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The Influence of the Discovery Learning Model Assisted by Kahoot Media on Learning Outcomes

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Abstract: *This study examined the effect of the Discovery Learning model assisted by Kahoot media on students' activities and learning outcomes on the topic of atomic structure. This study involved students of class X IPA SMA IT Jabal Noor Medan, with purposive sampling selecting class X PSP B as the experimental class (Discovery Learning with Kahoot) and class X PSP A as the control class (conventional learning). The test and non-test instruments used were valid, and the data met the assumptions of normality and homogeneity. The results showed that the experimental class achieved a higher average activity score (87.6) than the control class (76), with a significant difference (t count = 6.305 > t table = 2.023). The N-Gain score of the experimental class (0.83) also exceeded the N-Gain score of the control class (0.75). These findings indicate that the Discovery Learning model assisted by Kahoot is effective in increasing students' activities and learning outcomes in studying atomic structure.*

Keywords: *discovery learning; kahoot; learning activities; learning outcomes; atomic atructure*

INTRODUCTION

Education is a deliberate and structured effort to develop students' potential in intellectual, emotional, and moral aspects, equipping them with the skills necessary for personal and societal development (Aryanthi et al., 2019). In the context of science education, chemistry is a subject that plays a pivotal role in developing scientific reasoning. However, many students still face difficulties in understanding chemistry concepts, particularly in topics that are abstract, such as atomic structure. Mastering atomic structure requires strong visualization skills and conceptual reasoning, which often pose challenges for learners and lead to low academic performance. Many students still find chemistry, particularly atomic structure, difficult to understand because the concepts are abstract and require a high level of reasoning and visualization (Rahmadani & Nurhayati, 2022).

Preliminary observations and interviews with chemistry teachers at SMA IT Jabal Noor revealed that classroom instruction remains teacher-centered, relying primarily on lectures and written exercises. Traditional chemistry classes that are dominated by teacher explanations tend to make students passive and less motivated to engage in scientific inquiry (Lestari & Saputra, 2021). Students are rarely guided to actively explore or construct concepts independently. Combining discovery learning with virtual laboratory tools helps students become more active and develop both their conceptual understanding and experimental skills (Hidayah & Maulana, 2020). Consequently, learning tends to emphasize memorization rather than conceptual understanding. Discovery learning encourages students to explore and construct knowledge independently, leading to a more meaningful understanding of chemical concepts (Astafani, Rahmawati, & Ardiansyah, 2024). This condition is reflected in student achievement data showing that nearly half of the students scored below the Learning Objective Achievement Criteria (KKTP = 82), indicating that the learning process has not yet been optimal.

Previous studies have demonstrated the potential of interactive learning models and digital media in enhancing student engagement and learning outcomes. Gamified tools such as Kahoot can enhance students' attention, creativity, and problem-solving skills, turning passive learning into active participation (Aibar-Almazán et al., 2024). However, empirical evidence on how the integration of discovery-oriented learning models with digital quiz platforms specifically influences students' learning activities and cognitive outcomes, particularly in chemistry topics such as atomic structure, remains limited. Digital game-based learning improves students' engagement, collaboration, and enthusiasm to participate in chemistry classes (Fitria & Santosa, 2023; Zainuddin & Chu, 2022). This gap suggests the need for a more systematic investigation into how such approaches can foster deeper understanding and active participation in learning.

Therefore, this study aims to examine the influence of the Kahoot-assisted Discovery Learning model on students' learning activities and outcomes, as well as their correlation. The application of discovery learning assisted by interactive media has been proven to significantly improve students' chemistry learning outcomes (Putri & Suryani, 2023).

LITERATURE REVIEW

Several recent studies have highlighted the positive impact of using interactive learning models and media in chemistry education. Putri et al. (2024) study, "Discovery Learning Models on Student Learning Outcomes in Atomic Structure," found that the Discovery Learning Model improved student achievement, as reflected in increased average grades and greater enthusiasm during the learning process. Similarly, Laode et al. (2024), in their study, "The Effectiveness of the Discovery Learning Model in Improving Student Learning Outcomes in Atomic Structure," reported that student responses were very positive (80.59%), and their chemistry learning outcomes were categorized as good, confirming the model's effectiveness in encouraging active engagement.

In addition to learning models, the use of educational media has also proven beneficial. Fitriana (2023) demonstrated that the use of interactive presentation tools like ClassPoint and digital quiz applications like Quizizz and Kahoot significantly improved student participation and communication skills in chemistry learning. This finding is also supported by Konengian et al. (2023) findings, which showed that implementing Kahoot as an evaluation tool improved students' cognitive learning outcomes, focus, and accuracy through a competitive and enjoyable learning environment. Kahoot provides an engaging and interactive way for chemistry students to receive feedback and actively participate during learning activities (Aliyu, Abdul Talib, & Abubakar Garba, 2022). The use of game-based learning platforms such as Kahoot significantly increases students' motivation and interest in chemistry lessons (Al-Flayeh, Keziah, & Dikenwosi, 2025).

Collectively, these studies suggest that combining structured learning models with interactive media can enhance student engagement and understanding. However, empirical evidence on how the simultaneous integration of both strategies affects learning activities and outcomes, particularly in the topic of atomic structure, is limited, necessitating further research.

METHODS

This study employed a quasi-experimental design, specifically a pretest-posttest control group design. The study was conducted at SMA IT Jabal Noor Medan in the 2024/2025 academic year. The population consisted of all 10th-grade science students. The sample was selected using purposive sampling, consisting of 21 students from Class X PSP B as the experimental class and 20 students from Class X PSP A as the control class.

The experimental class was taught using the Discovery Learning model using Kahoot, while the control class was taught through conventional learning using the same media. Both classes were given a pretest before the lesson and a posttest afterward to measure differences in cognitive learning outcomes. The research instruments included both test and non-test instruments. The test instrument consisted of 20 valid multiple-choice items representing four cognitive domains based on Bloom's taxonomy: knowledge (C1), understanding (C2), application (C3), and analysis (C4). The instrument was tested for validity, reliability, difficulty level, discriminatory power, and distraction effectiveness.

The validity of each item was determined using the Pearson Product-Moment correlation formula:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

An item is considered valid if $r_{count} > r_{table}$. Using $r_{table} = 0{,}456$ at $\alpha = 0{,}05$. 24 of 40 items were valid, and 20 were selected for use.

Reliability was calculated using the Kuder–Richardson (KR-20) formula:

$$r_{11} = \left(\frac{K}{K-1}\right)\left(\frac{S^2 - \sum P^2}{S^2}\right)$$

Where k = number of items, p = proportion of correct answers, q = 1 – p, and s^2 = total variance. The calculation yields r_{11} = 0.902, which is categorized as very high reliability, indicating consistent measurement.

The item difficulty index was determined using the formula:

$$P = \frac{B}{T}$$

The results showed that 5 items were easy, 13 moderate, and 6 difficult.

The discriminating power of each item was calculated using:

$$D = \frac{BA}{JA} - \frac{BB}{JB} = P_A - P_B$$

The results showed 20 items had adequate discrimination and were feasible for use.

The effectiveness of each distractor was determined using the formula:

$$\text{Distruktor } X = \frac{JPA + JPB}{JA + JB} \times 100\%$$

A distractor is considered functional if chosen by ≥5% of students. The results showed 20 items had effective distractors, meeting the criteria for functional alternatives.

Before hypothesis testing, data were analyzed to ensure normality and homogeneity between the two groups, meeting statistical assumptions. Differences in learning outcomes between the two groups were analyzed using an independent-samples t-test, while learning gains were evaluated using an N-Gain analysis to assess the effectiveness of the applied learning model.

RESULT AND DISCUSSION

1. Research Instrument Data Analysis

Instrument analysis was conducted to ensure the quality and accuracy of the test items before being used in the study. All statistical calculations were performed using

Microsoft Excel 2021 to compute correlation, reliability, and item characteristics manually and transparently.

The validity test employed the Pearson Product-Moment correlation formula. The results showed that 24 out of 40 test items had correlation coefficients greater than the critical value ($r$table = 0.456, α = 0.05), indicating valid items. Of these, 20 items were selected for the final test because they represented all indicators of learning achievement.

The reliability test was carried out using the Kuder–Richardson 20 (KR-20) formula. Based on the calculation in Excel, the reliability coefficient was r_{11} = 0.902, categorized as *very high*. This means the test instrument was consistent in measuring students' learning outcomes.

The difficulty index (P) and discriminating power (D) were also analyzed using Excel formulas. The results indicated that 5 items were easy, 13 moderate, and 6 difficult, while 20 items had adequate discrimination ability. The distractor analysis revealed that all 20 items met the minimum criterion of 5% selection frequency, confirming that the distractors were functional.

2. Improved Learning Outcomes

The pretest and posttest data from both classes were processed in Microsoft Excel to determine students' learning improvement using the N-Gain formula.

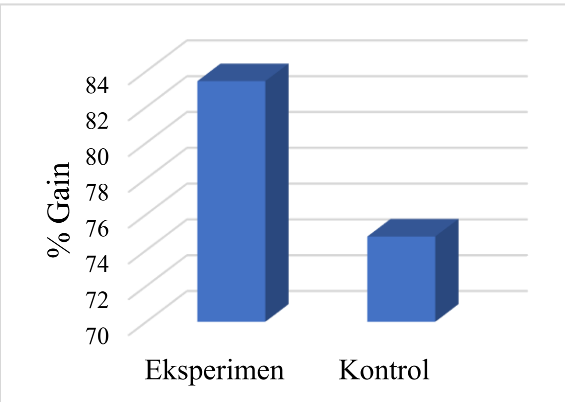

Figure 1. Comparison of Average Student Learning Activity Scores

Both classes showed improvement, but the experimental class achieved a higher average N-Gain (0.83) compared to the control class (0.75). This suggests that the use of the Discovery Learning model assisted by Kahoot media is more effective in improving students' understanding of atomic structure.

The improvement is attributed to the active discovery process, where students engage in exploration, hypothesis formulation, and concept verification, leading to deeper conceptual learning. The integration of Kahoot transforms assessment into an interactive activity, promoting enjoyment, competitiveness, and immediate feedback factors that reinforce student motivation and retention.

Learning outcomes are influenced by both internal and external factors. Internal factors include motivation, interest, and cognitive ability, while external factors involve teaching methods, learning environment, and social support.According to (Astafani et al., 2024) internal factors include low student motivation and interest in learning as well as inadequate cognitive abilities, meanwhile, significant external factors include less than optimal teaching methods, unsupportive learning facilities, and the negative influence of the family and peer environment.

3. Student Learning Activities

By using the Discovery Learning model, the researcher wanted to observe how students' activities were during the learning process. In the experimental class, this model was implemented for three consecutive meetings with stages that followed the Discovery Learning syntax. In the first meeting, students were given Student Activity Sheets containing material on atomic model concepts, such as the Dalton, Thomson, Rutherford, and Bohr models. Through group discussions, students were guided to explore the strengths and weaknesses of each model based on the available information. The second meeting focused on learning electron configurations and determining the periods and groups of elements in the periodic table. Students were asked to search for and process data from various sources to determine the position of elements in the periodic table based on the number of valence electrons. Next, in the third meeting, students learned the concepts of isotopes, isotones, and isobars. In groups, they analyzed data on the number of protons, neutrons, and atomic masses of various elements to classify them appropriately. The entire learning process was designed to encourage students to actively observe, gather information, discuss findings, and conclude concepts independently, so that their learning activities could be seen as comprehensive and structured.

The average student learning activity measured during three meetings showed a significant difference between the experimental class and the control class. The experimental class, taught using the Discovery Learning model assisted by Kahoot media, obtained an average activity of 87.6, while the control class using conventional learning only achieved an average of 76. To determine whether the difference was statistically significant, a hypothesis test was conducted using an independent t-test. Based on the calculation results, the value of t_{count} = 6.305, while t_{table} = 2.023 at a significance level of 0.05. Because $t_{count} > t_{table}$, the decision taken was to reject H_0 and accept H_a. Thus, it can be concluded that there is a significant influence of the use of the Discovery Learning model assisted by Kahoot media on student learning activities.

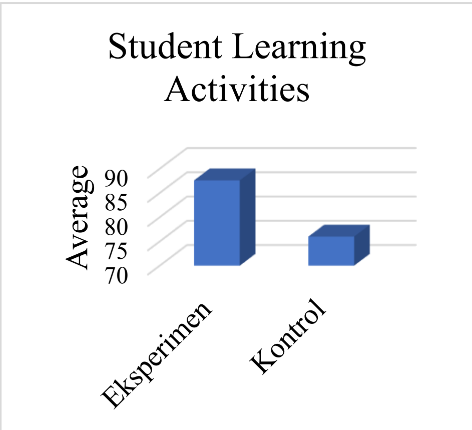

Figure 2. Comparison of Average Student Learning Activity Scores

The results showed that the experimental class achieved an average activity score of 87.6, while the control class obtained 76. Based on the independent sample t-test performed in Excel, tcount = 6.305 > ttable = 2.023 (α = 0.05), indicating a significant difference between the two groups.

Students in the experimental group demonstrated higher engagement, collaboration, and problem-solving activity, consistent with the characteristics of the Discovery Learning model. Kahoot supported this by providing real-time feedback, encouraging participation even from less active students. In contrast, the control class showed limited interactivity and tended to rely on teacher direction. Web 2.0-based learning environments, including Kahoot and Quizlet, promote continuous participation and sustained motivation among chemistry students (Yılmaz & Yaşar, 2023).

This result is consistent with Jayadiningrat et al. (2019) and Melina (2019), who reported that discovery-based instruction significantly increases student participation. The current study, however, adds evidence that combining discovery with gamified media enhances both cognitive and behavioral engagement.

4. Correlation between Learning Activities and Student Learning Outcomes

Table 1. Comparison of Average Student Learning Activity Scores

Variable Pair	t_{count}	t_{table}	p-value	Interpretation
Activities	0.748	0.456	0.0001	significant

Based on the calculation, with r = 0.748 and n = 21, the obtained value was t_{count} = 4,913, while the critical value (t_{table}) at α = 0.05 and df = n − 2 = 19 was 2.093. Because $t_{count} > t_{table}$ (4.913 > 2.093), the result indicates that there is a significant positive correlation between students' learning activities and their learning outcomes.

This means that students who are more actively engaged in the learning process, such as discussing, asking questions, and participating in interactive tasks, tend to achieve higher learning outcomes. These findings support Bruner's Constructivist Theory, which emphasizes that knowledge is more effectively retained when learners are actively involved in constructing their understanding. The implementation of the Discovery Learning model, assisted by Kahoot media, creates an engaging environment that strengthens both

CONCLUSION

The study shows that the Discovery Learning model, assisted by Kahoot media, significantly improves students' learning outcomes and learning activities in atomic structure lessons. A strong positive correlation ($r = 0.748$; $t_{count} = 4.913 > t_{table} = 2.093$) indicates that active participation enhances achievement. These findings suggest that combining discovery-based learning with interactive media can increase engagement and conceptual understanding in chemistry. However, this study was limited to one school with a small sample size, so further research involving larger populations and other science topics is recommended. Gamified learning environments like Kahoot enhance learner engagement and performance compared to traditional classroom models (Zainuddin & Chu, 2022).

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REFERENCE

Aibar-Almazán, A., Castellote-Caballero, Y., Carcelén-Fraile, M., Rivas-Campo, J., & González-Martín, F. (2024). Kahoot! as a tool for university teaching innovation: Effects on attention, creativity, self-regulated learning and problem-solving. *Frontiers in Psychology.* https://doi.org/10.3389/fpsyg.2024.1370084

Al-Flayeh, I. S., Keziah, C. B., & Dikenwosi, R. (2025). Game on for chemistry: How Kahoot transforms learning outcomes and student interest. *Journal of Chemical Learning Innovation, 2*(1), 1–11. https://doi.org/10.37251/jocli.v2i1.1717

Aliyu, H., Abdul Talib, C., & Abubakar Garba, A. (2022). Use of Kahoot! for assessment in chemistry classroom: An action research. *International Journal of Current Educational Studies, 1*(2), 51–62. https://doi.org/10.46328/ijces.22

Aryanthi, K. D., Suwatra, I. I. W., & Suarjana, I. M. (2019). Pengaruh Model Pembelajaran Air Berbantuan Media Gambar Terhadap Hasil Belajar Ips Siswa. *Media Komunikasi FPIPS*, *17*(1), 33–43. https://doi.org/10.23887/mkfis.v17i1.22215

Astafani, A., Resmawati, R. F., & Hakim, M. E. L. (2024). Systematic Review : Faktor- Faktor Kesulitan Belajar Materi Kimia. *Jurnal Inovasi Pendidikan Kimia*, *18*(2), 82–88.

Astafani, R. D., Rahmawati, Y., & Ardiansyah, R. (2024). The implementation of discovery learning model to improve students' learning outcomes in reaction rate material. *Jurnal Inovasi Pembelajaran Kimia (JIPK),* *8*(2), 112–121. https://doi.org/10.24114/jipk.v8i2.42789

Fitria, N., & Santosa, H. (2023). Enhancing student engagement and learning activities through digital game-based learning in chemistry class. *International Journal of Interactive Mobile Technologies, 17*(4), 32–45. https://doi.org/10.3991/ijim.v17i04.37125

Fitriana, N. (2023). Peningkatan Keaktifan Peserta Didik Melalui Media Persentasi Classpoint Dan Game Edukasi (Quizizz & Kahoot) Pada Pembelajaran Kimia. *ACTION : Jurnal Inovasi Penelitian Tindakan Kelas Dan Sekolah*, *3*(1), 35–41. https://doi.org/10.51878/action.v3i1.1982

Hidayah, S., & Maulana, I. (2020). The effect of discovery learning with virtual lab integration on students' activity and learning achievement. *Jurnal Inovasi Pembelajaran Kimia (JIPK), 4*(1), 78–86. https://doi.org/10.24114/jipk.v4i1.34723

Jayadiningrat, M. G., Agus, K., Putra, A., Septian, P., Adistha, E., Ganesha, U. P., Belajar, A., & Belajar, H. (2019). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Aktivitas Dan Hasil Belajar. *Jurnal Pendidikan Kimia Undiksha*, *3*(2), 83–89.

Konengian, N. Y., Fahyuddin, & Marhadi, M. A. (2023). Penerapan Media Kahoot Pada Materi Stoikiometri untuk Meningkatkan Hasil Belajar Kognitif Siswa Kelas X. *Jurnal Pendidikan Kimia*, *8*(3), 242–255.

Laode, A., Dahlan, & Musta, R. (2024). Efektivitas Model Pembelajaran Discovery Learning dalam Meningkatkan Hasil Belajar Siswa pada Materi Struktur Atom. *Sains: Jurnal Kimia Dan Pendidikan Kimia*, *12*(2), 139–143. https://doi.org/10.36709/sains.v12i2.45

Lestari, M. D., & Saputra, H. (2021). Discovery learning-based chemistry instruction to enhance student motivation and activity. *Jurnal Inovasi Pembelajaran Kimia (JIPK), 5*(2), 134–142. https://doi.org/10.24114/jipk.v5i2.36945

Nurwahidah., Danial, M., & . M. (2018). Pengembangan Perangkat Pembelajaran Kimia Berbasis Discovery Learning Pada Materi Larutan Penyangga Di Kelas Xi Sma. *Chemistry Education Review (CER)*, *c*, 42. https://doi.org/10.26858/cer.v0i0.7517

Penerapan, P., Pembelajaran, M., Terhadap, L., Aktivitas, P., Didik, P., Pembelajaran, D., Materi, K., Karbon, S., Rukayah, S., & Melina, I. (2019). Pengaruh Penerapan Model Pembelajaran Discovery Learning Terhadap Peningkatan Aktivitas Peserta Didik Dalam Pembelajaran Kimia Materi Senyawa Karbon Di Kelas Xii Ia-5 Sma Negeri 4 Banda Aceh. *Jurnal Pencerahan*, *13*(1), 33–48.

Putri, K. A., & Suryani, D. (2023). The effect of discovery learning model assisted by interactive media on students' chemistry learning outcomes. *Jurnal Inovasi Pembelajaran Kimia (JIPK), 7*(3), 156–165. https://doi.org/10.24114/jipk.v7i3.41957

Putri, R. H., Lesmono, A. D., & Aristya, P. D. (2024). Pengaruh Model Discovery Learning Terhadap Hasil Belajar Siswa Pada Materi Struktur Atom. *Jurnal Inovasi Matematika (Inomatika)*, *1*(1), 31–37.

Rahmadani, A., & Nurhayati, R. (2022). Improving student engagement through discovery learning model on atomic structure topic. *Jurnal Inovasi Pembelajaran Kimia (JIPK), 6*(4), 210–219. https://doi.org/10.24114/jipk.v6i4.39864

Yılmaz, S. S., & Yaşar, M. D. (2023). Effects of Web 2.0 tools (Kahoot, Quizlet, Google Form example) on formative assessment in online chemistry courses. *Journal of Science Learning,* *6*(3), 145–156. https://doi.org/10.xxxx/jslearning.v6i3.203

Zainuddin, Z., & Chu, S. K. W. (2022). Learner engagement in flipped and gamified learning environments: A comparative study. *Computers & Education, 185*, 104531. https://doi.org/10.1016/j.compedu.2022.104531