly gives a sense of responsibility to be more active (Puspitasari et al., 2015). Through this learning process, students must experience a (positive) change (Ghaliyah et al., 2015; Seifan et al., 2020). Students' activities become the main point of attention throughout the learning process so that participation, communication, and learning outcomes will increase (Adisel & Prananosa, 2020; Hamim et al., 2021).

Several previous studies have implemented the Time Token Arends model to improve speaking skills (Aqil et al., 2020; Bakti et al., 2019; Susanty & Panjaitan, 2021; Wijayanti et al., 2019), improving learning outcomes (Lestari et al., 2020), and improving social skills (Dewi et al., 2020). Therefore, this study fills the void to see the effecs of the Time Token Arends learning model on communication skills and learning outcomes. In this research, the measurement of communication and learning outcomes was carried out simultaneously to know whether the Time Token Arends model affected communication skills or learning outcomes. The results of this study are expected to be a reference for teachers in applying physics learning in the future, especially in communication skills and learning outcomes.

METHOD

This research was conducted at a public high school in Ogan Komering Ulu Timur. The sample in the study consisted of 58 students (29 students in each class) determined by random cluster sampling. The research design was the pretest-posttest control group design. Class X 1 acted as the control class, and class X 2 acted as the experimental class. The classes were given a pretest to see the difference between the two classes (Sugiyono, 2014). The designs are shown in Table 1.

Table 1. Research Design

Subject	Pretest	Treatment	Posttest
E	O_1	$X_{experimental}$	O_2
K	O_1	$X_{control}$	O_2

E = Experimental group (Time Token Arends)
K = Control group (conventional lecture)
O_1 = The pretest before the treatment
O_2 = The posttest after the treatment

The research data were obtained through questionnaires and tests (pretest and posttest). The indicators measured in

student communication consisted of 1) students' ability to answer questions orally, 2) students' active participation, 3) students' ability to ask questions in understanding learning material, and 4) students' ability to use nonverbal communication media effectively. The student learning outcomes were measured through a two-tier test. The two-tier test analyzed answers based on students' beliefs with certain indicators. Therefore, the level of understanding is clearer. The analysis of this test is more convincing than the multiple-choice test.

A communication questionnaire and a written test were administered at the beginning (pretest) and the end of learning (posttest). The data was obtained by finding the mean, standard deviation, and difficulty level of the questions. Furthermore, hypothesis testing was performed to see whether the Time Token Arends model affects learning outcomes using the t-test and two-tier analysis using the graded response model (GRM) scoring method (De Ayala, 2009). The scoring guidelines are presented in Table 2.

Table 2. The Scoring Guideline

No	Assessment Criteria	Score	Category
1	Do not answer without reason/ wrong answers and wrong reasons	0	Do not understand the concept
2	Wrong answer and correct reason (SB)	1	Guessing
3	Correct answer and wrong reason (BS)	2	Misconception
4	Correct answer and correct reason (BB)	3	Understand the concept

The researchers analyzed the communication skills using percentages. The percentage of communication criteria in Table 3 (Mweshi et al., 2020) and the model implementation steps in each class are described in Table 4.

Table 3. Communication Percentage

Achievement Rate (%)	Response Description
$79 < P \leq 100$	Excellent
$65 < P \leq 79$	High
$55 < P \leq 65$	Moderate
$45 < P \leq 55$	Low
$30 \leq P \leq 45$	Poor

Table 4. The Treatments in the Experiment Class and Control Class

Learning Activity	Time Token Arends Learning Model	Conventional Model (Lecturing)
Stimulation	Before starting the lesson, the teacher provides several applications of quantity and measurement material in everyday life, such as measurements in the market with the ideal theory of gaps. In theory, the unit of weight is Newton, but the market uses kilograms.	The teacher begins the lesson by describing the objectives of the material to be discussed.
Material Explanation	The teacher delivers material using pictures and demonstrating measurement instruments, such as a ruler, micrometer screw, calipers, measuring weight, balance scales, and thermometer.	The teacher delivers the material by showing pictures and several explanations orally.
Discussion	The teacher gives coupons to all students to respond, ask, or argue about the material size and measurement. The coupons provide the same sense of rights and responsibility (The number of coupons given is the same, namely three coupons per student) The teacher asks students to measure their book using a ruler and to use the span of their hands. After measuring, the teacher asks students to express what they got from these activities by giving coupons in advance. Then students who want to argue must submit a coupon first.	The teacher provides the opportunity for students who want to ask, argue, or answer the teacher's questions.

Learning Activity	Time Token Arends Learning Model	Conventional Model (Lecturing)
Evaluation	The teacher tasks assignments to all students to spend the coupons. If the coupon has run out, students may not answer or give opinions. Students who still have the coupon must speak so that all students are active in learning activities.	The teacher's tasks are written assignments to students.

RESULT AND DISCUSSION

The results of the study were obtained from the results of the questionnaire and the results of the pretest and posttest. The data from the communication questionnaire is shown in Table 5. Based on the communication questionnaire results in Table 5, the experimental class and the control class had poor communication (failed) before being given treatments. After being given treatment, the experimental class students can answer questions orally, participate actively, ask questions, and use non-verbal communication media. On the other hand, the control class had a high category. Communication is essential in learning. Good communication between teachers and students will make it easier to understand learning material. In this research, the experimental class was given stimulation through coupons. The coupons contained a question or statement that each student must answer. The students were given the same number of coupons. All students must answer according to the coupons. There is no more opportunity to answer questions for students whose coupons have run out.

However, students who still have a coupon must spend the coupon by answering questions or expressing statements. The results of student communication can affect learning outcomes. Student learning outcomes in this research are presented in Figure 1.

Table 5. Result of Communication Questionnaire

Communication Indicators	Experimental Class		Control Class	
	Prettest	Posttest	Prettest	Posttest
Students can answer questions orally	45%	75%	43%	70%
Students participate actively in learning	40%	85%	41%	78%
Students ask questions in understanding learning material	35%	82%	36%	76%
Students can use non-verbal communication media effectively	50%	87%	48%	82%
Average percentage	43%	82%	42%	77%
Response description	Poor	Excellent	Poor	High

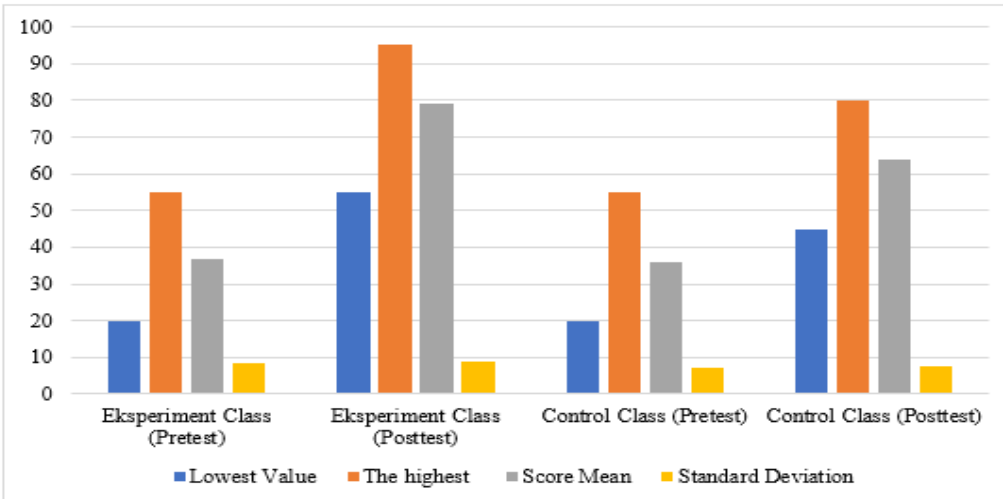


Figure 1. The Pretest and Posttest Results

After the analysis, the percentage of pretest and posttest results is shown in Table 6 and Table 7.

Table 6. Percentage of Pretest

No	Category	Experimental Class		Control Class	
		Total Students	%	Total Students	%
1	High	2	7	1	4
2	Moderate	25	86	25	86
3	Low	2	7	3	10

Table 7. Percentage of Posttest

No	Category	Experimental Class		Control Class	
		Total Students	%	Total Students	%
1	High	10	34	0	0
2	Moderate	18	62	24	83
3	Low	1	3	5	17

The results of the normality test are shown in Table 8.

Table 8. The Results of the Normality Test

Statistics	Experimental Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
$\chi^2_{observed}$	5.01	10.42	7.94	7.56
$\chi^2_{critical}$	11.07	11.07	11.07	11.07
Conclusion	$\chi^2_{observed} < \chi^2_{critical}$ Normal Distribution	$\chi^2_{observed} < \chi^2_{critical}$ Normal Distribution	$\chi^2_{observed} < \chi^2_{critical}$ Normal Distribution	$\chi^2_{observed} < \chi^2_{critical}$ Normal Distribution

The homogeneity test was carried out based on the variance similarity test for the two groups (F-test with $\alpha = 0.05$) with the criteria of $F_{observed} < F_{critical}$ (homogeneous). The homogeneity of the pretest and posttest of the two study sample groups is shown in Table 9.

Based on Table 9, the $F_{observed}$ value of the pretest was 1.14, and $F_{observed}$ value of the posttest was 1.17 with the $F_{critical}$ value of 1.88. Therefore, $F_{observed}$ was lower than $F_{critical}$ (homogeneous). The researchers used a t-test to test the hypothesis. If $t_{critical}$ is higher than $t_{critical}$, H_0 is rejected, and Ha is accepted. If $t_{observed}$ is lower than $t_{critical}$, H_0 is accepted, and Ha is rejected. The results of hypothesis testing are shown in Table 10.

Table 9. The Results of the Homogeneity Test

Statistics	Pretest		Posttest	
	Experimental	Control	Experimental	Control
S^2	8.38	7.33	8.76	7.43
$F_{observed}$	1.14		1.17	
$F_{critical}$	1.88		1.88	
Conclusion	Homogeneous		Homogeneous	

Table 10. Hypothesis Testing

Statistics	Pretest		Posttest	
	Experimental	Control	Experimental	Control
N	29	29	29	29
$\bar{x}$	37	36	79	64
SD	8.38	7.33	8.76	7.43
$t_{observed}$	1.47		22.06	
$t_{critical}$	1.67		1.67	
Conclusion	There is no influence		There is an influence	

The pretest value was 1.47, which was lower than 1.67. Therefore, H_0 was accepted, and Ha was rejected. It can be concluded that there was no difference between the experimental group and the control group. Thus, both classes had homogeneous abilities, and both classes deserve to be used as research samples.

In contrast to the posttest results, the two classes obtained different results after being given different treatments. The $t_{observed}$ was higher than $t_{critical}$ (22.06 > 1.67). Therefore, H_0 was rejected, and Ha was accepted. It can be concluded that this research can test the truth of the hypothesis.

In this research, the focus was the quantity and measurement in everyday life. The treatments between the two classes influenced the learning outcomes. The differences in treatment in the learning process are shown in Table 4.

Based on Table 4, the treatment given to the two classes was different. Classes with the Time Token Arends learning model emphasized responsibility in learning. Each student was required to have an opinion through the coupons given. All students were given the same coupon to have the opportunity to express their opinions. Students who are active or inactive in learning can express their opinions. Whereas in a class that applies the conventional model, the lesson was carried out through teacher explanations and questions and answers between students and teachers. The treatments revealed that the Time Token Arends model was student-centered and the conventional model was teacher-centered. Several previous researchers supported the results of this research.

Some research revealed that the Time Token Arends model fosters activities (Hidayah et al., 2021; Iriana, 2017; Lestari et al., 2020). It can increase speaking skills (Aqil et al., 2020; Daulay et al., 2018). Time Token Arends requires students to be active in quizzes or answering questions and develop enthusiasm to be more confident in expressing their opinions to increase their participation.

In the Time Token Arend learning model, the learning was no longer dominated by highly capable students. In the conventional model, capable students were more active in expressing opinions. However, students with low abilities just kept quiet and listened and recorded the explanations by the teacher. As a result, the class was only dominated by a few students. Therefore, the Time Token Arends learning model was more influential than a conventional model. One of the constraints experienced in implementing the Time Token Arend learning model was time. The time needed was quite long. Therefore, educators who will apply this model must manage time properly to go according to plan.

This research used a two-tier instrument. Table 11 displays one of the question and answer instruments in the experimental class and the control class.

Table 11. Students' Pretest and Posttest Questions and Answers in Problem Number 9

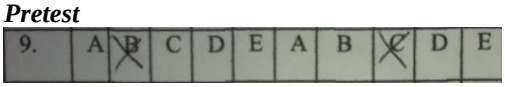
9. If the distance of an object required is [L] and the time required is [T], then determine the dimensions of the acceleration ...
   a. $[L][T]^{-2}$ d. $[L][T]^{2}$
   b. $[M][T]^{-3}$ e. $[L]^{-1}[T]^{-1}$
   c. [L][T]

The reason for choosing this answer is ...

a. Since acceleration is velocity multiplied by the time [T] while velocity is the distance [L] divided by the time [T], acceleration is equal to distance [L] divided by time squared $[T]^2$
b. Since acceleration is velocity divided by the time [T] while velocity is the distance [L] divided by the time [T], acceleration is equal to distance [L] divided by time squared $[T]^2$
c. Since acceleration is velocity divided by the time [T] while velocity is the distance [L] divided by the time [T], acceleration is equal to distance [L] divided by time to the negative power of two $[T]^{-2}$
d. Because acceleration is time [T] times distance [L]
e. Since acceleration is time [T] divided by distance [L]

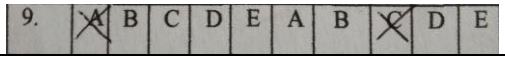
Experiment Class

- ***Pretest***



Category: Guessing due to wrong answers and right reasons.

- ***Posttest***



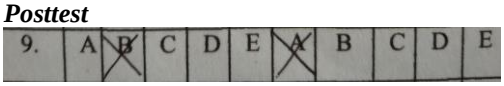
Category: Understanding Concepts due to correct answers and correct reasons.

Control Class

- ***Pretest***

Category: Guessing due to wrong answers and right reasons.

- ***Posttest***



Category: Don't understand the concept due to wrong answers and wrong reasons.

Based on Table 11, all classes had the same cognitive average before the treatments. Students only guessed when working on the pretest question. Unlike the results of the posttest, the control class (conventional) answered posttest questions with misconceptions (right answers and wrong reasons). In contrast, the experimental class (Time Token Arends) answered posttest questions by understanding the concept (correct answers and correct reasons). These results were due to different treatments. In the experimental class, the applied model improved learning outcomes, especially understanding concepts. In the control class, the conventional model had less effect in improving students' cognition.

Students' participation and activeness in class affect learning outcomes. Several previous researchers claim that the learning model must be applied according to students' needs. Each learning model has different characteristics and indicators. The Time Token Arends model is feasible for improving communication and learning outcomes. This research found that students with high learning outcomes do not necessarily have very good communication skills since each student has different skills. Some students prefer communication to writing. Also, some like writing rather than direct communication. Therefore, educators must channel skills according to the abilities of students.

CONCLUSION

This research reports that there are differences in learning outcomes (cognitive). The Time Token Arends learning model class obtained an average pretest score of 37 and an average posttest score of 79. On the other hand, the class with the conventional model obtained an average pretest score of 36 and an average posttest score of 64. The hypothesis test showed that $t_{observed}$ was higher than $t_{critical}$ (22.06 > 1.67). Therefore, H_0 was rejected, and Ha was accepted. In conclusion, the Time Token Arends significantly influence the learning outcomes (cognitive). The students' communication significantly improved in each class. The experimental class from failed (43 %) to excellent (82 %) and the control class from failed (42 %) to high (77 %).

This model needs a measurement instrument relevant to the needs of the current pandemic. During the coupon distribution, it is necessary to ensure that all students receive coupons without exception.

REFERENCES

Adisel, & Prananosa, A. G. (2020). Penggunaan teknologi informasi dan komunikasi dalam sistem manajemen pembelajaran pada masa pandemi COVID 19. *Alignment: Journal of Administration and Educational Management*, *3*(1), 1–10.

Aqil, M., Efendi, & Andini, A. (2020). Speaking skills improvement through time token arends cooperative learning model in class IV Students In SD Inpres 2 Bantaya. *Jurnal Dikdas*, *8*(2), 81–89.

Bakti, I., Hafiar, H., & Budiana, H. R. (2019). Environmental communication based on local wisdom in anticipation of Citarum flood. *Mimbar*, *33*(1), 208–216.

Darlis, N., Farida, F., & Miaz, Y. (2020). Pengembangan desain pembelajaran

model assure berbasis problem based learning menggunakan komik di sekolah dasar. *Jurnal Basicedu*, *5*(1), 334–342. https://doi.org/https://doi.org/10.31004/basicedu.v5i1.689

Daulay, S. H., Salmiah, M., & Ulfa, Z. (2018). Students' speaking skill through cooperative learning strategy: Time token arends. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, *279*, 388–393. https://doi.org/10.2991/icalc-18.2019.55

De Ayala, R. J. (2009). *The theory and practice of item response theory*. Guilford Press.

Dewi, S. S., Acesta, A., & Purnomo, H. (2020). Pengaruh model pembelajaran kooperatif tipe time token arends terhadap keterampilan sosial peserta didik di kelas. *Pedagogi: Jurnal Penelitian Pendidikan*, *7*(1), 43–56. https://doi.org/10.25134/pedagogi.v7i1.2859

Erviani, F. R., Sutarto, & Indrawati. (2016). Model pembelajaran instruction, doing, dan evaluating (MPIDE) disertai resume dan video fenomena alam dalam pembelajaran fisika Di SMA. *Jurnal Pembelajaran Fisika*, *5*(1), 53–59.

Fini, E. H., Awadallah, F., Parast, M. M., & Abu-Lebdeh, T. (2018). The impact of project-based learning on improving student learning outcomes of sustainability concepts in transportation engineering courses. *European Journal of Engineering Education*, *43*(3), 473–488. https://doi.org/10.1080/03043797.2017.1393045

Ghaliyah, S., Bakri, F., & Siswoyo. (2015). Pengembangan modul elektronik berbasis model learning cycle 7E pada pokok bahasan fluida dinamik untuk siswa SMA kelas XI. *Prosiding Seminar Nasional Fisika (E-Journal) SNF2015*, 149–154.

Githa, P. S., Sugiarta, I. M., & Puja Astawa, I. W. (2019). Pengaruh model pembelajaran kooperatif tipe time token terhadap kemampuan komunikasi dan aktivitas belajar siswa kelas VIII SMP Negeri 2 Singaraja. *Jurnal Pendidikan Matematika Undiksha*, *10*(2), 78–83. https://doi.org/10.23887/jjpm.v10i2.19933

Hamim, Sumartias, S., Hidayat, D. R., & Sugiana, D. (2021). Symbol of political communications by nahdlatul ulama in East Java , Indonesia. *Journal of Hunan University (Natural Sciences）*, *48*(1), 57–62.

Hastuti, I. D., Mariyati, Y., Sutarto, & Nasirin, C. (2020). The effect of guided inquiry learning model to the metacognitive ability of primary school students. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *8*(1), 37–45.

Hidayah, S. R., Putra, A. S., & Gunawan, Y. I. (2021). The effect of time token strategy on the eighth grade student speaking skills at SMP Al-Ijtihad 2 Kutabaru. *Globish: An English-Indonesian Journal for English, Education, and Culture*, *10*(1), 37. https://doi.org/10.31000/globish.v10i1.3211

Indraswati, D., Gunawan, G., Nursaptini, N., Widodo, A., & Sutisna, D. (2021). The effectiveness of the predict observe explain (POE) method and time token arends for students' concepts understanding in the social studies subject. *Journal of Physics: Conference Series*, *1779*(1), 1–5. https://doi.org/10.1088/1742-6596/1779/1/012079

Iriana. (2017). Penggunaan model pembelajaran time token arends untuk meningkatkan hasil belajar dan kemampuan berbicara siswa kelas VII A SMP Negeri 1 Tanjung.

Jurnal Langsat, *4*(1), 1–8.

Lestari, E. S. P., Murwaningsih, T., & Subarno, A. (2020). Peningkatan keaktifan dan hasil belajar administrasi umum melalui metode time token arends kelas X OTKP. *Jurnal Informasi Dan Komunikasi Administrasi Perkantoran*, *4*(2), 30–39.

Lusidawaty, V., Fitria, Y., MMiaz, Y., & Zikri, A. (2020). Pembelajaran IPA dengan strategi pembelajaran inkuiri untuk meningkatkan keterampilan proses sains dan motivasi belajar siswa di Sekolah Dasar. *Jurnal Basicedu*, *4*(1), 168–174.

Mweshi, E., Munyati, O., & Nachiyunde, K. (2020). Teachers' understanding of the link between the atomic theory and the mole concept. *African Journal of Research in Mathematics, Science and Technology Education*, *24*(3), 411–422. https://doi.org/10.1080/18117295.2020.1845462

Nuralita, A., Reffiane, F., & Mudzanatun. (2020). Keefektifan model PBL berbasis etnosains terhadap hasil belajar. *Mimbar PGSD Undiksha*, *8*(3), 457–467.

Nurwati. (2017). Penerapan model pembelajaran time token terhadap pencapaian hasil belajar fisika kelas X. *Jurnal Pendidikan Fisika*, *I*(3), 237.

Ott, L. E., Carpenter, T. S., Hamilton, D. S., & LaCourse, W. R. (2018). Discovery learning: Development of a unique active learning environment for introductory chemistry. *Journal of the Scholarship of Teaching and Learning*, *18*(4), 161–180. https://doi.org/10.14434/josotl.v18i4.23112

Puspitasari, R., Hastuti, D., & Herawati, T. (2015). Pengaruh pola asuh disiplin dan pola asuh spiritual ibu terhadap karakter anak usia sekolah dasar. *Jurnal Pendidikan Karakter*, *5*(2), 208–218.

Rofiqah, S. A., Widayanti, & Rozaqi, A. (2020). Thinking Aloud Pair Problem Solving (TAPPS) Method : The Effect of Understanding Physics Concepts and Communication in High Schools in Indonesia. *Young Scholar Symposium on Science Education and Environment 2019*, 1–8. https://doi.org/10.1088/1742-6596/1467/1/012066

Seifan, M., Robertson, N., & Berenjian, A. (2020). Use of virtual learning to increase key laboratory skills and essential non-cognitive characteristics. *Education for Chemical Engineers*, *33*, 66–75. https://doi.org/10.1016/j.ece.2020.07.006

Serway, R. ., & Jewett, J. . (2017). *Physics for scientists and engineers with modern physics*. Cengage.

Siregar, R. M. R. (2019). Pengaruh model pembelajaran kooperatif tipe time token terhadap kemampuan komunikasi matematika siswa di SMK Negeri 2 Binjai Tahun Pelajaran 2018/2019. *Jurnal MathEducation Nusantara*, *2*(1), 35–38.

Sugiyono. (2014). *Metode penelitian kuantitatif, kualitatif dan R&D*. Alfabeta.

Susanty, Y., & Panjaitan, C. J. (2021). Pengaruh teknik pembelajaran time token dan sikap bahasa terhadap keterampilan berbicara siswa kelas VIII SMPN 1 Batang Anai. *Jurnal Serunai Bahasa Indonesia*, *18*(1), 1–8.

Syarofah, F., Wiryokusumo, I., & Sugito. (2019). Penerapan metode discovery learning dan ekspositori terhadap peningkatan hasil belajar PKn siswa kelas 7 SMP Negeri 2 dan SMP Negeri 7 Bangkalan. *Jurnal Education and Development*, *7*(2), 222–226.

Tadjuddin, N., Robingatin, Meriyati, Hadiati, E., El-Fiah, R., Walid, A., & Widayanti. (2020). Emotional

Intelligence of Elementary Scholar: Instructional Strategy and Personality Tendency. *European Journal of Educational Research*, *9*(1), 203–213. https://doi.org/10.12973/eu-jer.9.1.203

Widayanti, Yuberti, Irwandani, & Hamid, A. (2018). Pengembangan lembar kerja praktikum percobaan melde berbasis project based learning. *Jurnal Pendidikan Sains Indonesia*, *06*(01), 24–31. https://doi.org/10.24815/jpsi.v6i1.10908

Wijayanti, S., Suhartono, & Suyanto, I. (2019). Penerapan model pembelajaran kooperatif tipe time token arends dengan media pop up untuk meningkatkan keterampilan berbicara pada siswa kelas III SD Negeri 3 Kalirejo Tahun Ajaran 2017/2018. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, *7*(1), 61–66.