Jambura Journal of Educational Chemistry
Volume 8 Issue 1, February 2026
p-ISSN: 2655-7606, e-ISSN: 2656-6427
Journal Homepage: http://ejurnal.ung.ac.id/index.php/jjec

Effects of the Teams Games Tournament (TGT) Learning Model Assisted by Spinning Wheel Media on Students' Learning Outcomes in Atomic Structure

Lita Lokollo[1]*, Yeslia Utubira[1]

[1]*Universitas Pattimura, Maluku 97233, Indonesia*

Article Info

Article history:
Received: 05-01-2026
Revised: 05-02-2026
Accepted: 12-02-2026
Available online: 13-02-2026

Keywords:
Teams Games Tournament (TGT); Spinning Wheel; Learning Outcomes; Atomic Structure

***Corresponding author:**
lokollolita@gmail.com

Abstract

Atomic structure material is abstract and requires a strong conceptual understanding, so innovative learning models and media that actively engage students are needed. This study seeks to investigate the impact of the Teams Games Tournament (TGT) learning model, supported by spinning wheel media, on the learning outcomes of Grade X high school students in atomic structure. The study employed a quantitative approach using a quasi-experimental method with a pretest–posttest control group design. The research sample consisted of two classes, namely class X_1 as the control class and X_7 as the experimental class, each comprising 27 students. The collected data were analyzed using descriptive and inferential statistical techniques with SPSS. Analysis using the Mann–Whitney U test indicated a significance level of 0.046 ($p < 0.05$), confirming that the learning outcomes differed significantly between the experimental and control groups. Students in the experimental class, where the TGT model supported by spinning wheel media was applied, achieved higher learning outcomes compared to those in the control class using traditional teaching methods. Therefore, it can be determined that the Teams Games Tournament learning model supported by spinning wheel media results in a significant improvement in students' learning outcomes in atomic structure and can serve as an innovative alternative in high school chemistry learning.

How to Cite: Lokollo, L., & Utubira, Y. (2026). Effects of the Teams Games Tournament (TGT) Learning Model Assisted by Spinning Wheel Media on Students' Learning Outcomes in Atomic Structure. *Jambura Journal of Educational Chemistry, 8*(1), 104-111. https://doi.org/10.37905/jjec.v8i1.36598

1. INTRODUCTION

The Modern education emphasizes the need for student-centered learning, aiming to cultivate critical thinking, creativity, communication, and teamwork skills, as well as to encourage students' active involvement in developing conceptual understanding (Redhana, 2019). Learning is no longer understood as a one-way process of conveying information, but rather as an interactive process that provides space for students to construct knowledge through meaningful learning experiences. This process of knowledge construction requires students to formulate and test ideas, solve problems, and express ideas logically, thus forming new and deeper understandings (Budyastuti & Fauziati, 2021).

However, in practice, chemistry learning at the senior high school level still faces various challenges that hinder the realization of student-centered learning. Low student engagement, learning interest, and suboptimal learning outcomes are often influenced by negative perceptions of chemistry as a difficult subject dominated by theoretical concepts and mathematical calculations (Harefa et al., 2020). This view is further reinforced by teacher-centered learning practices, which are dominated by lecture-based methods, less varied presentation of material, and limited use of interactive media (Lestari et al., 2024). As a result, students struggle to understand abstract chemical concepts, experience low active engagement, and a decline in learning motivation (Priliyanti et al., 2021; Redhana, 2019; Taruklimbong &

https://doi.org/10.37905/jjec.v8i1.36598

Murniarti, 2024). These challenges are even more complex in island regions such as Maluku, where limited media and supporting learning resources tend to make chemistry learning more theoretical and less contextual.

This condition is consistent with the results of preliminary observations conducted at SMA Negeri 12 Ambon. Chemistry learning, particularly in the topic of atomic structure, is still implemented through direct presentation of the material. This learning pattern results in limited student involvement in the learning process, as well as reduced learning interest and motivation, so that opportunities to develop thinking skills and build conceptual understanding are not optimally facilitated. As a consequence, students' understanding of the abstract concept of atomic structure has not been fully developed. Atomic structure is one of the fundamental topics in Grade X chemistry learning, characterized by high complexity and a high level of abstraction. The complexity of the material causes many students to experience learning difficulties, thereby affecting their academic performance (Hidayanti & Savalas, 2020). Concepts related to subatomic particles, atomic models, electron configurations, and quantum numbers cannot be observed directly; therefore, they require abstract thinking skills and strong conceptual understanding (Tasya et al., 2020). When learning is not supported by appropriate learning models, methods, and instructional media, students are likely to experience learning difficulties and misconceptions, which ultimately result in low learning outcomes(Prayunisa, 2022).

One effort that can be undertaken to address these problems is the use of a cooperative learning model combined with innovative and interactive instructional media that are capable of actively engaging students in the learning process (Riska et al., 2025). The Teams Games Tournament (TGT) learning model is one type of cooperative learning that emphasizes collaboration within groups, healthy academic competition, and active student participation through game-based activities. This model encourages students to support one another in understanding the learning material, while simultaneously motivating them to achieve optimal outcomes through academic tournaments. Findings indicate that implementing the TGT model can boost students' engagement, motivation, and understanding of chemical principles (Herawati et al., 2025; Matondang et al., 2025; Ummah & Bahriah, 2025).

The effectiveness of the TGT learning model can be enhanced through the use of interactive, game-based learning media. The use of learning media encourages a shift in learning orientation from educator-centered to student-centered learning, allowing students to gain more meaningful learning experiences through direct involvement (Farisi & Iswendi, 2024; Muttakin et al., 2022). One medium that aligns with this approach is the Spinning Wheel learning media. The Spinning Wheel is a game-based learning media that presents questions in the form of a rotating wheel with different scores and colors, containing HOTS (Higher Order Thinking Skills)-based questions that students must answer (Gea et al., 2025; Widyastuti & Susanti, 2025). The compatibility between the characteristics of the TGT model and the Spinning Wheel learning media makes them potentially complementary in chemistry learning. The integration of Spinning Wheel learning media into the TGT model not only strengthens cooperation and healthy competition but also enhances student motivation, focus, and engagement in understanding abstract concepts (Firnanda & Aryani, 2025).

Nonetheless, empirical research focusing specifically on the impact of the TGT learning model combined with Spinning Wheel media on students' achievement in atomic structure topics remains scarce, especially in the context of senior high school chemistry learning. Based on this description, conducting research examining the effect of the TGT learning model supported by spinning wheel learning media on the learning performance of Grade X students in atomic structure is essential. This study is anticipated to provide empirical support for the development of innovative learning models and learning media in chemistry education, as well as to serve as an alternative strategy for improving the quality of chemistry learning in senior high schools, especially at SMA Negeri 12 Ambon and across the Maluku region.

2. METHOD

A quantitative approach using a quasi-experimental design was utilized in this study. In particular, a pretest–posttest control group framework was used, involving both an experimental group and a control group. This design was selected to examine the influence of the TGT learning model supported by Spinning Wheel learning media on students' learning

https://doi.org/10.37905/jjec.v8i1.36598

outcomes by comparing the outcomes of students who received the treatment with those who did not.

Table 1. Research design

Class	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Description:

O_1 = Pre-test administered to both groups using the same instrument.

X_1 = Learning using the TGT learning model assisted by spinning wheel learning media.

X_2 = Conventional learning without the use of the TGT learning model or Spinning Wheel learning media

O_2 = Post-test administered to both groups using the same instrument.

The study population consisted of all students enrolled in Grade X at SMA Negeri 12 Ambon. The sample comprised two classes: Class X_1, consisting of 27 students, served as the control group, while Class X_7, also with 27 students, functioned as the experimental group. In this research, the TGT learning model supported by Spinning Wheel learning media was treated as the independent variable, whereas students' learning outcomes in atomic structure material were designated as the dependent variable. To assess students' learning outcomes, a multiple-choice test was used as the research instrument to examine students' conceptual understanding related to subatomic particles, atomic models, electron configurations, and quantum numbers. The instrument was validated prior to use. Data collection was carried out through pretests and posttests, in which the pretest aimed to determine students' initial abilities, The posttest was administered to evaluate students' learning outcomes following the implementation of the instructional intervention.

The obtained data were processed and examined through the application of both descriptive and inferential statistical analyses. Descriptive statistics were applied to present students' initial abilities and learning outcomes through measures such as mean values and score distributions. Inferential statistical analysis was then performed to test the proposed research hypotheses. Before hypothesis testing, assumption tests were conducted, including a normality test using the Shapiro–Wilk procedure and a homogeneity test using Levene's test. If the assumptions of normality and homogeneity were satisfied, an independent-samples t-test was used to evaluate the variation in mean learning outcomes across the experimental and control groups. If these assumptions were not fulfilled, the Mann–Whitney U test was applied as a nonparametric alternative.

All data were analyzed using SPSS software with a significance threshold of $\alpha = 0.05$. Hypothesis testing was based on the resulting significance values: a Sig. value below 0.05 led to the rejection of H_0, indicating a difference in learning outcomes between the experimental and control groups, whereas a Sig. value of 0.05 or higher led to the acceptance of H_0, suggesting no significant difference in outcomes between the two classes.

3. RESULTS AND DISCUSSION

3.1. Results

Description of Student Initial Abilities

The pretest was used to obtain an overview of students' initial abilities before the learning process began. The levels of student mastery based on the pretest results for the control and experimental groups are presented in Table 2.

Table 2. Categories of student mastery levels based on the pretest

Range of Values	Control (n=27)		Experiment (n=27)		Qualification
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	
87 – 100	-	-	-	-	Very good
76 – 86	-	-	1	3,70	Good
65 – 75	2	7,41	1	3,70	Sufficient
< 65	25	92,59	25	92,59	Poor/failed
Total	**27**	**100**	**27**	**100**	

Based on Table 2, the pretest results in the control group indicate that no students achieved either the excellent or good categories. Two students (7.41%) were in the adequate category, while the majority, 25 students (92.59%), were in the poor/failed category. In the experimental class, no students were found in the excellent category; only one student (3.70%) was in the good category and one student (3.70%) was in the

https://doi.org/10.37905/jjec.v8i1.36598

adequate category, while 25 students (92.59%) were in the poor/failed category.

The distribution across categories suggests that the baseline abilities of students in both classes were generally comparable. This comparability is demonstrated by the dominance of the poor/failed category, which showed the same percentage (92.59%) in both groups, as well as by the minimal difference in the number of students in the good and adequate categories, which was not descriptively significant.

Description of Student Learning Outcomes (Posttest)

The final test (posttest) was administered after the completion of the entire learning process on atomic structure. This test was intended to measure students' learning outcomes following the learning intervention.

The distribution of student mastery levels based on posttest scores is shown in Table 3.

Table 3. Categories of student mastery levels based on the posttest data

Range of Values	Control (n=27)		Experiment (n=27)		Qualification
	Frequency (f)	**Percentage (%)**	**Frequency (f)**	**Percentage (%)**	
87 – 100	3	11,11	7	25,93	Very good
76 – 86	7	25,93	8	29,63	Good
65 – 75	8	29,63	6	22,22	Sufficient
< 65	9	33,33	6	22,22	Poor/failed
Total	27	100	27	100	

It can be seen from Table 3, the posttest results in the control class show that most students were in the sufficient (29.63%) and poor/fail (33.33%) categories, with only 3 students (11.11%) achieving the excellent category. Conversely, in the experimental class, the proportion of students in the very good (25.93%) and good (29.63%) categories was surpassing the results of the control class, while the percentage of students in the poor/fail category was lower (22.22%). The distribution of these achievement levels reflects a disparity in learning outcomes across the two classes. The pattern observed in the score distribution further highlights a gap in performance between the two groups. Descriptive analysis showed that students in the experimental class experienced more pronounced improvement than those in the control class. This indicates that the use of the TGT learning model, supported by spinning wheel media, had a positive impact on students' comprehension of atomic structure concepts.

Prerequisite Analysis Tests

a. Homogeneity of Variance Test

To evaluate whether the variances across the experimental and control classes were equivalent, Levene's test was conducted.

Table 4. Results of the homogeneity test of variance of posttest data

		Levene's Test for Equality of Variances	
		F	**Sig.**
Student grades	Equal variances assumed	4.567	.037
	Equal variances not assumed		

The results of Levene's test yielded a significance value of 0.037 (Sig. < 0.05). This implies that the variances in learning outcomes between the control and experimental groups were unequal. Therefore, the assumption of homogeneity of variance was not met.

b. Normality Test of Posttest Data

A normality assessment was conducted to verify that the posttest data met the assumption of a normal distribution required for inferential statistical analyses. This assessment employed the Shapiro–Wilk test, with the results shown in Table 5.

Table 5. Results of the normality test for posttest data using Shapiro–Wilk

	Control and Experimental Classes	Shapiro-Wilk		
		Statistic	**df**	**Sig.**
Student grades	Control	.923	27	.046
	Experimental	.957	27	.310

The results show that the Shapiro–Wilk normality test, the posttest data in the control class obtained a significance value of 0.046 (Sig. < 0.05), suggesting that the data did not follow a normal distribution. In contrast, the posttest data in the experimental class yielded a significance value of 0.310 (Sig. > 0.05), implying that the data conformed to a normal distribution.

Hypothesis Testing

According to the normality test, the posttest data for the control class were not normally distributed, while the experimental class data conformed to a normal distribution. This condition indicates that the assumptions required for applying parametric tests, particularly the independent samples t-test, were not fully satisfied. As a result, hypothesis testing was performed using the Mann–Whitney U test, which serves as a nonparametric alternative when the assumption of normality is not satisfied.

To determine if there were statistically significant differences in learning outcomes, the Mann–Whitney U test was performed, as reflected by posttest scores, between the control and experimental classes after the implementation of different learning treatments. The findings from the analysis are summarized in Table 6.

Table 6. Mann–Whitney U test results for posttest data

Test Statistics[a]

	Student Grades
Mann-Whitney U	249.500
Wilcoxon W	627.500
Z	1.992
Asymp. Sig. (2-tailed)	.046

a. Grouping Variable: control and experimental classes

The Mann–Whitney U test produced a significance value of 0.046 (Sig. < 0.05), resulting in the rejection of the null hypothesis (H_0). This finding indicates a statistically significant difference in learning outcomes between the control and experimental groups on the topic of atomic structure. Accordingly, the findings suggest that the application of the TGT learning model supported by spinning wheel media positively affects students' learning outcomes.

3.2. Discussion

This purpose of this study is to examine how the implementation of the TGT learning model assisted by spinning wheel media affects Grade X students'achievement in atomic structure material. The study was conducted over three meetings. At the first meeting, a pretest was administered to determine students' initial abilities regarding the material to be taught, followed by an explanation of the material. In the control class (Class X_1), the material explanation was carried out using conventional instruction, namely the lecture method, while in the experimental class (Class X_7), the material explanation was carried out by applying the TGT model assisted by spinning wheel media. The learning stages followed the procedures of the TGT-type cooperative learning model, which included game activities and ended with an academic tournament. In the second and third meetings, learning was also carried out following the same stages as in the first meeting for both classes and concluded with a posttest to determine the level of students' understanding of the atomic structure concepts that had been taught.

The spinning wheel used in the experimental class was designed contextually using simple materials, making it economical and easily replicable by teachers. The spinning wheel consists of several sections that contain questions related to the concepts of subatomic particles, atomic models, electron configurations, and quantum numbers. Each section is assigned a different score depending on the difficulty level of the questions. Through a game-based mechanism, students are asked to spin the wheel in turns and answer the questions that appear, creating an interactive and enjoyable learning environment that encourages active student engagement.

The spinning wheel learning media used in this study is presented in Figure 1.

Figure 1. Spinning Wheel Learning Media

The learning process began with a pretest to identify students' initial abilities. Based on the pretest results presented in Table 2, the majority of students, both in the control and experimental classes, were in the poor/fail category, with a percentage of 92.59%. This finding indicates that students' initial abilities in both

https://doi.org/10.37905/jjec.v8i1.36598

classes were relatively equivalent before the treatment was administered. The low pretest performance was attributed to the test instrument being designed based on material that the students had not yet studied, resulting in most students being unable to answer the questions correctly. Furthermore, the abstract nature of atomic structure material requires high-level conceptual thinking skills, which also contributed to the low pretest results (Tasya et al., 2020).

The learning process was carried out with different treatments in both classes and concluded with a posttest. The results of the posttest presented in Table 3 show an improvement in learning achievement in both classes; however, the distribution of learning outcomes differed significantly. The experimental class had a higher proportion of students in the very good and good categories than the control class. In contrast, the proportion of students in the poor/failed category was lower in the experimental class than in the control class. This difference is corroborated by the Mann–Whitney U test, which yielded a significance value of 0.046 (Sig. < 0.05), as shown in Table 6. These findings indicate a statistically significant difference in learning outcomes between the control and experimental classes.

These findings confirm that the implementation of the TGT model assisted by spinning wheel media has a positive impact on student learning outcomes and is more effective than conventional learning using the lecture method. Consistent with this, Amni et al., (2021) stated that the lecture method tends to be less effective because learning is dominated by the teacher, while students play a passive role as listeners. This lack of active student involvement in the learning process results in low learning motivation, which ultimately affects student learning outcomes.

Meanwhile, the learning success in the experimental class was closely related to the characteristics of the Teams Games Tournament (TGT) model, which emphasizes group collaboration, healthy academic competition, and active student involvement throughout the learning process. The implementation of this model was further enhanced with the support of spinning wheel learning media, which played a significant role in creating engaging, varied, and challenging game activities. Without supporting learning media, TGT game activities tend to be monotonous, making them less effective in facilitating students' conceptual understanding. Therefore, the integration of spinning wheel media is a crucial component in TGT learning. The implementation of the TGT model, supported by appropriate learning media, can encourage students to collaborate, share knowledge, and actively participate in learning, while simultaneously increasing learning motivation and enthusiasm (Amni et al., 2021).

Furthermore, presenting Higher-Order Thinking Skills (HOTS)-based questions in a game-based format can help students develop higher-order thinking skills and construct clearer visualizations and conceptual representations, making abstract concepts such as subatomic particles, electron configurations, and quantum numbers easier to understand. This is consistent with constructivist theory, which highlights that knowledge is actively built through learning experiences (Budyastuti & Fauziati, 2021).

Game-based learning contexts have also been shown to effectively facilitate students' cognitive processes by positioning them as active participants in the learning process. Through this active engagement, students are encouraged to recall previously learned concepts, relate them to their learning experiences, and develop more meaningful understanding (Budyastuti & Fauziati, 2021).

Furthermore, game-based learning can enhance students' focus, motivation, and engagement, which in turn positively affects student learning outcomes (Herawati et al., 2025; Matondang et al., 2025; Ummah & Bahriah, 2025).

4. CONCLUSION

The results suggest that implementing the Teams Games Tournament (TGT) learning model, supported by spinning wheel media, contributes to an improvement in students' learning outcomes on atomic structure material. The variation in learning outcomes between the experimental and control groups indicates that the enhancement observed can be attributed to the learning model applied. Thus, the TGT model assisted by spinning wheel media is worthy of consideration as an innovative learning alternative in chemistry learning, especially for atomic structure material at the senior high school level.

5. ACKNOWLEDGEMENTS

The author extends sincere gratitude to the Pattimura University, Ambon-Maluku, for their support and facilities, which enabled the completion of this research.

6. REFERENCES

Amni, Z., Ningrat, H. K., & Raehanah. (2021). *Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament (TGT) Berbantuan Media Destinasi Terhadap Motivasi Dan Hasil Belajar Pada Materi Larutan Penyangga*. *15*(2), 2840–2848.

Budyastuti, Y., & Fauziati, E. (2021). Penerapan Teori Konstruktivisme pada Pembelajaran Daring Interaktif. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *3*(2), 112–119. https://doi.org/10.36232/jurnalpendidikandasar.v3i2.1126

Farisi, A. I., & Iswendi. (2024). Pengaruh Permainan Ludo Kimia Berbasis Chemo-Edutaiment Materi Struktur Atom Terhadap Hasil Belajar Siswa Kelas X.E. *SCIENCE : Jurnal Inovasi Pendidikan Matematika Dan IPA*, *4*(4), 461–468.

Firnanda, V., & Aryani, Z. (2025). Penerapan Media Pembelajaran Roda Putar Edukatif untuk Meningkatkan Motivasi Belajar Siswa. *Jurnal Inovasi Wawasan Akademik*, *1*(5), 412–415.

Gea, E., Pardede, S., & Sinaga, D. (2025). Analisis Penerapan Media Pembelajaran Spinning Question Melalui Aplikasi Spin the Wheel Random Picker untuk Meningkatkan Motivasi Belajar Siswa di Mata Pelajaran Ekonomi Kelas X-1 dan X-3 SMAS Methodist 8 Medan. *Innovative: Journal Of Social Science Research*, *5*(2), 2787–2796. http://j-innovative.org/index.php/Innovative/article/view/18647%0Ahttp://j-innovative.org/index.php/Innovative/article/download/18647/12690

Harefa, N., Tafonao, S. G., & Hidar, S. (2020). Analisis Minat Belajar Kimia Siswa Melalui Pembelajaran Berbasis Multimedia. *Paedagoria : Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan*, *11*(2), 81–86. http://journal.ummat.ac.id/index.php/paedagoria

Herawati, S., Kurniawan, R. A., & Kurniasih, D. (2025). Efektivitas Pembelajaran Kooperatif Tipe Teams Games Tournament Berbantuan Ludo Kimia Terhadap Minat Dan Hasil Belajar Siswa Pada Materi Reaksi Redoks. *Orbital: Jurnal Pendidikan Kimia*, *10*(1), 112–134.

Hidayanti, E., & Savalas, L. R. T. (2020). Keterampilan Kolaborasi: Solusi Kesulitan Belajar Siswa SMA dalam Mempelajari Kimia. *Prosiding Seminar Nasional Pendidikan Inklusif*, 1–7.

Lestari, C., Aliefman Hakim, & Lalu Rudyat Telly Savalas. (2024). Identifikasi Kesulitan Belajar Siswa pada Pelajaran Kimia Kelas XI MIPA di MAN 2 Mataram. *Chemistry Education Practice*, *7*(2), 350–357. https://doi.org/10.29303/cep.v7i2.7389

Matondang, S. E., Anggraini, F., & Putri, J. S. N. (2025). Hubungan Motivasi dan Hasil Belajar Siswa Menggunakan Model Pembelajaran Teams Game Tournament pada Materi Termokimia. *Jurnal Pendidikan Kimia Dan Terapan*, *09*(01), 55–62.

Muttakin, M., Dewi, U. M., Sari, A. M., Andriani, R., & Setiawan, T. (2022). Penerapan Media Word Square Pada Materi Struktur Atom Untuk Meningkatkan Hasil Belajar Siswa. *Relativitas: Jurnal Riset Inovasi Pembelajaran Fisika*, *5*(2), 85. https://doi.org/10.29103/relativitas.v5i2.9941

Prayunisa, F. (2022). Analisa Kesulitan Siswa Kelas XI dalam Pembelajaran Kimia di SMAN 1 Masbagik. *Journal of Classroom Action Research*, *4*(3), 147–150. http://jppipa.unram.ac.id/index.php/jcar/index

Priliyanti, A., Muderawan, I. W., & Maryam, S. (2021). Analisis Kesulitan Belajar Siswa dalam Mempelajari Kimia Kelas XI. *Jurnal Pendidikan Kimia Undiksha*, *5*(1), 11–18.

Redhana, I. W. (2019). Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia. *Jurnal Inovasi Pendidikan Kimia*, *13*(1), 2239–2253.

Riska, R., Erna, M., & Linda, R. (2025). Pengembangan Media Pembelajaran Interaktif Berbasis Website Pada Materi Struktur Atom Dan Sistem Periodik Kelas X SMA/MA Sederajat. *Chemistry Education Practice*, *8*(2), 329–342. https://doi.org/10.29303/cep.v8i2.9455

Taruklimbong, E. S. W., & Murniarti, E. (2024). Analisis Peluang dan Tantangan Pembelajaran Kimia pada Kurikulum Merdeka pada Satuan Pendidikan Sekolah Menengah Atas. *Edukatif : Jurnal Ilmu Pendidikan*, *6*(4), 3013–3021. https://doi.org/10.31004/edukatif.v6i4.7177

Tasya, Y., Sadiana, I. M., & Asi, N. B. (2020). Profil Penguasaan Konsep Struktur Atom pada Siswa Kelas X MIPA SMA Negeri 4 Palangka Raya Tahun Ajaran 2018/2019. *Jurnal Ilmiah Kanderang*

Tingang, *11*(1), 30–40. https://doi.org/10.37304/jikt.v11i1.70

Ummah, K., & Bahriah, E. S. (2025). Implementasi Metode TGT (Team Games Tournament) Terhadap Motivasi Belajar Kimia Siswa SMA Kelas X. *Prosiding Seminar Nasional Fakultas Ilmu Tarbiyah Dan Keguruan UIN Syarif Hidayatullah Jakarta*, *2*(1), 53–66. https://doi.org/10.64277/semnas.v2i1.196

Widyastuti, H., & Susanti. (2025). Pengembangan Permainan Spinning Wheel Berbantuan Genially Sebagai Media Pengayaan pada Elemen Perpajakan Kelas XI Akuntansi SMK Negeri di Surabaya. *Jurnal Studi Guru Dan Pembelajaran*, *8*(2), 1306–1317. https://doi.org/10.30605/jsgp.8.2.2025.6620