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IMPLEMENTATION OF GAME-BASED LEARNING (GBL) WITH KAHOOT! IN ENCOURAGING ACTIVE LEARNING OF STATISTICS

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ABSTRACT

Good understanding is a fundamental aspect of learning, and it involves the active participation of students. In one school in Karawaci, there were problems with learning activities, such as sleepy students who focused on devices, tended to ask or answer passively, and did not do assignments or discuss. In response to this, teachers play a role in presenting learning that helps students, namely through varied and exciting teaching by implementing Game-Based Learning (GBL) assisted by Kahoot! This study aimed to show the extent to which Kahoot-assisted GBL! Can encourage active learning and describe its application in encouraging active learning in statistical material. The research method used is descriptive qualitative. The results showed an increase in learning activity after the implementation of Kahoot!-assisted GBL, from 42.4% to 71.3%. This success is supported by motivation, appreciation, reprimand, and interaction that creates a comfortable atmosphere for students. Suggestions for future research include repeating the application of Kahoot!-assisted GBL, exploring the use of other *games* and applying them to different grade levels

Keywords: Active Learning, Game-Based Learning, Kahoot!, Statistics.

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PRELIMINARY

Statistics is one of the materials of the main subjects of mathematics studied starting from elementary school. Statistics is a mathematical science that discusses theories and methods in collecting, measuring, analyzing, and interpreting data until a conclusion is reached (Yusuf et al., 2017). Science, which was also studied up to the college level, turned out to be known as one of the branches of mathematics that is quite difficult to learn. Yensy (2020) in her research justifies this because according to her the material presented tends to be abstract and complex. No wonder the challenge that is often encountered in the classroom is the need for more student involvement. Students are often confused when they finish problems that differ from the examples (Listiani, 2023). The

involvement in question can take the form of active participation when students learn, such as involvement in discussions, doing exercises, or asking questions about concepts that are still difficult to understand. The form of student involvement synergizes with the level of student learning activity in the classroom.

Learning activity is a condition/condition of students can be active in learning (Nurfatimah et al., 2020). Supporting this, Aini, Nirvana, & Marjohan (2018) provide an overview of the student's own learning activity, namely paying attention to the teacher's explanation, reading the material, to conducting discussions. Not only behavioral involvement but learning activity is also defined when there are feelings that show student enthusiasm during learning (Kharis, 2019). A study conducted by (Chung & Pan, 2023) highlights the positive impact of gamification on student learning. The research indicates that psychological factors such as perceived challenges and social interactions significantly enhance student engagement, which is closely tied to their happiness and activeness in learning. The study underscores that engagement is a critical mediator in the relationship between gamification and learning outcomes, suggesting that happier students are more actively involved in their educational activities.

Princess et al. (2019) also provide their views regarding learning activity, namely the effort shown by student involvement so that students are expected to be able to recognize and develop their learning capacity and potential as a whole. Based on the explanation above, what is meant by learning activity is the state of students being able to be active in learning which is shown from the involvement of physical and psychological activities. In this case, the intended involvement is built from the interaction between students and students / teachers, and students with groups / environments so that students are able to recognize and develop their learning capacity or potential as a whole.

In order to measure student learning activity, indicators in the form of observable behavior are needed. All of this should be done because Facing Industry 4.0 in the world of education is the responsibility of the teacher to prepare students well (Tunde & Listiani, 2021). Nurhayati (2020) states that students are said to be active when solving problems given by the teacher, can work together, are able to express opinions and give their attention during the learning process. Furthermore, Dewi et al. (2016) provide a similar view of learning activity, namely, students who pay attention to the teacher's explanation, actively discuss during the learning process, dare to ask, dare to respond to questions, and solve problems. In addition, Hariandi & Cahyani (2018) in their research, said the indicators were carrying out discussions, seriously doing assignments, asking questions

about the material studied, having opinions, and paying attention to teacher explanations. The same thing was also conveyed by Prananta & Nainggolan (2022), namely, learning activity can be measured by observing student behavior in following learning well, asking or answering questions, doing practice questions, and discussing with friends/teachers. In addition, Pranoto (2020) also measures learning activity by paying attention to student aspects, such as listening and paying attention to teacher explanations, asking questions, giving answers, being actively involved, and arguing in group discussions.

From the five theories above, it can be seen the similarity in measuring learning activity, namely measuring it from students who ask, giving responses in the form of answers or opinions, paying attention to teacher explanations, discussing, and doing tasks given by the teacher (tasks can be in the form of practice questions or problem-solving). Based on the above, 5 (five) indicators will be used in measuring student learning activity, namely (1) students pay attention to the teacher's explanation, (2) students dare to ask questions, (3) students dare to express answers/opinions; (4) students have discussions in groups, and (5) students do assignments given by the teacher.

According to Masjudin (2016), activeness is essential to make students learn mathematics with a good understanding as a fundamental aspect of learning. Prijanto & Kock (2021) also said that students will be more motivated to construct their knowledge with a more active classroom atmosphere during learning. On the other hand, a person is said to be curious when the individual is driven from within himself to obtain new information without any rewards or extrinsic factors (Raharja et al., 2018). Based on these various views, it can be understood that when actively involved, students have the opportunity to encourage the character of curiosity so that they are able to construct knowledge and gain a good understanding. On the other hand, when students do not meet the indicators of learning activity, they often behave and act in ways that are different from their proper character. Thus, the role of the teacher is crucial to creating learning that encourages student learning activity.

Based on observations made during Field Experience Practice (PPL) 2, in one of the schools in Karawaci, it was found that student learning activity deserves special attention, especially in class XII. This is shown by the following various student behaviors: only 11 out of 23 students focus on paying attention to the teacher's explanation. Other students were found chatting, focused on devices or things unrelated to learning, and some took notes even though the teacher had conveyed the rules in class not to take notes during the explanation session. In addition, there were only four students who asked questions

during the learning process. Even when the teacher asks questions, it is found that students tend to be passive and seem hesitant to give answers or opinions on the teacher's questions. In the end, data was obtained. Namely, there were only seven students who dared to give answers or ideas in response to the teacher's questions.

Similarly, only 6 of the 23 students discussed completing the exercises. At the same time, the rest tended to choose to work alone, and two students still needed to do the exercises. Therefore, based on some of the behaviors above, it can be diagnosed that the learning activity of grade XII students in the school deserves attention.

Based on the gap between ideal conditions and reality, the alternative problem-solving student learning activity above will be used in the Game-Based Learning (GBL) model. Papastergiou (2009) in his research, concluded that this model is able to make students more active and motivated when compared to conventional methods (lectures). In line with this opinion, Jayantika & Putri (2023) even said that this model can encourage student learning activity because it can make students feel happy and not bored, resulting in increased enthusiasm and concentration. The digital games (games) used during GBL are usually adjusted to the needs and conditions of the class. One of the games that can be used is Kahoot!. The advantages of this application, according to Lisnani & Emmanuel (2020) include time allocations that can be set and limited to each question presented; features with attractive colors, shapes, and sounds; and equipped with a teacher monitoring system on student activities. Beside that (Sembiring & Listiani, 2023) also said that Games-Based Learning can make students to be more active in learning mathematics. While according to (Alsswey et al., 2024) the use of Kahoot makes students focus on learning. Kahoot features can encourage students to work on the questions until they get the highest score (Garza et al., 2023). The use of GBL with Kahoot has a positive impact on students (Balaskas et al., 2023). (Licorish & Lötter, 2022; Lohitharajah & Youhasan, 2022) also said that GBL integrated with Kahoot has a positive impact for students. To prioritize patient care, Kahoot supported students in learning new information and honing their critical thinking abilities (Cadet, 2023).

Despite the growing interest in Game-Based Learning (GBL) as an educational strategy, there is limited empirical evidence on its effectiveness in the context of higher education statistics courses. Statistics, often perceived as a challenging and abstract subject, can result in low student engagement and motivation, leading to poor learning outcomes. While traditional teaching methods focus on passive learning, the implementation of GBL tools such as Kahoot! has the potential to foster active learning by

increasing student participation, engagement, and motivation. However, there is a need to investigate how effectively Kahoot! can be integrated into statistics education to enhance student learning experiences and outcomes.

In response to the problems that occurred in the field, it was decided to implement GBL, assisted by Kahoot!, as an alternative problem-solving method. According to Vusić et al. (2018), GBL is a system in the educational process that adopts a game (game) for the needs of cognitive interests and student motivation. On the other hand, Kahoot! is an educational game online site that is free and can be accessed with the prerequisite of providing an internet connection by every group, including teachers and students. Kahoot! Equipped with various features with exciting innovations that can make students excited, which has an impact on the growth of activeness in learning (Khomsah & Imron, 2020). The GBL model has application steps, namely (1) choosing games according to the topic, (2) explaining the initial concept, (3) agreeing on game rules, (4) playing games, (5) summarizing knowledge, and (6) reflecting (Sholikhatun, 2023). Thus, Kahoot has assisted in the steps to implement GBL! will be used in this study, namely (1) the selection of Kahoot! as a game, (2) an explanation of concepts, (3) an explanation of Kahoot! Rules, (4) conduct of Kahoot! Sessions, (5) knowledge summarization, and (6) reflection.

Related to this, the formulation of the problem in this study is (1) "Is Game-Based Learning (GBL) assisted by Kahoot media! can encourage student learning activity on statistical material?" and (2) "How is the application of Game-Based Learning (GBL) assisted by Kahoot media! In encouraging student learning activity on statistical material?". Therefore, the purpose of this study is (1) to show the extent to which Kahoot media assist Game-Based Learning (GBL)! can encourage student learning activity on statistical material and (2) to describe the application of Game-Based Learning (GBL) assisted by Kahoot media! In encouraging student learning activity on statistical material.

METHODS

The research method used is qualitative, specifically the descriptive qualitative research method. This method is chosen because it allows the researcher to document the process systematically, without manipulating or engineering the data. It supports inductive analysis, helping to describe human behavior in its natural context, and is useful for understanding the dynamics of the subject matter over time (Nugrahani, 2014).

Instrument

The research instrument includes using Game-Based Learning (GBL) with the Kahoot platform, which is identified as a potential solution to address the issue of low student engagement in mathematics learning. The Research Flow Fishbone diagram visually represents the study's process, from identifying the problem to evaluating the impact of using GBL-Kahoot on student activity levels.

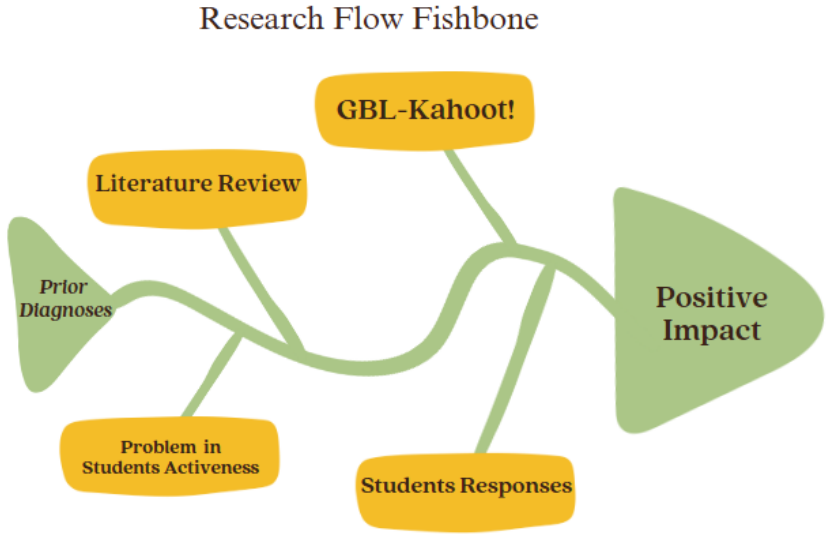

Figure 1. Research Flow Fishbone

Data Collection

Data collection begins with an initial diagnosis to identify the key issues affecting the classroom. The primary issue identified was the low student activity in mathematics lessons. The next step in data collection involves conducting a literature review to explore possible solutions, which led to the selection of GBL-Kahoot as an intervention.

The study involves 23 students from Grade XII, selected through purposive sampling. These students were chosen specifically due to the issue of low activity in mathematics learning. The researcher observes how students respond to the GBL-Kahoot method and monitor changes in their activity and engagement after the intervention.

Data Interpretation

First, an initial diagnosis is carried out to determine the problems that occur in the classroom. It turned out that students needed to be more active in learning. Then, a literature review is carried out to find the right solution. GBL with Kahoot can be a solution to overcome students' problems. Then, we will see how students respond after learning to use GBL-Kahoot. After using GBL-Kahoot, students will become more active or have a positive impact on students. Data analysis is assisted by descriptive analysis by

calculating learning activity scores using the following formula, quoted from Dewi et al. (2016).

$$Score = \frac{N}{Total\ of\ students} \times 100$$

Information:
N = frequency or number of students.

Furthermore, the above scores are then classified according to the following student learning activity criteria.

Table 1. Student Learning Activity Criteria

Level Interval	Criterion
81 – 100	Very High
61 – 80	High
41 – 60	Enough
21 – 40	Low
< 21	Very Low

Source: (Dewi et al., 2016, p. 283)

RESULT AND DISCUSSION

Activeness is one of the fundamental aspects for students to build a good understanding when learning mathematics (Masjudin, 2016). If a class wants to know the level of student activity in learning, it must be observed based on the active involvement of students as well. As already stated, learning activity can be measured from student behavior in class. For example, observing whether, during learning, students pay attention to the teacher's explanation or not, ask questions, answer questions, have discussions in groups, or do assignments given by the teacher.

The issue of activeness is often a concern for every teacher. Internal and external factors influence the high and low learning activity. According to Setyaningrum (2017), internal factors can be in the form of students' level of pleasure and interest in learning, while external factors are the intensity of teacher habits in praising students, excessive punishment, inappropriate reprimands, and unpleasant teaching. In other words, teacher performance and teaching also affect students' active involvement during learning. When teaching is presented appropriately and enjoyably, then students are supported in the process of building a good understanding of the material. This effort is essential because the construction of knowledge is related to the character of curiosity. Therefore, teachers, as observers of character education, carry out the task of striving for active learning in every teaching. Otherwise, the possibility of problems in this matter will be even greater.

The application of the Kahoot!-assisted GBL model is one way that teachers can find a solution to the problem of active learning. Kahoot's help! The application of GBL above is not the first time it has been proven to encourage student learning activity, but previous researchers have validated it. One of the things that make the classroom atmosphere active is Kahoot!, which can make students compete to answer questions quickly and correctly to become the top rank (Sakdah et al., 2022). This is also experienced in the field, especially every time 1 (one) question is completed, then Kahoot! will show a provisional score. That way, teachers and students can watch the provisional score together before continuing to play on the next question. When the name of the student group is displayed as the top 5 (five) scores, it will give birth to pride in the group concerned. This then rekindles the enthusiasm of students to compete on the following question and also reduces the sense of boredom. Compared to other games that tend to look monotonous and features are not as complete as this game, Kahoot! has a more attractive look.

The selection of the GBL model is based on indicators of learning activity that need to be boosted, namely student learning activity in paying attention to explanations, asking, answering, discussing, and doing assignments given by the teacher. GBL model was chosen to be applied because it can accommodate some of the above. Moreover, teachers also use a variety of media when explaining concepts – one of the syntaxes of GBL – as well as a study group system that is also applied and intended for students to discuss before the game session until the game session is held. The concept explanation session also provides space for teachers to interact with students so that they can spark activeness in asking and answering. Therefore, it is clear that the selection of this model is by the learning concept of Games Based Learning itself, namely the concept of active learning, which emphasizes more activeness when learning and is more effective when compared to passive learning (Wahyudi, 2019). In addition, students are also accustomed to using devices in the school environment, so this is felt to be intended for overcoming problems in class, especially active learning. As for the selection of Kahoot! as GBL media, including its exciting features, ease of access, and question work time that the teacher can set, students are also familiar with this media. In Figure 2, the Kahoot display that is given to students can be seen. The link game from Kahoot cannot be found because all the questions have been set to private or are no longer accessible due to the expiration of the game session. As a result, only participants who were present during the session or had direct access to the teacher or host can engage with the content.

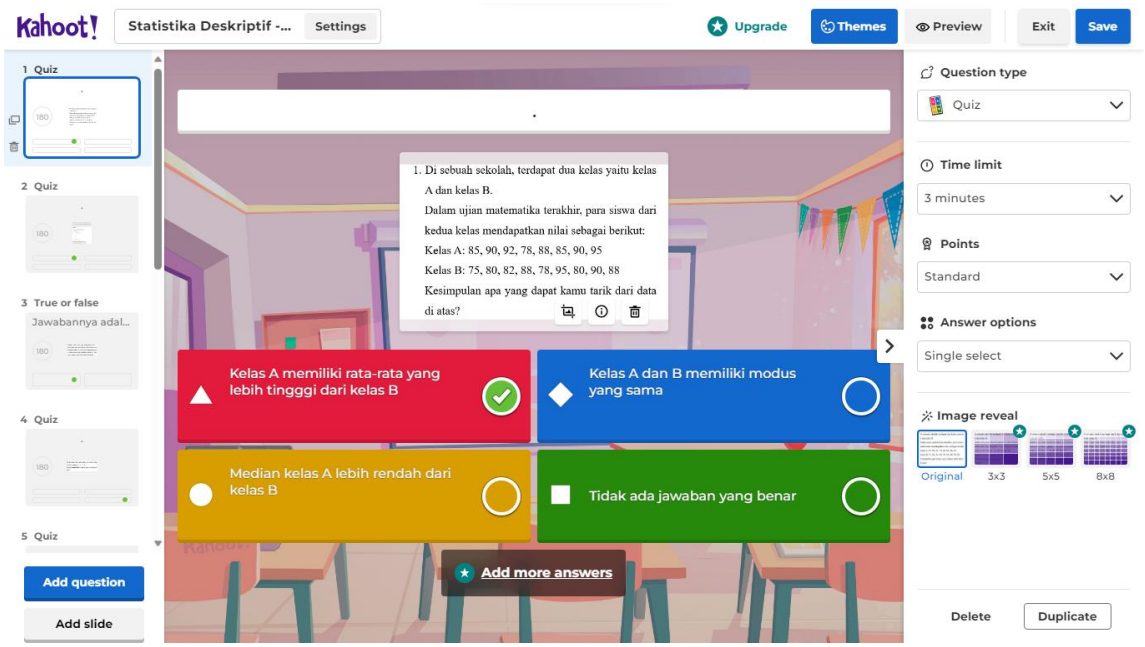

Figure 2. Kahoot! Display

Kahoot-assisted GBL implementation! In statistical material, the topic of outliers (outlier data) is carried out 100%, which means that each step is carried out according to its syntax. There are several steps that teachers take. First, the teacher chose Kahoot! as a game, and this step is done before the teaching session. Second, teachers explain concepts with the help of PowerPoint (PPT), TV instead of projector, and whiteboard. In this case, students are expected to show their activeness by paying attention to the teacher's explanation, even though there are still students who still need to meet this indicator. This is indicated by the presence of students who are still chatting, sleepy, and focused on their devices. Therefore, the teacher always calls the name of the student concerned and directs them to refocus on listening and paying attention to the teacher's explanation.

However, the number of students who do not match the above indicators has decreased when compared to before the implementation. To accommodate other indicators, the brainstorming procurement and question-and-answer method are also polished at this step. Teachers sometimes raise questions from the pictures shown on PPT (PowerPoint). In response to this, it was found that students were enthusiastic in answering. Not only is this the indicator of answering questions, but there was also an increase in the number of students who asked questions compared to the data before implementation. Although 2 (two) groups must be reminded to discuss, most students are enthusiastic about doing the above. In addition, not a few students raise their hands in their seats to ask for hints about solving questions or even ask the teacher to check the steps of the work, or they just want

to match their answers with the correct answers. Therefore, in this step, the entire indicator of student activeness is accommodated at once.

Third, the teacher explains the rules of the game Kahoot!. In this step, the indicator of activeness that can be observed is the indicator "students pay attention to the teacher's explanation." Fourth, the implementation of Kahoot!. At this stage, the teacher provides a PIN and directs each group to access Kahoot! by giving directions that there will only be 1 (one) device joining Kahoot! each group with a group username should "smell" about math. In response to this, students are very enthusiastic about discussing what group name to use. Next, students start playing Kahoot! with the group. Not to mention the teacher also plays a role as a motivator, constantly reminding students to discuss things in groups. However, in the middle of a session of Kahoot! There are some students in 2 (two) groups who do not discuss and prefer to guess the answers only. Although all questions can't be solved (only 6 out of 10 questions), in this session, students have been enthusiastic and have improved on the indicators of discussion in groups.

Fifth, teachers and students summarize knowledge. The teacher again invites students to discuss important concepts from each problem solved. This is actualized through the teacher's actions that display each question to be discussed together, starting from the first question to the sixth question as the last question solved in the Kahoot game! This time. In this step, the accommodated student activeness indicator is an indicator of students paying attention to the teacher's explanation, answering questions, giving opinions, and asking questions. This is possible because in each question, the teacher will first ask the group who answered the question correctly, and then the teacher will welcome the group who is willing to explain the solution in class. If there is no volunteer group, the teacher will assign a random group of students. Thus, some of the indicators referred to earlier can be observed in this session. Sixth, the teacher encourages students to reflect and asks some students to share what was gained from the learning. As a result, until the implementation of the last step was found that, the implementation of Kahoot!-assisted GBL, students became more active during the learning process as indicated by the reduced number of students who did not meet each indicator.

Based on the application steps above, an increase was found in each observed indicator. The data was collected before and after the implementation of the Kahoot-assisted Game-Based Learning (GBL) intervention. This allows for a comparison of student activity levels and engagement before and after the method is introduced. Data should be gathered at specific intervals during the class sessions: once at the beginning

(before Kahoot is implemented) and again after the intervention has been applied for a certain period (e.g., after several sessions using Kahoot). The data were Teachers recorded the frequency with which students met each indicator of activity, such as paying attention, asking questions, providing answers, participating in discussions, and completing assignments. Each indicator should be scored using the established criteria (e.g., Low, Enough, High, Very High) to quantify student engagement. The data were collected in the classroom, where the students were engaging with the lessons. The observation occur in the natural classroom setting to capture genuine student behavior. This would involve monitoring interactions and activities during the regular mathematics lessons where Kahoot-assisted GBL is implemented.

The following is a table of processed learning activity data before and after the implementation of Kahoot!-assisted GBL.

Table 2. Learning Activity Data Before and After Kahoot-Assisted GBL Implementation!

Indicator	Before the implementation of Kahoot-assisted GBL!			After the implementation of Kahoot-assisted GBL!		
	N	**Score**	**Criterion**	***N***	**Score**	**Criterion**
Students pay attention to the teacher's explanation	11	47,8	Enough	17	73,9	High
Students dare to ask questions	4	17,4	Low	16	69,6	High
Students dare to come up with answers	7	30,4	Low	11	47,8	Enough
Students have discussions in groups	6	26,1	Low	17	73,9	High
Students do the assignments given by the teacher	21	91,3	Very High	21	91,3	Very High
Average		**42,6**	**Enough**		**71,3**	**High**

N = frequency / many students who meet the indicator

Based on the table above, it can be seen that after the implementation of Kahoot!-assisted GBL there was an increase in each indicator of learning activity. First, the indicator "paying attention to the teacher's explanation" increased from only 11 students (sufficient) to 17 students (high). Second, the number of students who met the "dare to ask questions" indicator also increased significantly from 4 students (low) to 16 students (high). Third, the indicator "dare to answer," which previously only seven students met

(low), has now become 11 students (enough). Fourth, the indicator of "conducting discussions in groups" from the beginning was low. Namely, only six students who met now reached the high criteria, equivalent to 17 out of 23 students who met. Fifth, the indicator "doing the task given by the teacher" was observed to be fixed or constant in the "very high" category after the application of the solution variable. Furthermore, the general increase is also seen in Table 2, namely the average that initially only touched 42.6 or categorized as "sufficient," in reality, it increased to reach an average score of 71.3 or categorized as "high."

To facilitate observations on the increase in each indicator of learning activity, the following data on the percentage of learning activity before and after the application of this research solution variable are presented.

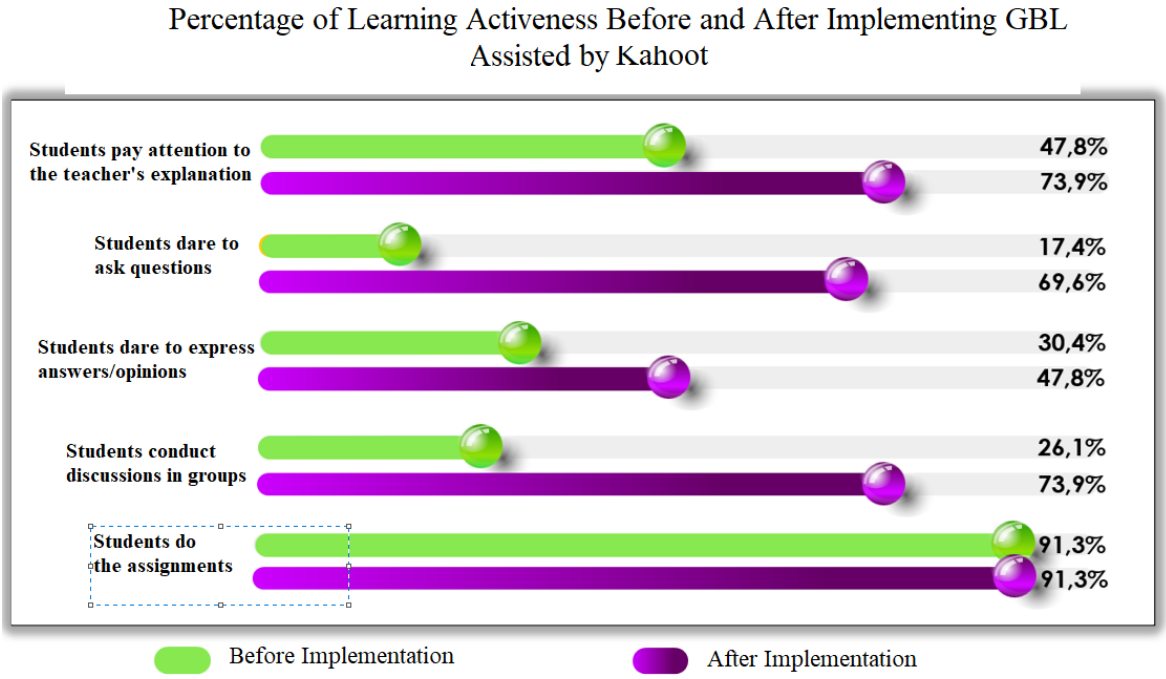

Figure 3. Percentage of learning activity before and after the implementation of Kahoot-assisted GBL!

Based on Figure 3 above, the first indicator increased from 47.8% to 73.9% or, in this case, changed from "sufficient" to "high" regarding paying attention to the teacher's explanation. Students do not pay attention to the teacher's explanation, usually because students already feel familiar with the material or precisely because they do not understand uninteresting material or because the learning media used by teachers is not attractive (Rea et al., 2013). When reviewed before the application, it was found that teachers taught with conventional methods, and the media used was a softcopy of student modules shown on TV. Variations of learning models and media have not been used optimally, making the learning atmosphere monotonous. Pranoto (2020) experienced the same thing so that he

applied Game-Based Learning to his research. In this study, the teacher explained the concept with a slightly different touch, namely using interactive PowerPoint so that it is more interesting and using the Kahoot web application! as a game medium. Considering that previously, there were still students who were easily distracted by devices and also chatting, then at this stage, the teacher tried to always and more intensely reprimand or remind the student to refocus. As a result, the first indicator has increased with many students who meet the indicator 17 students or equivalent to the "high" category.

The second indicator also increased from 17.4% to 69.6%, or, in this case, from "low" to "high" when it comes to asking questions. This indicates that more students dare to ask questions after the application of research solution variables. Dewi et al. (2016) state that interaction can encourage students to dare to ask questions. Before and after implementing the solution, teachers both provide space and open themselves if there are students who ask questions. Before the application of the model, the teacher opened a question-and-answer room by inviting students to come to the front desk, supervising the practice by visiting the student table, and offering help if there was something the students wanted to ask. During the implementation, the teacher still opens the question and answer room and visits the student table, but more intensely when compared to the previous one; 1 (one) student table can even be visited by the teacher 3-4 times. Not just visiting and asking, "Is there anything to ask?" but the teacher first seeks interaction with small talk outside the learning topic. Teachers also motivate students to dare to ask questions, as Astuti & Sari (2017) did in their research. As a result, the number of students who asked questions increased during the question work session before the Kahoot game! and knowledge summarization sessions (after the Kahoot game!).

The third indicator also increased from 30.4% to 47.8% or, in this case, changed from "low" to "sufficient" about daring to express an answer/opinion. The difficulty for students in achieving this indicator is a lack of confidence and fear of the views of friends or teachers. The role of teachers is important in this case to provide motivation to students (Ariani, 2017), hoping to create a supportive classroom atmosphere where students can feel safe to answer/argue without fear of being judged negatively. Some examples that teachers always say to boost this indicator are "It's OK if you want to answer or give the idea; there is no wrong answer here." and "Miss doesn't eat people, so please give her an idea.". Teachers also give appreciation to students who contribute to this indicator, such as saying "Good," "Nice," or "Good answer." Although it has not increased drastically, the achievement of this indicator can be helped by doing some of the above.

Furthermore, the fourth indicator increased from 26.1% to 73.9% or, in this case, changed from "low" to "high" regarding conducting discussions in groups. The absence of follow-up from group work can cause students to not pay attention to the implementation of group discussions. In response to this, when teaching practice, the teacher directs students to discuss in groups, and then the teacher designates groups randomly (randomly) for a brief presentation. In addition, with the Kahoot! What is done in groups requires students inevitably to have to discuss solving problems. What also requires them to discuss is the responsibility of each group that must present at least 1 (one) of the Kahoot! Questions. In addition, teachers continue to deliver motivation. With this, group discussions are greatly helped after the application of this research solution variable.

Different from other indicators, the fifth indicator, "students do the assignment given by the teacher," is constant at 91.3% or categorized as "high" both before and after the implementation of Kahoot!-assisted GBL. This means that only 2 (two) students were found who still needed to meet this indicator. The student was found to put less effort into doing the assignment and considered that the work of his friends at once was the result of his work as well. Even though the teacher always reminds each student to make sure that they contribute to group discussions while writing back in their respective books the results of their group discussions. In this regard, researchers realized the importance of conducting short interviews with the students concerned and teachers/homerooms. Still, they did not do so due to time and circumstances that could have been better. This is intended to find out the root cause so that further treatment can be carried out to help students meet the above indicators.

Based on the explanation above, it can be seen that 4 out of 5 indicators have increased after the implementation of Kahoot!-assisted GBL. This is also validated through the percentage of indicators as a whole, which previously only reached 42.4%, which was categorized as sufficient, and changed to 71.3%, which was already categorized as high after the implementation of the solution. Departing from the discussion of the steps to implement Kahoot-assisted GBL! Above and continuing with the analysis of each indicator of learning activity, it can be found a common thread that student learning activity can be encouraged at every step of its application. Therefore, in line with the statement of Adipat, et al., (2021), the most precise and most powerful reason for integrating digital games in the classroom is student involvement, which, in fact, can foster player responsiveness, especially if presented in groups will require students to apply teamwork skills (cooperation). Besides that, teachers play a role in knowing the characteristics of each

student and have the correct and reflective heart response to face various challenges in the world of education (Butar-Butar & Listiani, 2023).

From the explanation above, GBL with Kahoot can help students increase their engagement in learning. The integration of game-based learning with self-regulated learning strategies significantly enhances nursing students' learning performance, self-efficacy, and motivation (Chang et al., 2024). Game-based learning with explicit analogy discussion (GLX) groups showed significant improvements in conceptual understanding (Wichaidit & Wichaidit, 2024). This is in line with the research from (Ab. Rahman et al., 2018; Basriadi et al., 2019; Lv, 2024; Smiderle et al., 2020) an experimental group that uses Kahoot! showed improved performance compared to the control group that did not use the tool. Gamification with Kahoot, which is considered easy to use and valuable, positively affects students' attitudes toward technology and their engagement in learning.

The implementation of GBL with Kahoot! can make learning statistics more engaging and enjoyable for students. This can lead to better educational outcomes and a deeper understanding of statistical concepts, which are essential skills in various fields. By making learning more interactive and fun, GBL with Kahoot! Can reach a wider audience, including students who struggle with traditional teaching methods. This inclusivity can help bridge educational gaps and provide equal learning opportunities for all students. From this research, it can provide educators with evidence-based strategies to improve their teaching methods. This can lead to more effective pedagogical approaches, benefiting students and teachers alike. GBL with Kahoot! can foster a positive attitude towards learning and make education a more enjoyable experience. This can encourage lifelong learning, as individuals are more likely to continue their education if they have positive experiences with learning tools and methodologies. Using Kahoot! in educational settings can promote a sense of community and collaboration among students. Interactive and competitive elements encourage teamwork and peer learning, which are valuable skills both in academic settings and in the workplace. By contributing to these areas, the research on GBL with Kahoot! in statistics education can have a meaningful impact on the general public, enhancing the overall quality of education and fostering a culture of continuous learning and engagement.

CONCLUSION

Although the results of this research indicate a positive impact of Game-Based Learning (GBL) assisted by Kahoot! on student engagement, several limitations must be

considered. First, the study was conducted with a small sample of 23 Grade XII students, which limits the generalizability of the findings. These results may not be applicable to larger or different student populations, particularly those in other educational levels or subject areas. Future research could involve a larger sample size to confirm the findings across diverse groups. Additionally, this study focused on the immediate effects of Kahoot!-assisted GBL on student activity, without exploring the long-term impact on learning retention or deeper conceptual understanding. A longitudinal study would be beneficial to assess the sustained effects of this teaching method over time.

Another limitation of this research is the lack of control over external factors that may influence student activity, such as prior knowledge, individual learning styles, and external motivation. These variables could impact the results and should be considered in future studies. The study also did not examine the role of the teacher and how their facilitation of the Kahoot! sessions may have influenced student engagement. Differences in teaching styles and the level of teacher support during the GBL implementation could affect the students' activity levels, and this aspect should be explored in greater detail. Furthermore, the research assumed that all students had equal access to technology and were equally familiar with using Kahoot!, but variations in technological proficiency or access to devices could have influenced the results. This makes it difficult to determine if the success of the intervention was solely due to the Kahoot! platform or other factors.

Given these limitations, future research should consider several areas for further investigation. Longitudinal studies would help assess the long-term impact of GBL with Kahoot! on student engagement, retention, and application of statistical concepts, providing insights into whether the observed increases in activity translate into lasting learning outcomes. Comparative studies could also be conducted to compare Kahoot! with other interactive learning tools and methods, such as traditional lectures, flipped classrooms, or other digital platforms, to identify the most effective approaches for teaching statistics and other subjects. Finally, expanding the research to include GBL with Kahoot! across different educational levels and subject areas could provide a more comprehensive understanding of the benefits and challenges of using this approach in a variety of contexts and disciplines.

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