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The Effect of the Discovery Learning Model Assisted by Educaplay Games on Excretory System Material on Students' Collaboration Skills and Learning Outcomes

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Abstract

This study aims to determine the effect of the Educaplay game-assisted Discovery Learning model on excretory system material on students' collaboration skills and learning outcomes. The study used an experimental method with a Nonequivalent Control Group Design on 11th grade students at SMA Negeri 12 Semarang. The sample consisted of 35 students in the experimental class and 35 students in the control class. The research instruments included a collaboration skills questionnaire and a multiple-choice test of learning outcomes. The data were analyzed using descriptive statistics, hypothesis testing, and N-Gain testing. The results showed that the average collaboration skills of the experimental class increased from 70.06 to 84.40, while those of the control class increased from 72.97 to 77.51, with a significance value of 0.001 (<0.05). The N-Gain value for collaboration skills in the experimental class was 0.460 (moderate category) and in the control class was 0.129 (low category). The average learning outcome of the experimental class increased from 60.26 to 83.51 with a mastery level of 91%, while that of the control class increased from 61.80 to 73.77 with a mastery level of 40%, with a significance value of 0.000 (<0.05). The N-Gain value of the experimental class's learning outcomes was 0.561 (medium category) and the control class was 0.288 (low category). It can be concluded that the Educaplay game-assisted Discovery Learning model has a significant effect on students' collaboration skills and learning outcomes.

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INTRODUCTION

Learning is a process involving interaction between students, teachers, and various learning resources in an environment that supports learning activities. Just as learning is a process of acquiring knowledge, skills, and habits, as well as forming attitudes and beliefs, so too is the support provided by educators. The 21st-century skills that are the focus of education today are very important in preparing the next generation. In the 21st century, students are expected to have the skills to learn and innovate through the use of technology and acquire personal skills for survival (Mardhiyah *et al.*, 2021).

Teachers not only play a role as conveyors of knowledge in the learning process, but also teach skills that help students learn (Hasanah et al., 2024). Learning in the 21st century does not only emphasize cognitive aspects, but also focuses on developing process skills in students (Sulistyaningrum *et al.*, 2019). The skills needed in this century include Critical Thinking, Creativity, Communication, and Collaboration, known as the 4Cs (Sholikha & Fitrayati, 2021).

Collaboration is cooperation between individuals to complement and support each other in completing tasks, so that the objectives set can be achieved. In a collaboration, each individual complements each other's strengths and weaknesses, so that challenges can be overcome together in a more effective and optimal way. Collaboration is very important in learning, because through collaboration, students are able to improve social attitudes such as cooperation, responsibility, and respect for others. Collaboration skills are key to achieving an effective learning process (Masruroh & Arif, 2021).

With the current development of technology, traditional learning methods are no longer effective in meeting the complex needs of students (Tati *et al.*, 2025). Traditional learning methods tend to be teacher-centered. The role of the teacher is as the main source of knowledge, while students are recipients of information. In this traditional learning method, students are expected to listen and understand the information provided. Teacher-centered learning methods make students bored. Efforts to achieve educational goals and keep up with the times, which require students to have active and adaptable characters, necessitate an appropriate learning model (Ketut Suparya & Darmayoga, 2023). One suitable model is Discovery Learning with the help of Educaplay games. The Discovery Learning model is an approach that emphasizes the active involvement of students in discovering concepts and knowledge independently. The application of the Discovery Learning model has an impact on current educational goals.

Educaplay interactive games are an online platform that provides a number of interactive educational games for teachers and students (Sepriyanti *et al.*, 2024). Educaplay games aim to reinforce learned material in an engaging way by combining game elements with educational content. Some types of interactive games that can be used on the Educaplay game platform include quizzes, crossword puzzles, frog jumping games, and others (Batitusta & Hardinata, 2024). Educaplay games can be played in groups, so it is hoped that the Educaplay game platform will enable students to improve their collaboration skills and learning outcomes.

Observations conducted at SMA Negeri 12 Semarang revealed that there are still obstacles in the learning process. The level of student collaboration is still not optimal, resulting in suboptimal outcomes. The problem is that interactions between students are not focused on learning but tend to be outside the context of learning. The lack of interaction between group members during the learning process will have an impact on the completeness of learning outcomes.

With the development of educational technology, the use of game-based learning media such as Educaplay is considered capable of increasing motivation and interaction among students during the learning process (Utami *et al.*, 2023). However, so far, no research has specifically examined the application of the Educaplay game-assisted Discovery Learning model in the excretory system material at SMA Negeri 12 Semarang, particularly in improving students' collaboration skills and learning outcomes. Therefore, "The Effect of the Educaplay Game-Assisted Discovery Learning Model on the Excretory System Material on Students' Collaboration Skills and Learning Outcomes" needs to be studied.

RESEARCH METHOD

The research was conducted over three meetings, from January 19 to 26, 2026, in accordance with the biology class schedule at SMA Negeri 12 Semarang, Gunungpati District, Semarang City, Central Java

Province. The method used was an experimental method with the aim of improving students' collaboration skills and learning outcomes in the subject of the excretory system. The research was conducted in two classes, namely class XI.F.2 as the experimental class and class XI.F.3 as the control class.

The research instruments included test instruments and non-test instruments. The test instruments consisted of multiple-choice questions on the excretory system as pretest and posttest questions to determine the improvement in student learning outcomes. The non-test instruments consisted of questionnaires used as a measuring tool to determine the level of students' collaboration skills. The pretest and posttest scores and the collaboration skills questionnaire were analyzed using SPSS 25.

RESULTS AND DISCUSSION

Based on the research that has been conducted, the results presented include an analysis of student collaboration skills in the experimental and control classes, an analysis of student learning outcomes in the experimental and control classes in the form of multiple-choice questions, and an analysis of the percentage of implementation of the Educaplay game-assisted Discovery Learning model in the excretory system material in class XI at SMA Negeri 12 Semarang.

Students' Collaboration Skills

The results of the collaboration skills scale were collected before and after the learning process. The scale consisted of 20 items representing indicators of collaboration skills. Table 1. shows the descriptive statistics for collaboration skills derived from the data of both classes.

Table 1. Results of the Descriptive Statistical Analysis of Collaboration Skills

	Experiment Class		**Control Class**	
Measurement	Pre	Post	Pre	Post
Minimum	53	71	49	55
Maximum	84	96	88	91
Average	70,06	84,40	72,97	77,51

Table 1 shows that there is a difference in the average scores between the experimental class and the control class. The initial collaboration ability score for the experimental class was 70.06 on average, while that of the control class was 72.97. In the final results for student collaboration ability, the experimental class scored an average of 84.40 and the control class 77.51. The results of the descriptive statistical analysis indicate that students in the experimental class demonstrated higher collaboration ability compared to the control class.

The results of the students' collaboration skills in the experimental and control classes were categorized into predetermined categories: excellent, good, fair, poor, and very poor. The results of the percentage measurements from the pre- and post-tests on collaboration skills are illustrated in the diagram shown in Figure 1.

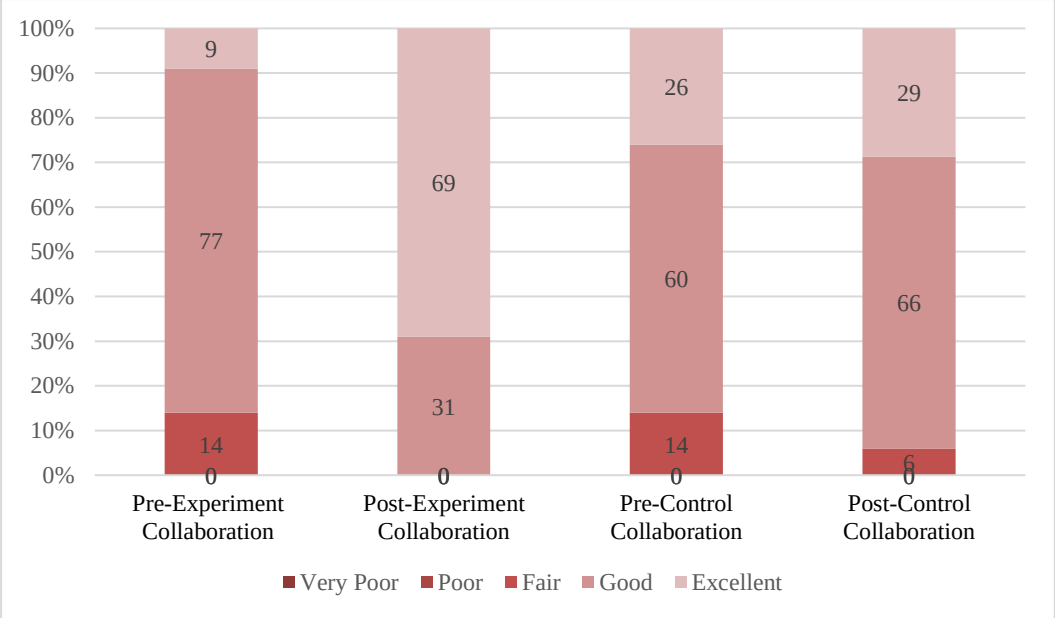

Figure 1 Percentage of Students' Collaboration Skills Scores in Each Category

Figure 1 shows that at the end of the learning process, 69% of students in the experimental class fell into the "very good" category for collaboration skills, whereas only 29% of students in the control class fell into the "very good" category. This indicates that the experimental class performed better in terms of collaboration skills than the control class.

The results of the measurements of collaboration ability were also analyzed as average percentages for each indicator in both classes, as shown in Figure 2.

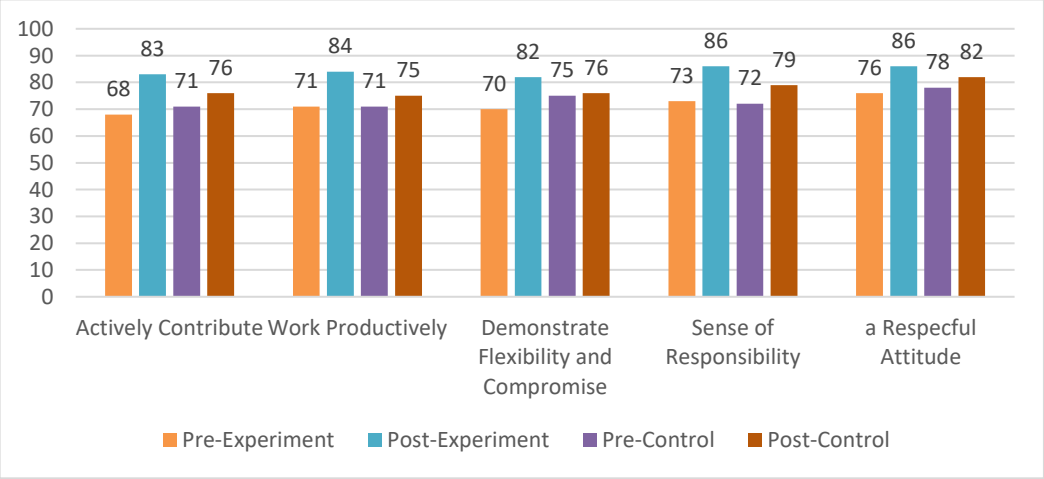

Figure 2 Percentage of Initial and Final Measurement Results for Collaboration Skills of 11th-Grade Students at State Senior High School 12 Semarang for Each Indicator

In Figure 2, all indicators of collaboration skills show an average percentage increase from the initial measurement to the final measurement. However, the increase in the experimental class was higher than that in the control class. The indicator showing the highest increase was "actively contributing," rising by 15 percentage points from 68% in the initial measurement to 83% in the final measurement. The "working productively" indicator showed an increase of 13 percentage points, from 71% in the initial measurement to

84% in the final measurement. The "flexibility and compromise" indicator increased by 12%, from 70% to 82%; the "sense of responsibility" indicator increased by 13%, from 73% to 86%; and the "respectful attitude" indicator increased by 10%, from 76% to 86%.

Table 2 Results of the Hypothesis Test on Collaboration Skills

	Sig.	**Description**
Hypothesis test	0,001	H_0 rejected dan H_1 accepted

Based on the results of the hypothesis test in Table 2, the final questionnaire score for collaboration skills was 0.001 < 0.05; therefore, H_0 is rejected and H_1 is accepted. This indicates that the Discovery Learning model supplemented by the Educaplay game has an effect on students' collaboration skills.

Table 3 Results of the N-Gain Test Analysis

Class	***N-Gain***	**Category**
Experiment	0,460	Currently
Control	0,129	Low

The results of the N-Gain test in Table 3 show that the experimental class performed better than the control class. The experimental class had an average N-Gain of 0.460, which falls into the moderate category, while the control class had an average N-Gain of 0.129, which falls into the low category. This indicates that the improvement in students' collaboration skills was greater in the experimental class than in the control class.

The Discovery Learning model emphasizes the process of discovering concepts through the stages of stimulation, problem identification, data collection, data processing, verification, and generalization. This approach requires interaction, discussion, and the division of roles within the group. This is evidenced by the highest improvement in the indicator of active participation. During the data collection and processing stages, each group member is encouraged to share ideas and engage in problem-solving, thereby increasing active participation.

Improvements in the indicators for working productively and demonstrating a sense of responsibility can also be attributed to the characteristics of discovery-based learning, which assigns students the responsibility of completing tasks. The Educaplay game reinforces the process through interactive activities that require collaborative problem-solving, so students are more structured in task distribution and time management. This supports Vygotsky's social constructivism theory, which emphasizes the importance of social interaction in knowledge formation.

Using Educaplay games as a learning tool creates an interactive and positively competitive learning environment, thereby encouraging students to communicate with one another. This is because Educaplay offers a variety of interactive games that encourage students to collaborate in solving challenges, discuss to determine the correct answers, and share ideas and strategies with one another. When students feel comfortable, they tend to be more willing to express their opinions, respect their peers' perspectives, and be open to feedback. This process indirectly trains key aspects of collaboration skills. This aligns with research conducted by Najib *et al.*, (2024), which found that the use of Educaplay game-based learning media in 5th-grade IPAS classes at SD Muhammadiyah 15 Surabaya demonstrated an improvement in students' collaboration skills.

Student's Learning Outcomes

Student learning outcomes were assessed through pretests and posttests administered in the experimental and control classes, consisting of 30 multiple-choice questions on the excretory system. The descriptive statistics for the pretest and posttest scores are presented in Table 2.

Tabel 4 Descriptive Statistics of Pre-test and Post-test Scores for the Experimental Class and Control Class

	Experiment Class		**Control Class**	
Measurement	*Pretest*	*Posttest*	*Pretest*	*Posttest*
Minimum	43	60	30	50
Maximum	80	93	80	90
Average	60,26	83,51	61,80	73,77
Students who have completed the course (%)	3%	91%	9%	40%
Students who have not passed (%)	97%	9%	91%	60%

Table 4 shows that there is a difference in the mean scores of the pretest and posttest results. The mean pretest score for the experimental class was 60.26, while that for the control class was 61.80. The pretest results indicate that neither class met the Minimum Passing Criteria set by the school, which is 75. The experimental class experienced an increase in the posttest average score to 83.51 with a mastery rate of 91%, while the control class had a posttest average of 73.77 with a mastery rate of 40%. The results of the descriptive statistical analysis show that the average scores of students in the experimental class were higher than those in the control class.

Student learning outcomes in the experimental and control classes were measured according to predetermined categories: excellent, good, fair, poor, and very poor. The results of the percentage measurements for the pretest and posttest scores are interpreted using the diagram shown in Figure 3.

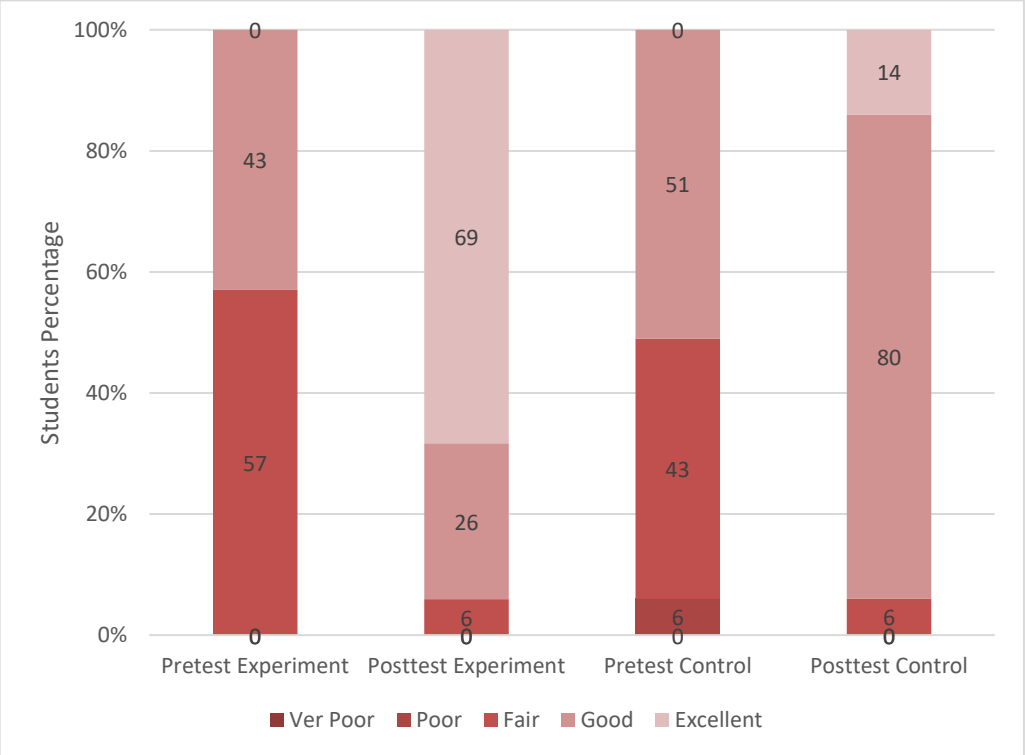

Figure 3 Percentage of Student Learning Outcomes for 11th Grade Students at State High School 12 Semarang by Category

Figure 3. shows that 69% of the experimental class's overall posttest scores fell into the "very good" category, compared to 14% in the control class. This indicates that the experimental class showed a greater improvement than the control class.

Table 5 Hypothesis Testing of Student Learning Outcomes

	Sig.	**Description**
Hypothesis test	0,000	H_0 rejected dan H_1 accepted

Based on the results of the hypothesis test in Table 5, the posttest result is 0.000 < 0.05, so H_0 is rejected and H_1 is accepted. This means that the Discovery Learning model supported by the Educaplay game has an effect on student learning outcomes.

Table 6 Results of the N-Gain Test Analysis

Class	***N-Gain***	**Category**
Experiment	0,561	Currently
Control	0,288	Low

The results of the N-Gain test in Table 6 show that the experimental class performed better than the control class. The experimental class had an average N-Gain of 0.561, which falls into the moderate category, while the control class had an average N-Gain of 0.288, which falls into the low category. This indicates that the improvement in student learning outcomes was greater in the experimental class than in the control class.

According to Hosnan (2014), the stages of Discovery Learning stimulation, problem statement, data collection, data processing, verification, and generalization, encourage students to actively explore concepts and construct knowledge independently. In learning about the excretory system, students are required to understand complex processes, such as the mechanisms of urine formation and the functions of excretory organs. Through the discovery process, students can make deeper connections between concepts. Discovery-based learning allows students to acquire more lasting knowledge (Bruner, 1961).

Research conducted by Safriani *et al*., (2021) found that the Discovery Learning model in the excretory system curriculum influences student learning outcomes. The Discovery Learning model creates a more enjoyable, active, and interactive learning environment, thereby enlivening the classroom and fostering optimal student engagement. It also provides students with the opportunity to explore concepts directly.

The use of the Educaplay game plays a role in student engagement during the learning process. Learning activities in the form of interactive games make students more enthusiastic and focused on participating in the learning process. Active student engagement has a positive impact on improving student learning outcomes. Research by Situngkir *et al*., (2024) shows that the use of the Educaplay game influences improvements in student learning outcomes regarding the excretory system. Through the use of Educaplay, students can learn while playing, making the process of understanding and remembering the material more enjoyable. This prevents students from getting bored easily and keeps them more motivated to participate in the learning process. These findings align with Rifaldin *et al*., (2024) research, which states that the implementation of the Discovery Learning model supported by Educaplay media was able to improve the learning outcomes of eighth-grade students at SMP 20 Makassar.

CONCLUSION

Based on the results of the study, it can be concluded that the Discovery Learning model, supported by the Educaplay game, has an impact on the collaborative skills and learning outcomes of 11th-grade students at State Senior High School 12 in Semarang regarding the excretory system.

REFERENCES

Bruner, J. S. (1961). The Act Of Discovery. *Harvard Educational Review*, *31*, 21–32.

Hosnan, M. (2014). *Pendekatan Saintifik Dan Kontekstual Dalam Pembelajaran Abad 21*. Ghala Indonesia.

Ketut Suparya, I., & Darmayoga, W. (2023). Penerapan Model Pembelajaran Discovery Learning Berbantuan Media Ulartangga Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Pendidikan Dasar*, *4*(2), 101–110.

Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya Keterampilan Belajar Di Abad 21 Sebagai Tuntutan Dalam Pengembangan Sumber Daya Manusia. *Jurnal Pendidikan*, *12 (1)*, 29–40.

Masruroh, L., & Arif, S. (2021). Efektivitas Model Problem Based Learning Melalui Pendekatan Science Education For Sustainability Dalam Meningkatkan Kemampuan Kolaborasi. *Jurnal Tadris Ipa Indonesia*, *1*(2), 179–188.

Najib, A., Martati, B., & Faradita, M. (2024). Analisis Keterampilan Kolaborasi Siswa Sekolah Dasar Dengan Menggunakan Media Pembelajaran Berbasis Games Educaplay Pada Pembelajaran Ipas. *Jurnal Ilmiah Pendidikan Dasar*, *9*(3), 1964–1978.

Rifaldin, M., Muhiddin, N. H., & Rante, P. (2024). Penerapan Model Discovery Learning Berbantuan Media Educaplay Untuk Meningkatkan Hasil Belajar Ipa Kelas Viii. D Smpn 20 Makassar. *Jurnal Pemikiran Dan Pengembangan Pembelajaran*, *6*(2), 1623–1633.

Safriani, D., Oktavia, R., & Hadi, K. (2021). Pengaruh Model Discovery Learning Terhadap Hasil Belajar Pada Materi Sistem Ekskresi Di Kelas Ix Smp Negeri 1 Samatiga Kabupaten Aceh Barat. *Jurnal Ilmiah Pendidikan Biologi*, *8*(1), 51–62.

Sepriyanti, D., Supriatna, D., & Hartono, R. (2024). Pengaruh Game Edukasi Educaplay Untuk Meningkatkan Hasil Belajar Siswa Kelas 5 Di Sdn Neglasari 02. *Jurnal Teknologi Pendidikan*, *13*(2), 80–94.

Sholikha, S. N., & Fitrayati, D. (2021). Integrasi Keterampilan 4c Dalam Buku Teks Ekonomi Sma/Ma. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(5), 2402–2418.

Situngkir, D. M., Situmorang, M., & Gunaria, S. (2024). Pengembangan Media Pembelajaran Educaplay Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Sistem Ekskresi Di Kelas Viii. *Jurnal Rectum*, *6*(1), 355–369.

Sulistyaningrum, H., Winata, A., & Cacik, S. (2019). Analisis Kemampuan Awal 21st Century Skills Mahasiswa Calon Guru Sd. *Jurnal Pendidikan Dasar Nusantara*, *5*(1), 142.

Tati, A. D., Arismunandar, & Suardi. (2025). Transformasi Pendidikan: Rahasia Teori Dan Inovasi Dalam Menghadapi Perubahan Sosial Dan Teknologi. *Jurnal Publikasi Pendidikan*, *15*(2), 599–608.

Utami, R. D., Wibawa, S., & Marzuki. (2023). Pemanfaatan Aplikasi Educaplay Pada Pembelajaran. *Jurnal Ilmiah Pendidikan Dasar*, *8*, 5808–5818.