IMPLEMENTATION OF GAME-BASED LEARNING USING CLASSCRAFT IN SPREADSHEET INSTRUCTION TO ENHANCE COLLABORATION AMONG ACCOUNTING VOCATIONAL HIGH SCHOOL STUDENTS

Rika Wahyuni
Universitas Negeri Malang
rika.wahyuni.2204216@students.um.ac.id

Hanjar Ikrima Nanda
Universitas Negeri Malang

Eren Prinstin
Universitas Negeri Malang

Abstract

This study evaluates the effectiveness of Game-Based Learning using the Classcraft platform in enhancing students' collaboration skills in Spreadsheet learning at Accounting Vocational Schools. The main issue addressed is the low student participation and collaboration in a subject often seen as technical and monotonous. Employing Kemmis and McTaggart's Classroom Action Research model, the study was conducted over two cycles involving class X students at SMK Muhammadiyah 3 Singosari. Data were gathered through observation, questionnaires, tests, and documentation. Results showed an increase in collaboration skills from 64% ("sufficient") in cycle I to 82% ("good") in cycle II. Student learning completion also rose from 57% to 89%. Classcraft successfully fostered positive group interdependence, motivation, and engagement. These findings suggest that Classcraft is an effective, innovative tool for promoting collaboration in technical subjects like Spreadsheet learning.

Keywords: Game-Based Learning, Classcraft, Spreadsheet, Collaboration

INTRODUCTION

In an increasingly digitized world of education, the integration of technology in education is key to creating innovative and engaging learning experiences (Saroh & Nurhamidah, 2024). According to Zulkarnaen et al. (2022), spreadsheet learning (Excel) involves complex logical and mathematical concepts, coupled with numerous technical formulas. The study revealed that vocational high school students often struggle to understand the material due to suboptimal teaching methods, overly rapid pacing of instruction, and a lack of repetitive practice, leading to easy forgetting. One concrete example of this issue was observed during an initial observation at SMK Muhammadiyah 3 Singosari, which indicated that spreadsheet material is difficult to understand without repeated practice and detailed comprehension, so without an interactive approach, students easily become bored. Teachers acknowledge that spreadsheet

learning requires hands-on practice, but the use of engaging and collaborative media remains challenging to implement. As a result, conventional methods remain dominant. This finding is supported by Rahayu et al., (2024) & Zulkarnaen et al., (2022), who state that spreadsheet learning in various vocational schools still heavily relies on conventional, one-way methods, such as teacher explanations via PowerPoint or Google Classroom, which cause students to become less active. Based on the research observation results, this one-way learning approach is deemed boring and uninteresting to students.

One promising solution to this problem is the use of a gamification approach through the Classcraft platform. In line with Self-Determination Theory, which states that students are motivated when they feel competent and connected, the use of game elements (rewards/points, challenges) can increase intrinsic motivation and participation (Minzi Li et al., 2023). A study by Minzi Li (2023) also states that gamified learning methods introduce rewards for students' efforts to increase motivation and participation by utilizing game elements to make the learning experience more engaging. The constructivist theory proposed by Jean Piaget emphasizes that students build knowledge through direct experience. Interactive media and gamification enable students to construct their own understanding in a meaningful context. A study by Peters et al. (2022) found that interactive Excel exercises allow students to apply calculation concepts explicitly, making learning more engaging and productive than conventional methods.

Parody et al. (2022, Applied Sciences) in the context of first-year engineering education state that students who learn with Classcraft experience an increase in Four C's skills, including collaboration, compared to conventional controls. In their analysis, the gamification group using Classcraft showed higher collaboration scores than the conventional control group (Parody et al., 2022). The authors emphasize that "the gamification group's students' collaboration skills were improved" after using Classcraft and refer to the platform as "a promising new tool for active learning" (Parody et al., 2022). These findings confirm that Classcraft effectively facilitates student collaboration through its features.

However, research on the application of Classcraft in spreadsheet learning remains limited. Yet, such technical learning requires not only mastery of technical aspects but also collaboration and problem-solving skills. This is reinforced by Baanqud et al. (2020), who state that collaborative mathematical calculation tasks using Google Sheets enhance knowledge

sharing and reflective thinking among students. These findings support the idea that effective spreadsheet learning should incorporate elements of collaboration and problem-solving, not just technical exercises.

Gamification by integrating Classcraft can provide a solution by transforming repetitive spreadsheet tasks into enjoyable and competitive challenges while encouraging collaboration among students (Sipone et al., 2021). Classcraft, as a gamification platform, has proven effective in enhancing student motivation and participation through game elements such as character development, reward systems, and collaborative missions (Krishnan et al., 2021).

This study aims to evaluate the effectiveness of Classcraft as a gamification tool in spreadsheet learning at vocational schools of accounting to encourage student motivation and activity. This study is also designed to examine the influence of Classcraft in improving students' collaboration skills when working on spreadsheet tasks, as well as to understand students' views on learning experiences through a gamification approach, especially in learning technical aspects such as formulas, functions, and data analysis. This research also has another objective, which is to design a gamification-based learning model tailored to the profile of vocational high school accounting students, by integrating game elements and collaboration into Spreadsheet usage practices. The findings of this research are expected to serve as a reference for educators in developing more dynamic, engaging, and contemporary workplace-aligned teaching methods, particularly in the field of accounting, thereby fostering students' technical and collaborative competencies comprehensively.

LITERATURE REVIEW

Game Based Learning

Gamification, defined as "the application of game elements in non-game contexts," began to gain popularity after 2010. This concept aims to transform activities into game-like experiences to enhance intrinsic motivation, attract more people, and strengthen their participation in a task. This method has been widely applied across various sectors, including business management, marketing strategies, and the education sector (Wang et al., 2022).

Research by Wang et al. (2022) states that gamification, which is still in its early conceptual development stage, is often misinterpreted in its application. Terms like serious

games and game-based learning do share similarities, but they differ in principle and implementation. Serious games focus on educational objectives rather than entertainment, though they use a framework similar to conventional games. Game-based learning emphasizes the persuasive aspects of learning, while serious games are more focused on changing the behavior of training participants.

Classcraft

Classcraft is an educational platform designed to increase student engagement in the teaching and learning process by incorporating game elements into the classroom setting (Saroh & Nurhamidah, 2024). Classcraft is an educational game designed to encourage positive student behavior, expand knowledge, and hone communication and collaboration skills. With attractive visuals and engaging interactive features, it is able to increase student motivation to learn. Teachers can freely customize the content and storyline of the game while guiding students toward learning objectives, fostering teamwork, and strengthening social bonds among them (Nurohman et al., 2024).

Spreadsheet

Research by Aliyah & Wahjudi (2021) states that spreadsheet learning is one of the important productive subjects in vocational schools, because students will learn how to work on accounting cycles using various Microsoft Excel formulas. This skill is essential to support technological advances in the modern era. Spreadsheet learning is systematic because it not only emphasizes practice and skills, but also involves knowledge aspects (Aliyah & Wahjudi 2021). This is evident in the use of Microsoft Excel, where students can apply their own logical thinking to select the appropriate formulas. Therefore, this subject requires critical thinking skills to solve problems and build knowledge based on daily experiences. Additionally, spreadsheets serve as a tool to integrate information and communication technology into accounting education (Aliyah & Wahjudi 2021).

RESEARCH METHOD

This study used a collaborative classroom action research (CAR) approach based on Kemmis and McTaggart's spiral model, which was implemented in two cycles. This approach was chosen because it is designed to improve the learning process repeatedly through continuous reflection, enabling researchers to design solutions and evaluate their impact systematically (Kemmis & McTaggart, 1988; Arikunto, 2010). In this context, the study aims to improve student collaboration through Classcraft game-based spreadsheet learning. Each cycle consists of four stages, namely planning, acting, observing, and reflecting.

In the planning stage, the researcher developed a learning strategy by integrating Classcraft to encourage student interaction and cooperation. Next, implementation is carried out in the Spreadsheet class at SMK Muhammadiyah 3 Singosari, while observation is used to monitor student engagement and collaboration. Through reflection at the end of each cycle, the researcher evaluates the effectiveness of the approach used, both in terms of the learning process and outcomes, enabling continuous improvement. Before implementing Cycle 1, an observation will be conducted to compare the results of applying the lecture-based learning model with the Game-Based Learning approach using Classcraft as a medium to enhance collaboration skills in Cycle 1 and Cycle 2.
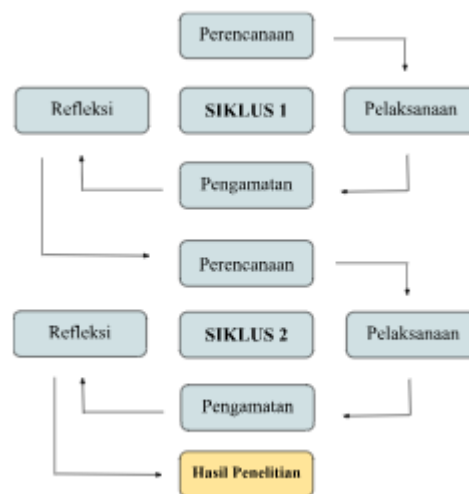
Figure 1. Adaptation of the Research Cycle Design by Kemiis and Mc Taggart (Arikunto et al., 2017)

Type of Research

This research design uses Classroom Action Research (CAR) with the Kemmis and McTaggart model, which consists of the planning, action, observation, and reflection stages. The research was conducted in two cycles in one class that applied the Classcraft-based Game-Based Learning method in the Spreadsheet subject. CAR was chosen because it directly involves teachers as agents of change in classroom learning practices. The implementation of Classcraft aims to enhance student collaboration, in line with previous research indicating that this platform is effective in fostering engagement, teamwork, and student motivation (Ilma, 2023; Zhang, Yu, & Yu, 2021).

Data Sources

The data sources in this study consist of primary and secondary data. Primary data were obtained from direct observations of learning activities, questionnaires on the perceptions of vocational high school students majoring in accounting in Malang Regency regarding collaboration, group assignment assessment results, and field notes during the action process. Meanwhile, secondary data includes supporting documents such as lesson plans, syllabi, activity logs on the Classcraft platform, and literature related to game-based learning models and collaborative theory. The dependent variable (problem) of this study is students' collaboration skills during spreadsheet learning. The independent variable (action) of this study is the implementation of learning using the Game-Based Learning approach with the use of Classcraft media. The material used covers the accounting cycle of service companies.

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Data Collection Techniques

The data collection techniques used are observation, collaboration skills questionnaires, tests, and documentation. Observation activities are conducted by assessing students' collaboration skills during spreadsheet learning. This observation used an observation sheet that recorded five indicators of collaboration skills, with a score ranging from 1 to 5 for each indicator. In addition, a questionnaire was given to students containing 24 statements related to their collaboration skills. These statements were developed from the established indicators of collaboration skills. The indicators of collaboration skills are as follows:

Table 1.
Collaboration Skills Indicators (Dhitasafari et al., 2023)

Indicators	Explanation
Active Contribution	Contribute to presenting ideas, consolidating results, and finding solutions to problems.
Working Productively	Actively participate in discussions, complete tasks effectively and efficiently, focus on finding solutions through discussion, and communicate smoothly during discussions.
Responsible	Be responsible for assigned tasks, complete tasks on time, and follow instructions.
Flexibility and Compromise	Accepting criticism and suggestions and assignments in groups.
Mutual Respect	Respect and honor opinions in the forum and accept joint decisions.

Meanwhile, documentation in the form of photos and videos was used as supporting data to reinforce the research findings. Data analysis of observations of student collaborative activities was carried out by calculating the percentage of collaboration skill scores in each cycle to obtain an overview of the level of achievement of the predetermined indicators. The formula used to measure the percentage of student involvement in activities is as follows:

$$P = F/N \ X \ 100\%$$

Explanations:
P = Persentation
F = Students carry out activities during the event.
N = All students listed

The criteria for assessing student activities according to Sudjana (Indahwati & Abdullah, 2019) can be seen in Table 2.

Table 2.
Student Activity Assessment Criteria

Score Range	Category
90 - 100%	Very Good
80 - 89%	Good
70 - 79%	Enough
60 - 69%	insufficient
<60%	Extremely less

The analysis of the collaboration skills questionnaire uses the following percentage formula.

$$Percentage = \frac{\Sigma\ obtained\ score}{\Sigma\ maximum\ score}\ x\ 100\%$$

Then, the results of the student collaboration skills questionnaire were compared with the criteria presented in Table 3 (Purwanto, 2013).

Table 3.
Collaboration Skill Criteria

Percentage	Category
86 - 100%	Very Good
76 - 85%	Good
60 - 75%	Enough
55 - 59%	Insufficient
Less than 54%	Extremely less

The indicator of success in this study is marked by an increase in the collaborative abilities of students in each cycle. This increase is reflected in the development of scores in the collaboration skills criteria table. If this indicator has been optimally fulfilled, the

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implementation of the action cycle will be stopped because it is considered to have achieved the expected goals.

RESULTS AND DISCUSSION

Research Results

This study was conducted in two cycles, with each cycle comprising four main stages, namely: (1) formulation of an action plan, (2) implementation of actions, (3) observation, and (4) reflection on the results obtained. Each cycle consisted of one face-to-face meeting session. These stages were carried out systematically in each cycle in order to achieve the research objectives optimally.

Cycle I Planning Stage

Cycle I was conducted on May 14, 2025, and consisted of four stages: planning, action, observation, and reflection. The planning stage in Cycle I focused on designing game-based learning utilizing the Classcraft platform in spreadsheet material, which aimed to improve the collaborative skills of vocational school accounting students. The initial step in this phase is to formulate learning objectives aligned with core competency outcomes and collaboration skill indicators. Subsequently, an analysis of students' learning characteristics and needs is conducted to determine the appropriate instructional approach. Based on identified collaboration issues in the classroom, relevant instructional actions are developed. Teaching materials, including lesson plans (RPP), media, and digital teaching materials, were developed by integrating game elements through the Classcraft platform. Additionally, research instruments such as collaboration skill questionnaires and student activity observation sheets were developed for data collection purposes.

Stage of Taking Action

The implementation stage of Cycle I is the initial implementation of the game-based learning model based on the Classcraft platform, which was developed in the previous planning stage. The learning process begins with introductory activities that serve to build readiness to learn and create a conducive classroom atmosphere. At this stage, the teacher begins the activity

by greeting the students and providing brief motivation to increase their enthusiasm and focus on learning. After establishing emotional connection and readiness to learn, the teacher then explicitly conveys the learning objectives and explains the urgency of mastering spreadsheet material in the context of the workplace and its application in everyday life. This step is important to foster students' awareness of the relevance of the material to be learned, thereby encouraging their active involvement during the learning process.

Next, the teacher introduced gamification-based learning media, namely Classcraft, as the main tool to support the learning process. A systematic explanation was given regarding the main features of Classcraft, such as the roles of digital characters, the point system (experience points, health points, and gold points), and the mechanism of teamwork in the form of collaborative missions or challenges. The teacher also informs the students about the learning activity agenda and explains the stages that the students will go through during the cycle. As part of the technical preparation, the teacher provides instructions on the digital learning tools that will be used and ensures that all students have access to their Classcraft accounts. Technical instructions are clearly communicated to ensure that each student is able to operate the application independently or in groups. The implementation of the initial activities in Cycle I serves as an important foundation for building students' understanding of the learning model used, while also encouraging motivation and readiness to collaborate in the context of educational game-based learning.

After the introductory activities are completed, the teacher moves into the core phase by implementing game-based learning strategies using the Classcraft platform. This phase is divided into several structured activities that support mastery of the material and the development of students' collaborative skills. In the initial core stage, the teacher introduces the material by explaining the basic concepts of spreadsheets, such as the use of electronic worksheets, basic functions (SUM, AVERAGE, IF), and the application of simple formulas in the context of accounting activities. The presentation of the material is accompanied by practical examples in the workplace, so that students can understand the relevance of the competencies being learned. Teachers also conduct question-and-answer sessions and interactive discussions to explore students' initial understanding and build active engagement from the start of the learning process. Next, the activity continues with an introduction to the

Classcraft learning platform. At this stage, students are given the opportunity to create or select their own characters as part of the gamified learning experience. Teachers explain the game mechanics, including the point system (Experience Points and Health Points), rules of play, and how individual and collaborative missions work. The reward and consequence system is clearly explained so that students understand its connection to discipline, participation, and learning outcomes.

During the practical implementation session, students begin working on tasks and challenges packaged as missions on the Classcraft platform. These tasks involve applying basic spreadsheet formulas, both individually and in groups. Students are asked to complete missions within a certain time limit, while teachers act as facilitators by providing guidance, clarifying material, and giving direct feedback. This process encourages students to be actively involved, competitive, yet cooperative in solving the problems given. The next part of the core activity is the collaboration session, where students work in small groups to complete collaborative challenges that emphasize the integration of conceptual understanding and role sharing. Teachers facilitate group discussions and observe the interaction process among students to identify forms of cooperation, communication, and joint decision-making. Formative feedback is provided by teachers to reinforce positive collaborative practices and guide groups that are not yet optimal.

The learning activity ended with a closing session that included reflection and evaluation. Students were invited to share their experiences and feelings during gamified learning, including the challenges they faced and the strategies they used to complete the mission. The teacher summarized the material by reiterating the benefits of mastering spreadsheets in the workplace and assessing the learning process from cognitive and affective perspectives. As reinforcement, the teacher assigned independent tasks to be completed outside of class, which also served as preparation for the next learning cycle. The learning session concluded with closing remarks and motivational messages to maintain students' enthusiasm for learning.

Observation Stage

The observation stage in cycle I was conducted systematically and structurally to monitor and record the entire process of implementing the designed learning activities, in order to obtain

empirical data related to student engagement and collaboration during the implementation of the Classcraft-based game-based learning model. Observations were conducted directly by researchers and collaborators using pre-designed observation sheets, which included indicators of active student engagement, participation in group discussions, use of Classcraft features, and collaborative attitudes during learning activities. During the learning process, teachers played an active role not only as learning facilitators but also as observers of classroom dynamics, noting how students responded to gamification-based learning strategies, particularly in terms of collaboration. Teachers observed the intensity of interaction among group members, the appropriateness of Classcraft account use in relation to learning objectives, and the effectiveness of communication among students in completing challenges or missions assigned through the platform. Additionally, teachers also note any obstacles that arise, such as technical difficulties in using digital devices, students' understanding of instructions within the application, or students showing a lack of active participation. This data is systematically recorded for analysis during the reflection phase. This observation also includes students' behavior in following teachers' instructions, their activity in answering questions, and their participation in collaborative activities designed in the learning scenario.

Reflection Stage

The reflection stage in cycle I is carried out after all action and observation processes have been completed. At this stage, the data obtained is analyzed systematically to evaluate the level of success of the implementation of the action. The results of this analysis form the basis for reflection, which aims to identify the strengths and weaknesses of the learning implementation, as well as to serve as a reference in formulating improvements and refinements to the strategy for the next learning cycle. Based on the learning that has been carried out in cycle 2, there are several important areas that teachers need to focus on for improvement, including: 1) The explanation of the procedures for the learning process using Classcraft was not detailed enough, resulting in some students being less engaged, 3) Students' levels of understanding of the material varied, so that some students relied solely on their groupmates who were considered to have a better understanding, causing other students to not pay attention,

4) Problems in time management caused an imbalance in the completion of missions, with some missions exceeding the planned time allocation and others experiencing time constraints.

The results of the analysis of observational data on students' collaboration skills in Cycle I show that the average percentage for each collaboration skill indicator can be reviewed as listed in Table 4.

Table 4
Percentage of Collaboration Skills Indicators Cycle I

Indicator	Percentage
Active Contribution	57%
Work Productively	50%
Responsibility	57%
Flexibility	85%
Mutual Respect	71%
AVERAGE	64%

Furthermore, the results of the learning achievement tests and the level of learning completeness of students in cycle I are presented in Table 5.

Table 5
Analysis of Learning Outcomes and Learning Completion Cycle I

Score	Frequency	%	Category
78–100	16	57%	Complete
Less than 78	12	43%	Incomplete
Total	28	100%	
Average		71.78	
Highest Score		98	
Lowest Score		53	

Based on the results of the analysis in Tables 4 and 5, it was found that the percentage of students' collaboration skills reached 64%, which is classified as adequate. The percentage of classical learning completeness was 57%, with 16 out of 28 students successfully meeting the learning completeness criteria. The class average score was recorded at 71.78. Therefore, the learning outcomes in Cycle I have not yet met the success indicators optimally, as the classical learning achievement rate has not reached ≥75% and the collaboration skills are still classified as adequate. Therefore, the research needs to be continued to Cycle II to improve the results obtained.

Cycle 2

Planning Stage

Cycle II was implemented on May 21, 2025, and consisted of four stages: planning, implementation, observation, and reflection. During the planning stage, the main focus was on designing game-based learning utilizing the Classcraft platform in spreadsheet material, which aimed to improve the collaborative skills of vocational school accounting students. The initial planning stage began with the formulation of learning objectives aligned with basic competency outcomes and collaboration skill indicators. Subsequently, an analysis of students' learning characteristics and needs was conducted to determine an appropriate learning approach. Based on the collaboration issues identified in the classroom, learning actions were designed, adapted from findings in Cycle I. Teaching materials, including lesson plans (RPP), media, and digital teaching materials, were improved by integrating game elements through the Classcraft platform. Additionally, research instruments such as collaboration skill questionnaires and student activity observation sheets were developed to support systematic data collection.

Stage of Taking Action

The action phase in cycle II was implemented with a structure similar to cycle I, but with a number of improvements based on the results of reflection. These improvements included a more detailed explanation of the procedures for using the Classcraft platform so that all students understood the learning process and could participate constructively. Additionally, teachers provided more intensive guidance to students with varying levels of understanding to prevent reliance on specific group members. Time management was also improved by setting more proportional durations for each mission to avoid disparities in task completion. The learning activity began with a preliminary stage, which involved building readiness to learn, communicating learning objectives, and explaining the urgency of mastering spreadsheet material in the workplace. The teacher then systematically introduced the Classcraft platform, explained its main features, and ensured that all students had access to and technical understanding of the application.

In the core activity, the teacher presented basic spreadsheet material and linked it to accounting practices. Learning continues with gamification activities, where students create

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characters in Classcraft, understand the point system, and participate in individual and collaborative missions. Students complete tasks packaged as spreadsheet-based challenges, with the teacher acting as an active facilitator providing guidance and immediate feedback. Collaborative activities focus on strengthening teamwork and effective communication, with the teacher observing group dynamics to ensure all students are equally engaged. The activity concludes with a reflection and evaluation session, where students share their experiences during the learning process, discuss mission completion strategies, and receive feedback from the teacher. The material is summarized concisely, and students are given independent assignments as reinforcement and preparation for the next learning phase.

Observation Stage

The observation stage in cycle II was carried out simultaneously with the action stage, as in cycle I. Observations were conducted systematically and structurally to monitor and record the entire process of game-based learning using the Classcraft platform. The purpose of this observation was to obtain empirical data related to the level of student engagement and collaboration during the learning process. The observation activities were carried out directly by the researcher and collaborators using a pre-designed observation sheet, which included indicators such as active participation in group discussions, utilization of Classcraft features, and students' collaborative attitudes. Teachers act not only as facilitators but also as observers of classroom dynamics, including the intensity of interaction among group members, the appropriateness of Classcraft account usage in relation to learning objectives, and the effectiveness of communication in completing learning missions.

Reflection Stage

Through an evaluation of the entire series of activities, it can be concluded that the implementation of learning in cycle II went well. All missions were completed on time and in accordance with the allocated time. The Game-Based Learning approach using Classcraft for spreadsheet learning became more interactive and structured, as reflected in Cycle I. Based on the analysis of observation data from Cycle II, the average percentage of students' collaborative

Table 8
Percentage of Collaboration Skills Indicators Cycle 2

Indicator	Percentage
Active Contribution	89%
Work Productively	82%
Responsibility	75%
Flexibility	85%
Mutual Respect	79%
AVERAGE	**82%**

skills for each indicator was obtained, which is detailed in Table 8.

Furthermore, the results of the learning achievement tests and the level of learning completeness of students in cycle II are presented in Table 9.

Table 9
Analysis of Learning Outcomes and Learning Completion in Cycle II

Score	Frequency	%	Category
78–100	25	89%	Complete
Less than 78	3	11%	Incomplete
Total	28	100%	
Average		74.76	
Highest Score		98	
Lowest Score		53	

The results of the analysis in Tables 8 and 9 show that the percentage of students' collaborative skills reached 82%, which is classified as good. In addition, the percentage of classical learning completeness reached 89%, which means that 25 out of 28 students met the completeness criteria. The average score obtained by students in that class was 74.6. Compared to the results in Cycle I, Cycle II shows a significant improvement, both in terms of collaborative skills and learning achievement. With the achievement of the 'good' category in

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the collaborative indicator and the fulfillment of the classical achievement standard exceeding 75%, it can be concluded that the research objectives have been achieved in Cycle II. Based on these achievements, the implementation of actions in this classroom action research (PTK) is deemed sufficient up to Cycle II and will not be continued to the next cycle.

Discussion

The results of the study indicate that the implementation of Classcraft-based Game-Based Learning in spreadsheet learning can significantly improve students' collaboration skills. This was proven through two action cycles. In cycle I, students' collaborative skills were in the "fair" category with a percentage of 64%, while in cycle II, they increased to 82%, which is in the "good" category. This improvement was also accompanied by an increase in learning achievement from 57% to 89%, indicating that the implemented learning strategy not only impacted the affective aspect (collaboration) but also students' cognitive outcomes.

The average level of collaborative skill achievement among students in Cycle I and Cycle II is summarized in Figure 2 as a recapitulation of observation results.
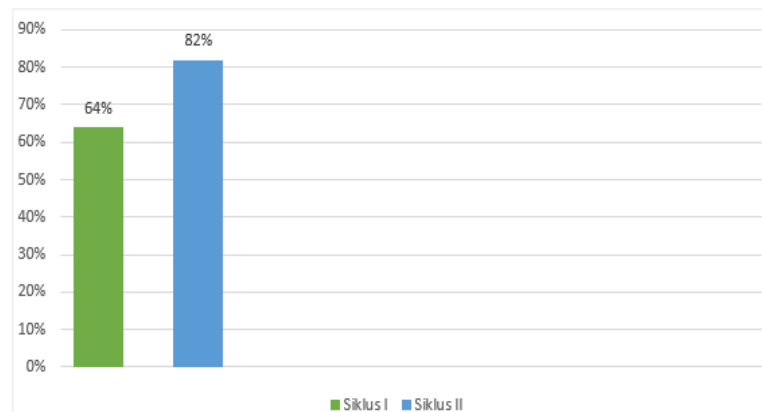
Figure 2. Percentage Increase in Collaboration Among Accounting Students in Grade X at Vocational High Schools in Malang Regency

Referring to Figure 2, students' collaboration skills improved in each cycle. From Cycle I to Cycle II, there was an increase of 18%, from 64% to 82%. The recapitulation of the increase in classical learning completeness of students in Cycle I and Cycle II can be seen in Figure 3.
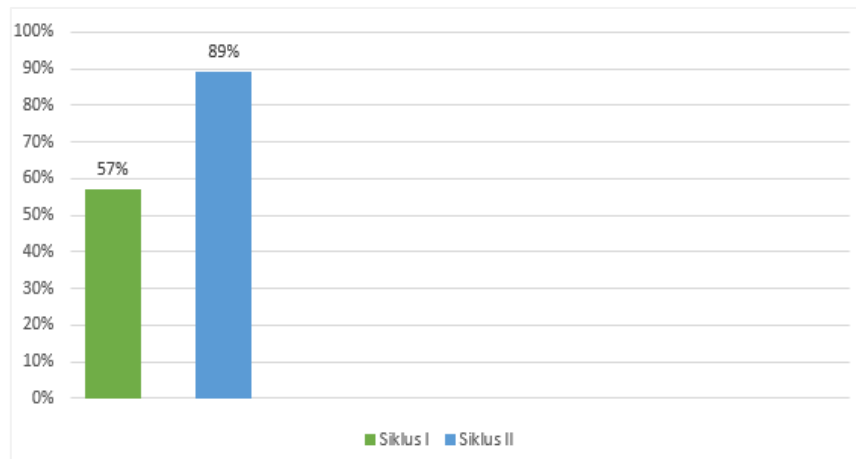
Figure 3. Percentage of Learning Completion of Accounting Students in Grade X of Vocational High Schools in Malang Regency

Referring to Figure 3, the learning completeness of Grade X Accounting students at SMK x Kab. Malang increased in each cycle. From Cycle I to Cycle II, there was an increase of 32%, from 57% to 89%. This improvement can be explained by referring to Self-Determination Theory (Deci & Ryan, 2000) and Social Interdependence Theory (Johnson & Johnson, 2009). According to social interdependence theory, cooperation within a group is effective when there is positive interdependence among its members. In this context, Classcraft systematically creates such conditions through character role mechanisms (such as Warrior, Mage, and Healer), an interdependent point system, and group-based mission challenges. When one member fails to perform their task, the entire team is affected, thereby fostering awareness of the importance of each individual's active contribution.

Research by Shimizu et al. (2020) explains that, theoretically, the collaborative concept emphasizes shared tasks and positive interdependence as the primary attributes of group learning processes. Classcraft facilitates this through team assignments, specialized roles (Warrior, Mage, Healer), and shared point/health mechanisms that make the success of one member dependent on others. As noted by Shimizu et al., positive social interdependence is a fundamental attribute that enhances learning outcomes through cooperative interdependence.

Vygotsky's social-constructivist theory states that play is inherently social and enables students to achieve beyond their current capabilities (zone of proximal development) (Plass et al., 2015). Classcraft, as a collaborative game environment, is designed to encourage social

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interaction and peer guidance. For example, players who take on the role of "Healer" gain the ability to assist friends with low health, thereby encouraging students to help one another and communicate actively for the team's objectives. Thus, the learning method using Game-Based Learning based on Classcraft creates a scaffolding environment where students naturally build shared knowledge through dialogue and negotiation within a game that simulates spreadsheet learning scenarios.

Following the Classcraft intervention, there was an increase in positive interdependence as well as individual and group responsibility among students. These findings align with the results of the latest gamification meta-analysis by Slamet & Chen (2025), which reported a large effect on cognitive learning outcomes (d=0.875) and a moderate-to-high effect on affective/social outcomes (d=0.748) when gamification was applied in a collaborative learning context. They concluded that gamification, including game-based learning like Classcraft, substantially enhances the cognitive and socio-emotional dimensions of collaborative learning. In other words, integrating game elements encourages students to work together more effectively and with greater motivation.

Analytically, this success can be explained through the theory of social interdependence. The task design and rules of Classcraft create positive interdependence: achieving common goals (game points, team points) can only be attained if each member collaborates and supports one another (Shimizu et al., 2020). Classcraft implements this principle through clear shared risks and rewards. Additionally, the dimensions of dialogue and co-construction in collaboration are encouraged through Classcraft's interactive quests, enabling each student to become an active learner and educator for their peers, in line with Vygotsky's collaborative learning perspective (Plass et al., 2015). Research by Parody et al. (2022) supports these findings, showing that the use of Classcraft significantly improves students' collaboration skills in technical learning. The group using gamification experienced an increase in collaborative scores compared to the control group using conventional methods.

Based on the findings and discussion of this study, the integration of Classcraft into spreadsheet instruction has transformed a primarily technical and individual learning activity into a repetitive yet enjoyable collaborative challenge. This aligns with the findings of Chen and Tang (2023), who asserted that digital game-based Excel learning not only enhances

technical understanding but also strengthens peer interaction during the learning process. The results of this study are also consistent with Baanqud et al. (2020), who found that collaborative spreadsheet activities using cloud-based tools such as Google Sheets improve student reflection, communication, and knowledge sharing within groups.

Thus, from both technical and pedagogical perspectives, the incorporation of game elements has proven effective in creating a more dynamic, interactive, and student-centered learning environment. The implementation of gamified instruction through Classcraft in this study also demonstrated a noticeable increase in student motivation and active participation. As highlighted by Li et al. (2023) in their meta-analysis, gamification has a significant positive effect on learning outcomes and student engagement in collaborative learning environments. In this study, students exhibited greater enthusiasm when assigned roles and challenges in Classcraft, taking initiative to support their peers and engaging actively in group discussions to complete assigned tasks.

Overall, the successful application of Classcraft in spreadsheet learning illustrates that the Classcraft-based Game-Based Learning model is effective in enhancing student collaboration, both conceptually and practically. These findings are in line with global educational trends that emphasize the integration of technology and innovative strategies to equip students with 21st-century competencies, particularly the "4Cs": Critical Thinking, Creativity, Communication, and Collaboration.

CONCLUSION

Based on the findings and discussion, it can be concluded that the implementation of the Game-Based Learning model through the Classcraft platform significantly contributes to the enhancement of students' collaborative skills in spreadsheet learning at vocational accounting schools. This strategy led to a marked improvement, with students' collaboration skills increasing from a "sufficient" category in Cycle I (64%) to a "good" category in Cycle II (82%). Additionally, this improvement was accompanied by a rise in classical learning mastery from 57% to 89%, indicating that the approach was effective not only in the affective domain but also in achieving students' cognitive outcomes.

The success of this implementation was supported by the integration of gamification elements within Classcraft, such as collaborative mission systems, strategic role allocation among team members, and an educational reward system. These elements directly fostered a learning environment that promoted positive interdependence, individual accountability within groups, and effective interpersonal communication. This aligns with the principles of Social Interdependence Theory, which emphasizes the importance of positive interdependence as the foundation of successful cooperation, as well as social constructivism, which posits that meaningful learning is constructed through social interaction and shared experiences.

These findings are reinforced by previous studies that underscore the effectiveness of gamification in enhancing learning motivation, active participation, and the development of students' socio-emotional skills. In the context of spreadsheet instruction, which requires mastery of technical concepts, logical thinking, and problem-solving abilities, the Game-Based Learning approach has proven effective in transforming a typically monotonous learning atmosphere into one that is more engaging, competitive, and collaborative. Therefore, this learning model is recommended as a strategic alternative in the design of 21st-century education, particularly to strengthen collaborative skills that are essential in both the workforce and higher education.

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IMPLEMENTATION OF GAME-BASED LEARNING USING CLASSCRAFT IN SPREADSHEET INSTRUCTION TO ENHANCE COLLABORATION AMONG ACCOUNTING VOCATIONAL HIGH SCHOOL STUDENTS
Rika Wahyuni, Hanjar Ikrima Nanda, Eren Prinstrin
Universitas Negeri Malang

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