Asian Journal of Applied Education (AJAE)
Vol. 5, No. 2, 2026: 267-274

The Effect of Ice Breaking and Rewards on Chemistry Students' Learning Outcomes in Basic Chemistry Courses

Zuhrah Adminira Ruslan
Makassar State University
Corresponding Author: Zuhrah Adminira Ruslan zuhrah.adminira@unm.ac.id

A R T I C L E I N F O

Kata Kunci: Ice-Breaking, Reward, Learning-Outcomes, Chemistry-Learning, Students

Received : 27, February
Revised : 28, March
Accepted: 30, April

A B S T R A K

Chemistry learning in higher education often encounters low student participation and boredom, affecting learning outcomes. This study examines the effect of ice breaking and rewards on student achievement in Basic Chemistry courses. A quantitative quasi-experimental design was applied, with purposive sampling to form experimental and control groups. The intervention, consisting of ice breaking and rewards as motivational reinforcement, was conducted over eight meetings. Data were collected using valid and reliable written tests and analyzed inferentially. Results indicate that the experimental group achieved a higher mean score (79.74) than the control group (73.03), with a significant difference $t(33)= 4.854$; $p < 0.001$ and a large effect size (1.41), confirming the effectiveness of the strategy.

DOI prefix: https://doi.org/10.55927/ajae.v5i2.16346
ISSN-E: 2693-5241
https://journal.formosapublisher.org/index.php/ajae

INTRODUCTION

Chemistry lessons in higher education require students to understand abstract concepts, think logically, and demonstrate persistence and high motivation to learn. However, in practice, the learning process often faces challenges such as low student participation, boredom during lectures, and suboptimal learning outcomes. This situation indicates that learning requires not only lecturers' mastery of the material, but also pedagogical strategies capable of creating a conducive, enjoyable, and sustainably motivating learning environment for students (Siregar & Nara, 2018).

One strategy that can be used to create a more active learning atmosphere is icebreaking. Icebreaking is a short activity aimed at breaking the ice, reducing tension, and increasing students' concentration and readiness to learn before and during class. Several studies have shown that implementing icebreaking can increase students' attention, motivation, and engagement in the learning process, thus positively impacting conceptual understanding and learning outcomes (Taupik, 2023). In chemistry lessons, which tend to be dense with concepts and calculations, icebreaking plays a crucial role in maintaining student focus and enthusiasm.

In addition to icebreaking, reward strategies are also often implemented as a form of external reinforcement in learning. Rewards can take the form of praise, symbolic recognition, or other forms of appreciation given to students for specific participation or achievements. Based on motivation theory, rewards can increase learning motivation by providing positive reinforcement that reinforces expected learning behaviors (Deci et al., 2017).

However, the effectiveness of ice breaking and rewards depends heavily on how they are implemented in learning. Ice breaking that are relevant to the material and rewards that are educational and proportionate tend to have a positive impact on motivation and learning outcomes, compared to those that are monotonous or solely oriented toward material rewards. Therefore, it is important to empirically test how the combination of ice breaking and rewards affects student learning outcomes, particularly in basic chemistry courses, which are complex and challenging (Slavin, 2020).

Based on the description above, this study aims to analyze the effect of ice breaking and rewards on chemistry students' learning outcomes in basic chemistry courses. The results are expected to provide theoretical contributions to the development of chemistry learning strategies in higher education and serve as a practical reference for lecturers in designing more effective, engaging learning that is oriented toward improving the quality of student learning outcomes.

LITERATURE REVIEW

Ice Breaking

Icebreaking is a learning strategy aimed at creating a pleasant learning atmosphere, reducing boredom, and increasing students' focus and readiness to learn. Theoretically, icebreaking aligns with the constructivist approach, which emphasizes the importance of active student involvement in the learning process.

This activity is usually conducted at the beginning or middle of a lesson to regain students' attention if it is starting to wane.

Research shows that implementing icebreaking can increase student motivation and concentration, thus positively impacting learning outcomes (García, & Weiss, 2021). Furthermore, icebreaking also plays a role in creating more dynamic interactions between lecturers and students, making the learning process more effective and less monotonous (Dewaele, & Li, 2020). In the context of science learning, particularly basic chemistry, the use of icebreaking has been shown to help students better understand abstract concepts through a more relaxed and conducive learning environment.

Reward

Rewards are a form of reinforcement in behaviorist theory that aims to increase student motivation to learn and maintain positive behavior. Rewards can take various forms, such as praise, additional credit, or other symbolic recognition. Providing appropriate rewards can encourage students to be more active, disciplined, and engaged in the learning process.

Research results show that rewards have a significant influence on student motivation and learning outcomes (Deci, et al. 2020; Hidi & Renninger, 2019). Students who receive rewards tend to demonstrate higher participation and have a stronger drive to learn. Furthermore, rewards have been shown to increase students' self-efficacy and cognitive engagement in learning. Other research shows that a reward system integrated into learning can significantly improve academic performance (Schunk, & DiBenedetto, 2020). Therefore, in basic chemistry learning, rewards are an important strategy to help students overcome difficulties in understanding complex material.

The Relationship between Ice Breakers and Rewards on Learning Outcomes

The combined use of ice breakers and rewards is believed to have a more optimal impact on student learning outcomes. Ice breakers create a conducive learning atmosphere, while rewards increase motivation to learn continuously. The combination of the two can increase student engagement, both emotionally and cognitively, in the learning process.

Previous research has shown that integrating enjoyable learning strategies with a reward system has a significant impact on improving learning outcomes (Adedigba & Sulaiman, 2020; Kouyate, 2025). This demonstrates that innovative and motivating learning can increase the effectiveness of basic chemistry learning. Therefore, implementing these two strategies simultaneously is a relevant approach to improving student learning outcomes.

METHODOLOGY

This study employed a quantitative approach with a quasi-experimental design, specifically a non-equivalent control group design. This design was used because the researchers did not fully randomize the subjects but instead used pre-existing groups in the learning process. This design consisted of two groups: an experimental group that received treatment in the form of ice breaking and rewards during the learning process, and a control group that underwent conventional learning without such treatment.

The study population was all students in the Chemistry Education Study Program taking the Basic Chemistry course at Makassar State University. The sample was selected using a purposive sampling technique, considering the equivalence of students' initial abilities based on their previous academic grades. The study sample consisted of 46 students divided into two groups: 23 students in the experimental group and 23 students in the control group.

The study was conducted over eight meetings over one semester. In the experimental group, learning activities began with an icebreaker activity aimed at increasing students' attention and learning readiness. The ice breaking used included rhythmic handclaps, light stretching movements, puzzle games related to chemistry concepts, and interactive digital media-based ice breaking. In addition, students who demonstrated activeness, cooperation, or good learning outcomes were rewarded with verbal praise, class appreciation, and simple gifts as a form of positive reinforcement. Meanwhile, the control group followed conventional learning methods without the systematic implementation of ice breaking or rewards.

The research instrument used to measure student learning outcomes was a written test designed based on the learning outcome indicators for the Basic Chemistry course. Before being used in the study, the instrument was tested for validity and reliability. Student learning outcome data were analyzed using inferential statistical techniques. Before hypothesis testing, assumption tests were conducted, including a normality test using the Shapiro–Wilk test and a homogeneity of variance test using the Levene test. After both assumptions were met, the analysis continued with an independent sample t-test to determine differences in learning outcomes between the experimental and control groups. Furthermore, to determine the magnitude of the treatment's effect on student learning outcomes, the effect size was calculated using Hedges' g.

RESULTS AND DISCCUSION

Ice breaking and rewards are pedagogical strategies frequently used to create a more conducive learning environment and motivate students. Ice breaking serve to foster a positive classroom atmosphere, reduce boredom, and increase student focus and engagement in the learning process. Meanwhile, rewards serve as external reinforcement that can encourage learning motivation, increase participation, and strengthen learning outcomes through appreciation of student effort and achievement. The integration of these two strategies is expected to not only enhance learning dynamics but also impact student academic achievement.

Before further analysis, a graph of the distribution of learning outcome scores is presented to provide a descriptive overview of the data distribution in the experimental and control groups. This visualization aims to identify distribution trends, score variations, and general pattern differences between groups as a basis for initial interpretation of the research results, as seen in the following figure:

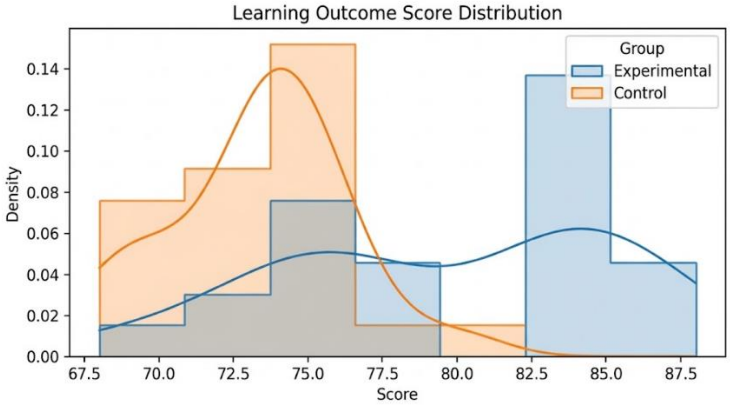

Figure 1. Distribution of Learning Outcome Scores for the Experimental and Control Groups

The distribution of learning outcome scores shows a difference in patterns between the experimental and control groups. The experimental group exhibits a rightward shift in the distribution, with a higher range of scores than the control group. The density curve in the experimental group appears wider than in the control group, indicating greater variation in learning outcome scores. This shift in the distribution toward higher scores is a descriptive indicator of improved learning outcomes due to the treatment (Field, 2018). This difference in distribution patterns supports the inferential statistical finding that there is a significant difference between the two groups (Gravetter & Wallnau, 2021).

The influence of ice breaking and rewards on chemistry students' learning outcomes in basic chemistry courses can be seen in the following table:

Table 1. Inferential Statistical Analysis of Chemistry Student Learning Outcomes

Group	N	Mean	SD	t(df)	p	CI 95% (mean difference)	Effect size (g)
Experiment	23	79,74	0,252778	4,854 (33,06)	< 0,001	[3,74; 9,13]	01.41
Control	23	73,03	0,147917				

Table 1 shows significant differences between the learning outcomes of chemistry students in the experimental group and the control group. The average learning outcome score in the experimental group was 79.74 with a standard deviation of 0.25, while the control group achieved an average of 73.03 with a standard deviation of 0.14. The independent t-test yielded a value of $t(33) = 4.854$ with $p < 0.001$, indicating that the difference in average scores between the two groups was statistically significant. The 95% confidence interval was in the range (3.74 and 9.13), indicating that the experimental group's scores were consistently higher. The effect size (Hedges' g) of 1.41 indicates a large effect according to Cohen (1988).

The results of the study indicate that icebreaking and reward strategies significantly improved chemistry students' learning outcomes. The positive effects demonstrated by the shift in score distribution and the large effect size support previous findings that learning that combines motivation and initial stimulation

can increase student cognitive engagement (Slavin, 2020; Sadewo & Marsofiyati, 2024).

These findings align with research by Sari et al. (2023), which demonstrated that icebreaking activities can improve student learning outcomes and enthusiasm through fun and dynamic activities. These activities create a conducive classroom atmosphere and support positive social interactions (Sasan et al., 2023). Icebreaking has also been shown to improve concentration and reduce boredom, as demonstrated in research by Pratama et al. (2021) and Sari et al. (2021). Thus, icebreaking contributes to students' mental and emotional readiness to begin learning, especially in challenging courses like chemistry.

Rewards also strongly contribute to motivation and learning outcomes. Alam (2023) reported that rewards contribute 30.5% to learning achievement. Research by Hubaib et al. (2023) and Mujahidah (2025) confirmed that rewards not only have a direct impact on learning outcomes but also increase student learning activity and motivation. This supports the use of rewards as effective external reinforcement to increase academic participation.

In higher education contexts, ice breaking have been shown to reduce academic anxiety and improve focus before core learning (Prihatini, 2021). Providing rewards in the form of praise, recognition, or simple gifts has also been shown to increase learning motivation and academic achievement without reducing intrinsic motivation (Ramadhani et al., 2022; Fitriya et al., 2025).

Therefore, the integration of icebreaker and reward strategies can be considered a complementary pedagogical approach. Ice breaking serve to create a positive emotional and social environment, while rewards provide reinforcement to maintain engagement and academic performance. The combination of the two creates a more effective, enjoyable, and goal-oriented learning process.

CONCLUSIONAND RECOMMENDATION

The results of this study indicate that the implementation of icebreaking and reward strategies in basic chemistry learning significantly improved student learning outcomes. The experimental group exhibited a shift in score distribution toward higher scores compared to the control group, and inferential analysis revealed a significant difference with a $t(33)$ value of 4.854, $p < 0.001$, and a large effect size (Hedges' $g = 1.41$). These findings confirm that the integration of icebreaking and reward strategies can improve student motivation, engagement, and academic performance. Therefore, this strategy can be recommended as an effective learning approach to improve the quality of learning in basic chemistry courses.

Based on these findings, it is recommended that lecturers routinely implement icebreaking strategies at the beginning of lectures to create a more positive and conducive learning environment. Rewards should be provided proportionally in the form of praise, recognition, or simple rewards to strengthen learning motivation.

FURTHER STUDY

This study has several limitations that should be considered when interpreting the results. First, the sample size was relatively limited, coming from

only one study program at one university, thus limiting the generalizability of the findings. Second, the treatment duration of only eight meetings does not fully reflect the long-term impact of ice breaking and rewards on student learning outcomes. Third, this study focused solely on cognitive learning outcomes without considering affective aspects and science process skills in greater depth. Therefore, further research is recommended to involve a broader and more diverse sample, extend the intervention period, and examine the effect of ice breaking and rewards on other aspects such as motivation, engagement, and critical thinking skills. Furthermore, exploring the use of technology-based ice breaking and rewards in digital or hybrid learning is also an interesting research direction to develop.

REFERENCES

Adedigba, O., & Sulaiman, F. R. (2020). Influence of teachers' classroom management style on pupils' motivation for learning and academic achievement in Kwara State. *International Journal of Educational Methodology*, *6*(2), 471-480. https://doi.org/10.12973/ijem.6.2.471

Alam, N. (2023). Pengaruh Pemberian *Reward* terhadap Prestasi Belajar Siswa. *Learning: Jurnal Inovasi Penelitian Pendidikan Dan Pembelajaran*, *3*(2), 165–172. https://doi.org/10.51878/learning.v3i2.2301

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences (2nd ed.)*. . Lawrence Erlbaum.

Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-Determination Theory in Work Organizations: The State of a Science. *Annual Review of Organizational Psychology and Organizational Behavior*, *4*(1), 19–43. https://doi.org/10.1146/annurev-orgpsych-032516-113108

Deci, E. L., Koestner, R., & Ryan, R. M. (2020). Extrinsic rewards and intrinsic motivation revisited. *Contemporary Educational Psychology*, 61, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Dewaele, J. M., & Li, C. (2020). Emotions in Second Language Acquisition: A Critical Review. *Foreign Language Annals*, 53(2), 371–393. https://doi.org/10.1111/flan.12455

Field, A. (2018). *Discovering Statistics using IBM SPSS Statistics (5th ed.)*. Sage Publications.

Fitriya, N., Marzuki, I., & Sari, A. D. I. (2025). Pengaruh Pemberian *Reward* dan Punishment Terhadap Keaktifan Belajar Siswa Kelas V di Sekolah Dasar. *Realisasi: Ilmu Pendidikan, Seni Rupa Dan Desain*, *2*(2), 48–59. https://doi.org/https://doi.org/10.62383/realisasi.v2i2.576

García, E., & Weiss, E. (2021). Student Engagement and Learning Outcomes: The Role of Active Classroom Strategies. *Educational Research Review*, 34, 100411. https://doi.org/10.1016/j.edurev.2021.100411

Gravetter, F. J., & Wallnau, L. B. (2021). *Statistics for The Behavioral Sciences (10th ed.)* . Cengage Learning.

Hidi, S. E., & Renninger, K. A. (2019). Interest development and its relation to curiosity: Needed neuroscientific research. *Educational Psychology Review*, *31*(4), 833-852. https://doi.org/10.1007/s10648-019-09491-3

Hubaib, I.M., Pakaya, A.R., Umar, Z.A. Alam, H.V.. (2023). The effect of *reward* and punishment on student learning outcome through student learning activity at SMA Terpadu Wira Bhakti Gorontalo, Indonesia. *International Journal of Science and Research Archive*, *10*(2), 991–697. https://doi.org/10.30574/ijsra.2023.10.2.0912

Khodijah, S. (2023). Implementation of Ice Breaking in Increasing Student's Spirit of Learning. *International Journal Of Education, Social Studies, And Management (IJESSM)*, *3*(3), 7–13. https://doi.org/10.52121/ijessm.v3i3.185

Kouyate, A., Rashid, N. A., & Mohamed, F. A. (2025). Gamification and Reward Systems for Enhancing Student Involvement in Extracurricular Activities at Universities. *INTI Journal*, *2025*(2), 1-10. https://doi.org/10.61453/INTIj.202516

Knaflic, S. N. (2020). *Storytelling with data: Let's practice! Hoboken* . Wiley.

Prihatini, M. & Isna, N. (2023). Implementation Of The Ice-Breaking Method To Increase Fourth-Grade Student Understanding Of The Material "Telling Time" In Al – A'raf Bilingual Elementary School. *Nusantara Hasana Journal*, *3*(2), 27–32.

Mujahidah, N. (2025). Analisis Pemberian *Reward* dan Pengaruhnya terhadap Motivasi Belajar Siswa Sekolah Dasar. *Dirasat Islamiah: Jurnal Kajian Keislaman*, *4*(2), 111–122. https://doi.org/10.56324/drs.v4i2.115

Sari, N., Rakiyah, S., Suciawati, H. (2023). Penerapan Ice Breaking dalam Meningkatkan Hasil Belajar dan Menumbuhkan Semangat Siswa SMP Darma Medan. *SAFARI :Jurnal Pengabdian Masyarakat Indonesia*, *4*(1), 68–79. https://doi.org/10.56910/safari.v4i1.1111

Pratama, H., Maduretno, T. W., & Yusro, A. C. (2021). Online Learning Solution: Ice Breaking Application to Increase Student Motivation. *Journal of Educational Science and Technology (EST)*, 117–125. https://doi.org/10.26858/est.v7i1.19289

Prihatini, S. R. (2021). Ice Breaking Sebagai Stimulus dan Reinforcement dalam Belajar Bahasa Inggris di Program Sks (Sistem Kredit Semester) Di SMA Negeri 5 Surabaya. *JIRA: Jurnal Inovasi Dan Riset Akademik*, *2*(3), 335–341. https://doi.org/10.47387/jira.v2i3.101

Ramadhani, N. A., Mujahidah, M., & Rukayah, R. (2022). Hubungan Pemberian *Reward* and Punishment dengan Motivasi Belajar Siswa Kelas IV. *JPPSD: Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *2*(3), 406. https://doi.org/10.26858/pjppsd.v2i3.34750

Sadewo, A. P., & Marsofiyati. (2024). Pengaruh Strategi Pembelajaran dan Motivasi Belajar Mahasiswa terhadap Nilai Indeks Prestasi Mahasiswa. *Seroja : Jurnal Pendidikan*, *3*(2), 25–37. https://doi.org/https://doi.org/10.572349/seroja.v3i2.1897

Sari, U. A., Fauziyah, N., Ghozi, A., Azizah, I. N., & Al-Fidyah, U. F. (2021). *Improving the Students' Learning Concentration Through Ice Breaking*. https://doi.org/10.2991/assehr.k.210421.089

Sasan, J. M. V, Tugbong, G. M., & Alistre, K. L. C. (2023). An Exploration Of Ice breaking And Their Impact On Student Engagement In The Classroom. *International Journal of Social Service and Research*, *3*(11), 2921–2930. https://doi.org/10.46799/ijssr.v3i11.566

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, 60, 101832. https://doi.org/10.1016/j.cedpsych.2019.101832

Siregar, E., & Nara, H. (2018). *Teori Belajar dan Pembelajaran*. Ghalia Indonesia.

Slavin, R. E. (2020). *Educational psychology: Theory and practice (13th ed.)*. Pearson Education.

Taupik, R. P. (2023). The Effect of Using Ice Breaking on Learning Motivation of Elementary School Students in Learning Science. *Indonesian Journal of Science and Education*, *7*(2), 63–68. https://doi.org/10.31002/ijose.v7i2.735