Implementation of Joyful Learning through the Team Games Tournament (TGT) Model and Ethnopedagogical Approach: Adoption of Dakon as a Traditional Game-Based Learning Medium in Chemistry Learning as an Effort to Improve Students' Cognitive Abilities

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Abstract
This study aims to determine the differences in the development of students' cognitive abilities in Chemistry, particularly in the topic of Electron Configuration, by using traditional games such as dakon and the Team Games Tournament (TGT) learning model. This is a quantitative study involving two classes: class X-E2 as the experimental class and class X-E3 as the control class from SMA 1 Muhammadiyah Cilacap in the 2025/2026 academic year, odd semester. Learning achievement data was collected through pretest and posttest questions. The data was analyzed using descriptive statistics, N-Gain analysis, and ANCOVA hypothesis testing. Learning using dakon media and the TGT model had an effect on students in improving their understanding of electron configuration concepts, as seen from the increase in test scores and N-Gain values in both classes. The ANCOVA hypothesis test showed a significant difference between the two classes, as the Sig. value (Kelas_2) was less than 0.05. These results indicate that the use of dakon as a learning medium in combination with the TGT learning model has a positive effect on students' cognitivie abilities.

Keywords: Joyfull Learning, Team Games Tournament, Traditional Game-Based Learning, Dakon, Ethnopedagogical

1. Introduction

According to data from the Indonesian Child Protection Commission (KPAI), cases of violence against children in 2024 reached tens of thousands (KPAI, 2025). Most of the cases reported by the public were sexual violence cases. The Ministry of Women's Empowerment and Child Protection (KemenPPPA) recorded 28,831 cases of violence against children throughout 2024 (NU Online, 2024). KPAI explained that young children are very vulnerable to violence both at home and in their immediate environment. This situation is due to a lack of education about children's rights and bodily privacy, making children vulnerable to becoming victims, especially since children often cannot identify the incidents they experience and report them (Fitri, et al. 2025).

Based on Law No. 20 of 2002 concerning the National Education System, early childhood education is defined as an effort to nurture children from birth to six years of age by providing educational stimuli to assist their physical and spiritual growth and development (Ministry of Education and Culture, 2002). This definition should be used as a reference for stimulating children to protect themselves. One form of guidance related to child protection is introducing children to their bodily privacy (Suryani, et al. 2024). On the other hand, introducing body privacy is part of sex education (Jafar, et al. 2024). Sex education begins with introducing the parts of the body, followed by learning about the function of the genitals as reproductive organs. The goal is for children to understand their bodies and the bodies of the opposite sex and to be able to avoid inappropriate situations (Jafar, et al. 2024).

Introduction to body parts is the beginning of a child's understanding of the concept of self and the individual rights that children should have. The development of reflective body awareness begins when children are 18-21 months old. Over time, children will explore their bodies and compare them with the bodies of others (Brownell, et al. 2007). As children's cognitive maturity increases, their knowledge about the body needs to be enhanced with awareness of their bodily privacy. Children should be aware that their bodies are their private property (Marlina & Pransiska, 2018). Good privacy awareness in children can form a strong foundation to protect them from potential abuse and give them a better understanding of their own boundaries and those of others. This privacy education is even more crucial in today's digital age, where privacy violations can occur in various forms, both directly and indirectly (Rahmadani, 2024).

Recent research findings from Smith et al. (2023) show that experience-based learning programs for early childhood, including toilet training integrated with the introduction of the concept of privacy, can improve children's understanding of bodily boundaries and strengthen protection against the risk of abuse. Toilet training needs to be introduced early to predict the reflexes of urination and defecation at the right time and also help children to do it in the right place (Wulandari, Rachmawati, 2024). Research on toilet training is usually limited to urination and defecation activities. In fact, there are many other activities related to the toilet, such as wudhu, bathing, and washing hands/feet, one of which is a medium for learning about the anatomy and function of their own body parts (Fitri, et al. 2025). During toilet training, children learn to practice cleaning their anus and genitals properly (Hasanah, 2020).

According to Erik Erikson's psychosocial development theory, children aged 1-3 years are in the stage of autonomy vs. shame and doubt, where children begin to learn self-control but also have the potential to develop shame and doubt if they do not receive the right support (Mokalu & Charis, 2020). Toilet training is an activity that contributes to the development of autonomy by training children to control their bodily functions so that they can avoid feelings of shame and doubt (Kamilla, et al. 2022). In early childhood, the application of toilet training within the limits of body privacy awareness includes children being able to go to the bathroom by themselves, not taking off their clothes in front of others, and not allowing others to touch their bodies, especially their private areas (Kurniawati, 2024).

However, based on initial observations at KB Yumna, toilet training is often focused solely on functional aspects, such as the child's ability to use the toilet independently, without integrating the concept of privacy awareness. This indicates a gap in the learning approach that could maximize the potential of toilet training as a means of increasing children's privacy awareness.

Therefore, the purpose of this study is to increase children's privacy awareness through toilet training.

2. Research Method

This study employs a quantitative research design with an experimental approach, adjusted to the problems under investigation. Two sample classes were randomly selected and assigned as the experimental class and the control class. The experimental class received treatment using the Teams Games Tournament (TGT) learning model combined with the dakon traditional game as learning media, while the control class received treatment through conventional group discussion without the use of dakon as a learning medium.

The purpose of this study is to determine whether there is an influence of learning models and learning motivation on students' learning outcomes in Chemistry. The study involves three variables: two independent variables (X), consisting of the learning method and model (treatment) (X1) and students' pretest scores (X2), and one dependent variable (Y), namely students' cognitive ability or learning outcomes (posttest scores).

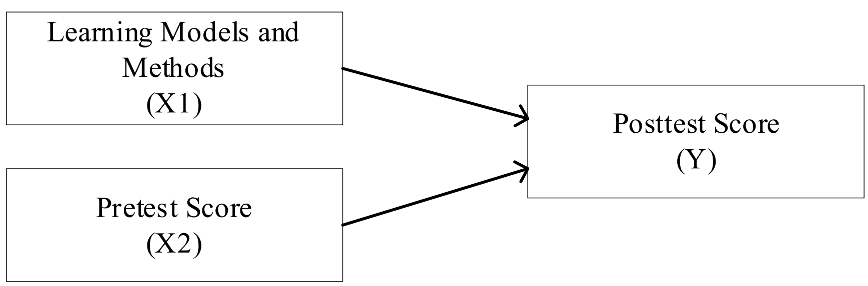

Figure 1. Research Design

The study was conducted at SMA 1 Muhammadiyah Cilacap during the odd semester of the 2025/2026 academic year, from mid-July to mid-August 2025. The school is located at Jl. Kalimantan No.12, Kemiren, Tegalkamulyan, South Cilacap District, Cilacap Regency, Central Java Province.

The population of this study consisted of all 10th-grade students (Phase E) at SMA 1 Muhammadiyah Cilacap, comprising four classes: XE-1, XE-2, XE-3, and XE-4. The selection of the classes used in this study was made in consultation with the Chemistry subject teacher and by considering the availability of time for conducting the research. Consequently, the sample of this study consisted of class XE-2, designated as the experimental class with 28 students, who were taught using the TGT model and dakon as a learning medium, and class XE-3, designated as the control class with 30 students, who were taught using the conventional group discussion model without dakon.

This research was carried out in three stages: the planning stage, the implementation stage, and the completion stage. The planning stage involved a literature review and the preparation of research instruments to be used during the study. The implementation stage included: (1) administering the pretest, (2) conducting the learning process, and (3) administering the posttest. The completion stage involved processing and analyzing the data, followed by drawing conclusions.

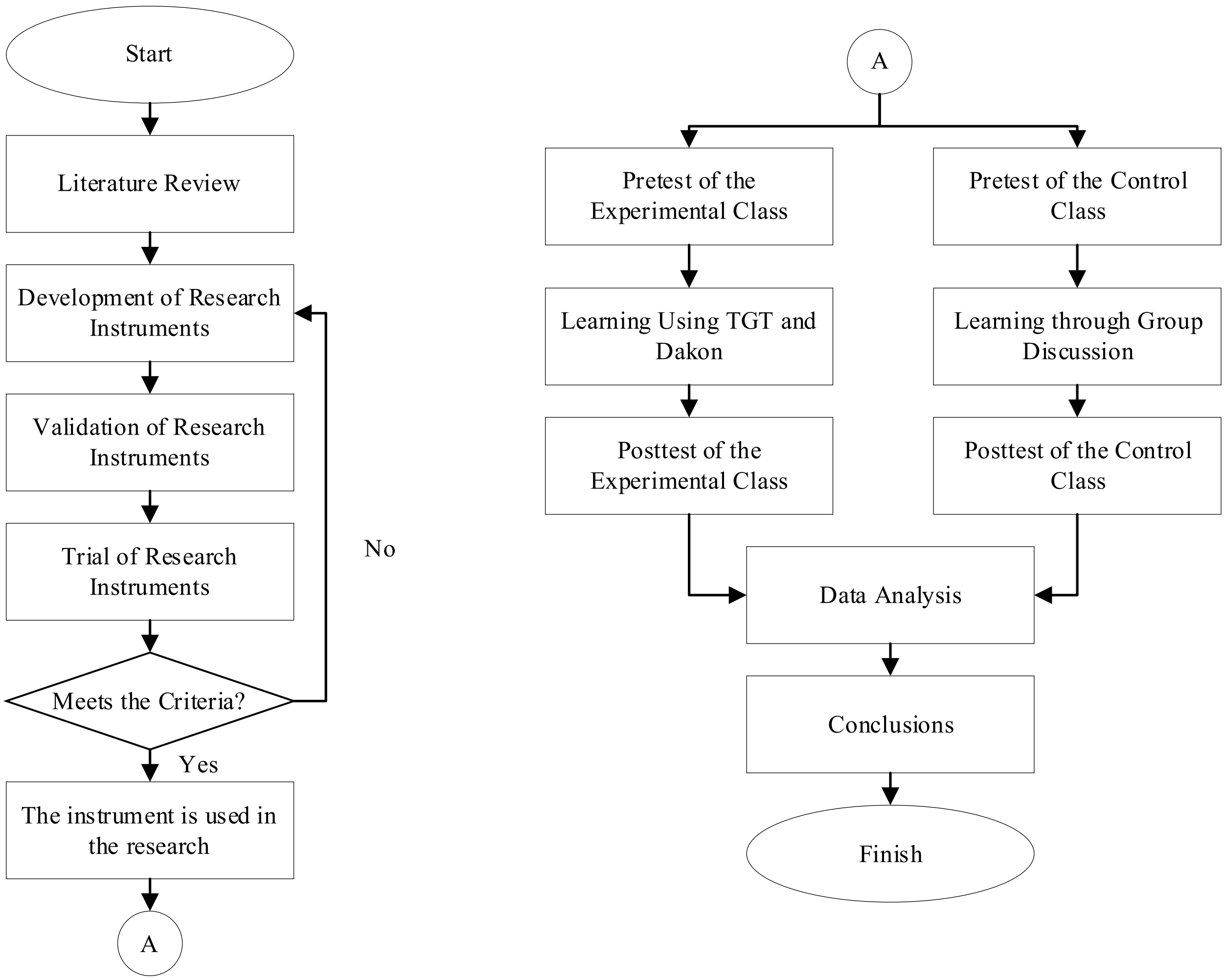

Figure 2. Research Flowchart

The instruments used to collect research data were pretest questions to determine students' initial understanding before the study and posttest questions to determine students' understanding after the study.

The instruments used in data collection underwent a series of instrument tests. The test items used in the pretest and posttest were first tested for content validity by subject matter experts and language experts, construct validity was tested statistically using Pearson correlation, reliability was tested, difficulty level was tested, and item discrimination power was tested.

Reliability testing was conducted using the Kuder-Richardson formula 20 (KR-20) with the assistance of Microsoft Excel. Table 1 is a table of reliability test criteria according to Guilford in Afrida (2024).

Table 1. Reliability Test Criteria

Correlation Coefficient	Correlation Level	Interpretation
0,90 ≤ r ≤ 1,00	Very High	Very consistent/Very good
0,70 ≤ r < 0,90	High	Consistent/Good
0,40 ≤ r < 0,70	Medium	Fairly consistent/Fairly good
0,20 ≤ r < 0,40	Low	Inconsistent/Poor
r < 0,20	Very Low	Very inconsistent/Very poor

The discrimination power test was conducted with the help of Microsoft Excel. Table 2 is the table of item discrimination power test criteria (Afrida, 2024).

Table 2. Criteria for Item Discrimination Power Test

Discrimination Power Value (DP)	Interpretation
0,70 ≤ DP ≤ 1,00	Very good
0,40 ≤ DP < 0,70	Good
0,20 ≤ DP < 0,40	Fairly good
0,00 ≤ DP < 0,20	Poor
DP < 0,00	Very poor

The difficulty level of the questions was tested by using Microsoft Excel. Table 3 is a table of criteria for question difficulty levels (Afrida, 2024).

Table 3. Criteria for Item Difficulty Level Test

Difficulty Index Value (IK)	Interpretation
IK = 0,00	Too difficult
0,00 < IK ≤ 0,30	Difficult
0,30 < IK ≤ 0,70	Medium
0,00 < IK < 1,00	Easy
IK = 1,00	Too easy

The data that has been obtained will be analyzed. After that, prerequisite tests for analysis (normality test, homogeneity test, linearity test), n-gain test, and ANCOVA test were conducted to examine the influence of the learning model and media variables (treatment) and the covariate variable, which is the pretest score, on the dependent variable, which is the posttest score of the students. Prerequisite analysis testing and hypothesis testing (ANCOVA test) were conducted using SPSS 26 software.

The normalized gain (n-gain) test was calculated using the n-gain formula with the assistance of Microsoft Excel. Table 4 presents the criteria for normalized gain.

Table 4. Normalized Gain Criteria

N-Gain Score	Interpretation
0,70 ≤ N-Gain ≤ 1,00	High
0,30 ≤ N-Gain < 0,70	Medium
0,00 ≤ N-Gain < 0,30	Low
N-Gain = 0,00	No improvement
-1,00 ≤ N-Gain < 0	Decline in performance

In addition to the tests mentioned above, the researcher also analyzed the data using descriptive statistics, including maximum score, minimum score, and mean score, with the assistance of SPSS 26 software.

3. Results and Discussions

The test instruments were developed through a series of evaluations, including content validity testing by subject matter experts and language experts, construct validity testing using Pearson's correlation, reliability testing, item difficulty testing, and item discrimination testing. The test instruments were given to 25 students who had already studied the topic of "Electron Configuration." Table 5 presents the results of the construct validity test of the instruments.

Table 5. Results of Construct Validity Test of the Instrument Items

Item Number	r-calculated	r-table	Description
1	0,5751	0,3961	Valid
2	0,6286	0,3961	Valid
3	0,5893	0,3961	Valid
4	0,4974	0,3961	Valid
5	0,7567	0,3961	Valid
6	0,7733	0,3961	Valid
7	0,6492	0,3961	Valid
8	0,4496	0,3961	Valid
9	0,6680	0,3961	Valid
10	0,6813	0,3961	Valid
11	0,6037	0,3961	Valid
12	0,6385	0,3961	Valid
13	0,6506	0,3961	Valid

Item Number	r-calculated	r-table	Description
14	0,6483	0,3961	Valid
15	0,6483	0,3961	Valid
16	0,5751	0,3961	Valid
17	0,6581	0,3961	Valid
18	0,6778	0,3961	Valid
19	0,7324	0,3961	Valid
20	0,5368	0,3961	Valid
21	0,7478	0,3961	Valid
22	0,6801	0,3961	Valid
23	0,6581	0,3961	Valid
24	0,6302	0,3961	Valid
25	0,7244	0,3961	Valid
26	0,6560	0,3961	Valid
27	0,6063	0,3961	Valid
28	0,7248	0,3961	Valid
29	0,6621	0,3961	Valid
30	0,6874	0,3961	Valid

The results of the construct validity test for the test instrument items in Table 5 show that the test instrument created is "Valid," as the calculated r value is greater than the table r value, which is 0.3961 with a significance level of 5%. Since all test items were declared valid, the next test, the reliability test, was conducted. Table 6 is the table of results for the test instrument reliability test.

Table 6. Results of Instrument Reliability Test

r-calculated Result	Interpretation	Description
0,9552	Reliable	Very Good

The reliability test results in Table 6 show that the test instrument is reliable for use during the study, as the calculated r value is 0.9552. The interpretation and explanation in Table 6 are taken from the reliability test criteria in Table 1. After conducting the reliability test, a test of item discrimination power was performed to determine the ability of the items to differentiate students' abilities. Table 7 is the table of item discrimination index test results.

Table 7. Results of Item Discrimination Power Test

Item Number	Item Discrimination Power (DP)	Description
1	0,3333	Fair
2	0,5064	Good
3	0,3462	Fair
4	0,2628	Fair
5	0,5000	Good
6	0,4231	Good
7	0,5000	Good
8	0,4167	Good
9	0,3462	Fair
10	0,5833	Good
11	0,4295	Good
12	0,3462	Fair
13	0,5833	Good
14	0,5064	Good
15	0,3462	Fair
16	0,3333	Fair
17	0,3462	Fair
18	0,3462	Fair
19	0,5833	Good
20	0,2692	Fair
21	0,4167	Good
22	0,4295	Good
23	0,5064	Good
24	0,5833	Good
25	0,3397	Fair
26	0,4167	Good
27	0,3397	Fair
28	0,5128	Good
29	0,4359	Good
30	0,5128	Good

The results of the item discrimination test in Table 7 indicate that the test items had discrimination levels categorized as “fair” and “good,” meaning that no revision or improvement of the items was necessary. The descriptions in Table 7 were based on the item discrimination criteria presented in Table 2. After the item discrimination test, an item difficulty test was conducted to determine the balance of the test difficulty levels. Table 8 presents the results of the item difficulty test.

Table 8. Results of Item Difficulty Level Test

Item Number	Difficulty Index (IK)	Description
1	0,8400	Easy
2	0,6800	Medium
3	0,6800	Medium
4	0,7200	Easy
5	0,7600	Easy
6	0,7200	Easy
7	0,7600	Easy
8	0,8000	Easy
9	0,6800	Medium
10	0,7200	Easy
11	0,6400	Medium
12	0,6800	Medium
13	0,7200	Easy
14	0,6800	Medium
15	0,6800	Medium
16	0,8400	Easy
17	0,6800	Medium
18	0,6800	Medium
19	0,7200	Easy
20	0,6400	Medium
21	0,8000	Easy
22	0,6400	Medium
23	0,6800	Medium
24	0,7200	Easy
25	0,7600	Easy
26	0,8000	Easy
27	0,7600	Easy
28	0,6000	Medium
29	0,5600	Medium
30	0,6000	Medium

The results of the item difficulty test in Table 8 show that the instrument items consisted of varying levels of difficulty, categorized as “medium” and “easy.” The descriptions in Table 8 were based on the item difficulty criteria presented in Table 3. After the test instruments were successfully developed, they were administered as pretests and posttests in two classes (the experimental class and the control class).

The results of the pretest and posttest from both classes were then further analyzed. The data were analyzed using descriptive statistics, including maximum score, minimum score, and mean score, with the assistance of SPSS 26 software. Figure 3 presents the results of the descriptive statistical analysis.

Descriptive Statistics

	N	Minimum	Maximum	Mean
Pretest_Kontrol	30	7	43	19.67
Posttest_Kontrol	30	57	80	67.03
Pretest_Eksperimen	28	7	37	18.71
Posttest_Eksperimen	28	80	100	87.07
Valid N (listwise)	28			

Figure 3. Results of Descriptive Statistical Analysis Using SPSS 26

Descriptive analysis in Figure 3 shows that the average pretest score for the control class was 19.67 and for the experimental class was 18.71. After the treatment (learning process), the average posttest score for the control class was 67.03 and for the experimental class was 87.07. The treatment in the experimental class had a better impact, as the increase in scores was greater than in the control class, as shown in Figure 4.

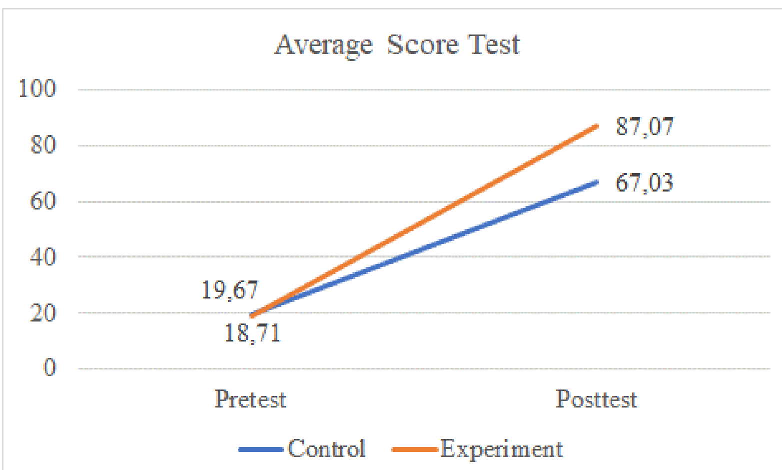

Figure 4. Comparison of Average Score Test

After analyzing the data using descriptive statistics, the researcher conducted an n-gain test to examine the level of improvement in the learning process. The results of the calculation and the comparison graph of the n-gain scores between the control class and the experimental class are presented in Table 9 and Figure 5.

Table 9. Results of N-Gain Calculation

	Control	Experiment
N-Gain Score	0,42	0,82

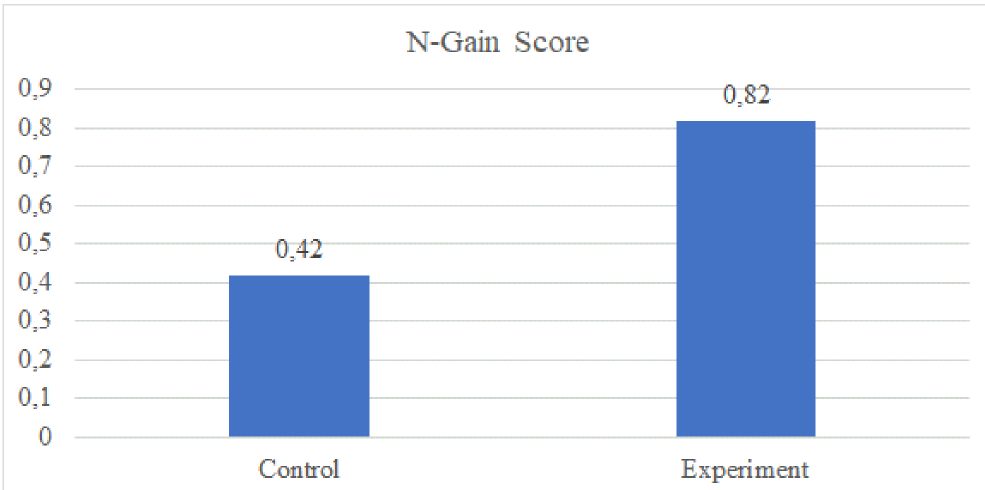

Figure 5. Comparison of N-Gain Scores

From the n-gain test that was found that based on Table 4, the n-gain obtained in the experimental class was 0.82, indicating a learning improvement in the “high” category, while in the control class it was 0.42, indicating a learning improvement in the “medium” category.

To strengthen the results of the analysis, an ANCOVA hypothesis test was conducted to determine whether the independent variable (differences in treatment between the two classes) had an effect on the dependent variable, namely learning outcomes (posttest scores), with pretest scores as the covariate. Before conducting ANCOVA, prerequisite tests were carried out, namely the normality test, homogeneity test, and linearity test.

The normality test aims to examine the conformity of the data distribution with the normal distribution. The normality calculation was performed using SPSS 26, and the results are presented in Figure 6.

Tests of Normality

	Jenis Kelas	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Hasil Tes	Pretest Kontrol (Diskusi Kelompok)	.140	30	.138	.938	30	.082
	Posttest Kontrol (Diskusi Kelompok)	.153	30	.072	.941	30	.099
	Pretest Eksperimen (TGT&Dakon)	.139	28	.178	.939	28	.105
	Posttest Eksperimen (TGT&Dakon)	.133	28	.200*	.937	28	.092

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 6. Results of Normality Test Using SPSS 26

The calculation results in Figure 6 show that all pretest and posttest scores for both the control and experimental classes are normally distributed, as the Sig. value is greater than 0.05. After conducting the normality test, a homogeneity test was performed to examine the homogeneity of the data. The homogeneity calculation was carried out using SPSS 26, and the results are presented in Figure 7.

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hasil Tes	Based on Mean	.638	3	112	.592
	Based on Median	.377	3	112	.770
	Based on Median and with adjusted df	.377	3	99.347	.770
	Based on trimmed mean	.590	3	112	.623

Figure 7. Results of Homogeneity Test Using SPSS 26

The calculation results in Figure 7 show that all pretest and posttest scores for both the control and experimental classes are homogeneous, as the Sig. (Based on Mean) value is greater than 0.05.

After conducting the homogeneity test, a linearity test was performed to examine whether the relationship between pretest and posttest scores for both classes forms a linear pattern. The linearity calculation was carried out using SPSS 26, and the results are presented in Figure 8.

Graph

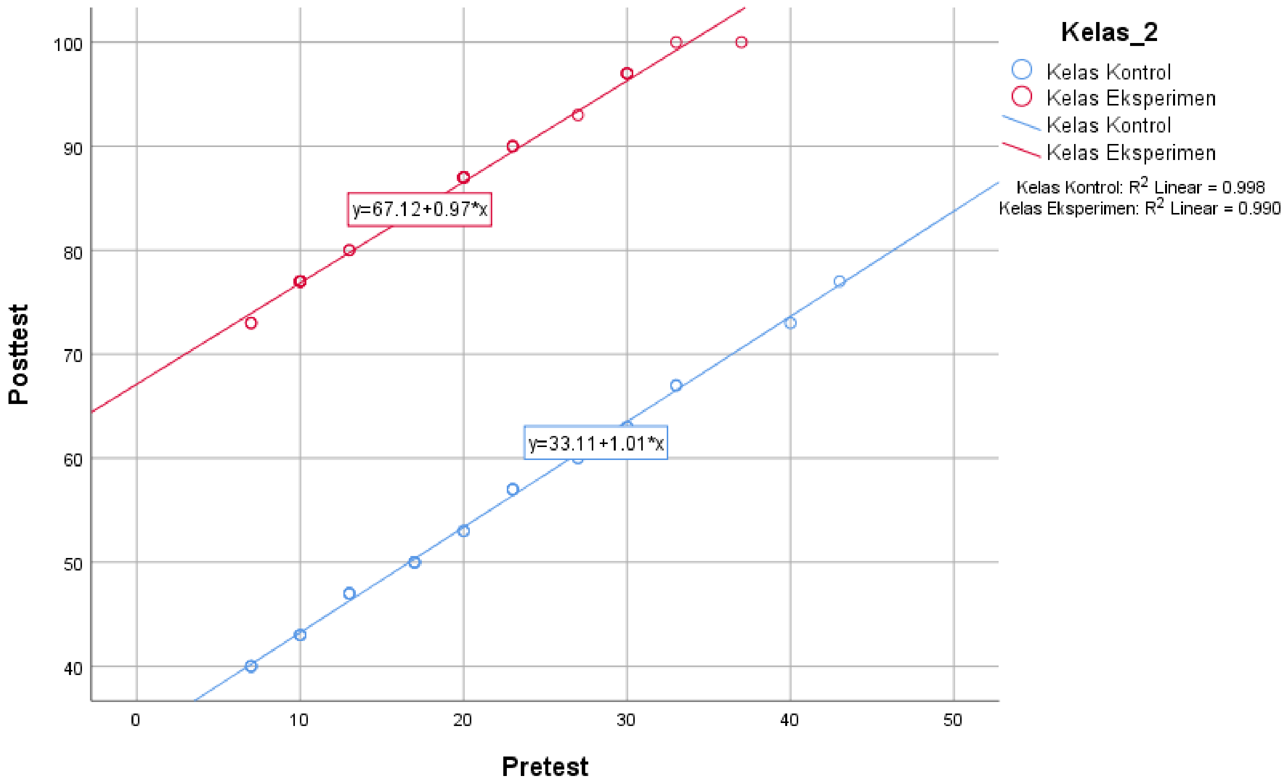

Figure 8. Results of Linearity Test Using SPSS 26

The calculation results in Figure 8 indicate that the two variables have a linear relationship, as the graph forms a straight line. After conducting the linearity test, all prerequisite tests for the hypothesis have been completed. Based on the results of the three prerequisite tests, it can be concluded that the ANCOVA hypothesis test can be performed, as the data are normally distributed, homogeneous, and exhibit a linear relationship.

The ANCOVA hypothesis test was conducted to determine the effect of the treatment, with the analysis carried out using SPSS 26. The results are presented in Figure 9.

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	19744.055[a]	2	9872.027	21209.097	.000
Intercept	26077.025	1	26077.025	56023.968	.000
Pretest	4645.473	1	4645.473	9980.351	.000
Kelas_2	15954.747	1	15954.747	34277.232	.000
Error	25.600	55	.465		
Total	292880.000	58			
Corrected Total	19769.655	57			

a. R Squared = .999 (Adjusted R Squared = .999)

Figure 9. Results of ANCOVA Analysis Using SPSS 26

The results of the statistical analysis using the ANCOVA hypothesis in Figure 9 show that the Sig. value (Kelas_2) is less than 0.05. Therefore, it can be concluded that there is a significant difference between the treatments applied in the two classes on students' learning outcomes (posttest scores).

The research results using the TGT method are in line with the study conducted by Fitri (2024), which showed that the learning outcomes of students using the TGT method had an average score of 80.4, which was higher than the conventional method with an average score of 68.2. Research conducted by Masuroh (2022) showed a positive influence on student learning outcomes due to the use of TGT in the learning process.

The research results using dakon are consistent with the study conducted by Fadila (2024), which showed an increase in the average score from 64.31 during the pretest to 83.34 during the posttest when using dakon media in mathematics lessons. The study conducted by Pratama et al. (2022) showed that using dakon for mathematics can improve students' learning outcomes, as evidenced by the increase in the average score from 37.33 in the pre-cycle to 70.76 in cycle 1, and to 82.2 in cycle 2.

The research results obtained are in line with the study conducted by Agustini et al. (2024), which showed that using the TGT model and the dakon media can improve students' learning mastery, with 58% completing the pre-cycle stage, 73% completing cycle 1, and 88% completing cycle 2. Research conducted by Kayadoe et al. (2022) also showed that learning with the TGT model and modified congklak media can improve students' learning outcomes with an average n-gain value of 0.7, indicating a high learning improvement.

4. Conclusion

Learning using the dakon media combined with the Teams Games Tournament (TGT) model in the experimental class had a significant effect on improving students' understanding of the electron configuration concept compared to group discussion learning in the control class. This is evidenced by the greater score improvement in the experimental class, which was 68.36, compared to 47.36 in the control class, as well as the increase in n-gain from 0.42 in the control class to 0.82 in the experimental class. The improvement in students' learning outcomes (cognitive achievement) between the control and experimental classes was significantly different. This was confirmed through the ANCOVA hypothesis test, with a Sig. value (Class_2) < 0.05. These results indicate that the use of dakon as a learning medium in combination with the TGT learning model has a positive effect on students' cognitivie abilities.

It is hoped that this research can serve as an impetus for subject teachers to improve and enhance the quality of their classroom instruction. This research can still be developed in various ways, namely: 1) it can be expanded to wider areas and samples by involving several schools, 2) TGT and ethnopedagogy-based research can be extended to different chemistry materials, 3) other research variables such as learning motivation can be added to link learning treatment, learning motivation, and student learning outcomes, or 4) TGT and dakon methods can be applied to other subjects if possible.

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