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Five Important Aspects in Game-Based Learning

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Abstract

Learning participation is an important, especially in learning mathematics. Low learning participation is one of the problems in learning. This becomes the background in the report on the results of this study. There are many alternatives in overcoming low learning participation, one of which is by implementing game-based learning. This article reports on the potential of game-based learning to increase student participation, especially in learning mathematics. The research in this report is part of a qualitative study with data based on literature studies and the results of discussions with other researchers studying game-based learning. The data obtained was elaborated with the results of discussions with other researchers, then the essence of the results of the study was taken. This study reveals that there are at least five aspects that need to be used as a basis for designing game-based learning. The five aspects are 1) Integration of the learning system, 2) retention of learning outcomes, 3) role regulation, 4) motivation and endurance, 5) and focus on concept mastery. These five aspects were obtained based on the results of studies that might still be developed through further research.

Keywords
Learning participation; Game-based learning

Some students feel that learning is a routine that is mandatory. Some argue that following lessons in class feels like only following the existing system. There are also those who perceive that learning is fun. After exploring, in general they agree that learning is not always fun, they tend to want to finish the lesson immediately. This was revealed from the results of a questionnaire presented to students in one of the junior high schools. Between the entry bell and the exit bell, one hundred percent of students like the exit bell rather than the entry bell. This means that there are other activities that are more interesting than attending lessons.

some mathematics learning teachers try to improve students' negative perceptions of their

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learning. Game-Based Learning is one such effort. Some teachers deliberately conduct research by applying game-based learning in overcoming the problem of student enthusiasm for learning. Some of them stated good results, thus gradually changing the learning atmosphere to be more enjoyable (Wati, 2020).

Some researchers who have succeeded in improving learning through the application of game-based learning suggest other teachers to try it. Likewise, some teachers are interested in trying to implement game-based learning in overcoming the problem of weak student learning enthusiasm in class. However, limitations are needed in implementing game-based learning in learning, especially learning mathematics. This article attempts to take an inventory of several points that must be considered in implementing game-based learning in learning mathematics. Thus, the purpose of writing this article is to collect strong ideas in implementing game-based learning in mathematics learning..

Research Methodology

Several research articles and books reporting on game-based learning activities were collected, collaborated with several findings from learning observations and discussions between researchers, used as the basis for this study. The data obtained is elaborated so that it becomes an idea in implementing game-based learning, especially in learning mathematics. This form of research is included in the qualitative type. Some of the data is described to explain the phenomena that are revealed. Descriptive method is a form of the most basic research. Aimed at describing or depicting existing phenomena, both natural phenomena and human engineering, and used to try to solve problems that are being faced in the current situation.

Several tools in the study were also used, in the form of notes on the discussion results of research members and research data analysis forms. The data obtained are discussed together, at one time and in an adjacent place (one room). The discussion involved several external researchers as an effort to maintain the objectivity of the study results.

Research Results and Discussion

Research Results

Game-based learning has been widely used by educational units. The description given by Pellas et al (Rajan, 2022) shows that game-based learning has become a widely used option. These conditions are as presented in Figure 1.

Game-based Learning by Region***	2012 Revenues in $US Millions	2017 Revenues in $US Millions	Five Year CAGR 2012-2017
North America	$359.18	$582.00	*10.1%*
Latin America	$26.94	$71.59	*21.6%*
Western Europe	$96.98	$113.49	*3.2%*
Eastern Europe	$13.65	$29.10	*16.3%*
Asia	$1,029.43	$1,475.01	*7.5%*
The Middle East	$4.31	$9.89	*18.1%*
Africa	$17.96	$28.52	*9.7%*
Total	**$1,548.44**	**$2,309.60**	***8.3%***

Figure 1: Global revenue of Game-based learning

Source: Pellas at al (Rajan, 2022: 8)

The design of game-based learning needs to consider the achievement of student learning outcomes. According to Anastasiadis et al (Rajan, 2022) there are four aspects of the role of games that need to be considered in designing game-based learning, namely affect, motivation, cognition, and social/culture. In full, (Rajan, 2022) describes the important points to consider in designing game-based learning, namely 1) Role of Game Based Learning, 2) Application of Game Based Learning to Enhance Student Learning, and 3) Benefits of Game Based Learning to Enhance Student Learning.

Liu and Chen (2013) developed a game based on the levels of cognition presented by Anderson and Krathwohl. The game in learning fulfills the following levels 1) Remember– Factual knowledge; 2) Remember – Conceptual knowledge; 3) Understand – Conceptual knowledge; 4) Understand – Meta-cognitive knowledge; 5) Apply – Procedural knowledge; 6) Analyze – Procedural knowledge; and 7) Evaluate – Meta-cognitive knowledge. To design stages of mastery of concepts in game-based learning, it is necessary to consider the characteristics of the subject matter. Some of them need to be considered such as the difficulty, complexity, and complexity of the subject matter.

Game-based learning needs to consider convenience for students. This convenience also needs to be considered as a positive or negative impact when participating in the game. Comfort in playing is needed with the aim of achieving an optimal understanding of the concept. Complete definition of enjoyment should further explore how enjoyment influences learning and learning outcomes specifically in serious/educational games. The results can then contribute to the establishment of design principles for the highest enjoyment, learning outcomes and student performance or achievement in serious/educational games (Papadimitriou, 2023: 18).

To provide learning motivation and endurance, game-based learning needs to pay attention to the challenges presented, comfort, joy, or fantasy that are in line with the student's psychological level at that time. Cheng et al (Chen, 2017) stated that there are three points that must exist in game-based learning, namely Challenge, Fantasy, and Fun. Challenge aspects of game-based learning can be viewed from the difficulty aspect of games including goals of gemes, degrees of freedom, rules and the basic restrictions, strategies, time, et al. Fantasy aspects in game-based learning can be seen from imagination, motivation to complete, and attraction of games. For the fun aspect of learning based on games, it can be seen from entertainment and motivation.

Discussion

Game-based mathematics learning has often been applied, various results have been reported by many researchers. The following research results show several main ideas that need to be considered in implementing game-based learning. At least the basic ideas obtained are categorized into several points such as integration into learning systems, retention of learning outcomes, role management, motivation and endurance, and focus on understanding concepts.

Integration of learning systems

Game-based learning needs to integrate all aspects of the learning process in the classroom. This includes starting from planning to the evaluation stage of learning outcomes. Likewise, the achievement of student learning outcomes must be facilitated properly starting from acquiring knowledge, reflecting, understanding, and applying concepts (Adipat et al, 2021). Therefore, learning must be well-planned, well-organized, well-executed, and well-evaluated. In planning, teachers need to prepare learning tools such as learning plan tools including learning outcomes evaluation systems. In the next stage, learning readiness is well organized including sharing roles with other parties if necessary. In implementation, the teacher prepares a self-

observation plan or with the help of others to record events that become important notes. The final stage, the teacher reflects as part of the learning evaluation to improve subsequent learning.

Likewise game-based learning in its application to learning, needs to be managed properly, so that it is integrated in learning. Some ideas that need to be considered in the application of game-based learning to learning mathematics are:

1) Contains all material that must be presented, in stages according to their characteristics.
2) covers the depth and breadth of the material.
3) Integrated with learning outcomes evaluation systems such as Formative, Summative tests, and others.
4) Support the learning administration system that applies to educational units.
5) Having instruments to document learning processes and outcomes.

Retention of learning outcomes

Learning outcomes are the most important elements in learning. Teachers and students need to focus on how deep and how broad the concepts learned are well understood. In addition, retention is also an element of learning outcomes which can be a measure of learning success. The retention in question is the staying power of the concept learned in the student's memory. Good learning certainly helps students understand the concepts being studied so that they can be remembered longer in students' memories. A concept can be remembered longer, of course it needs to be understood properly.

Game-based learning can help retention of student learning outcomes, this is one of the previous research reports which reported that games that are used continuously will help students remember the concepts presented longer. To obtain activities that help retain student learning outcomes, several important things need to be considered, namely 1) Many questions are presented, and 2) Scaffolding (explanation) of material.

1) Many questions are presented.

The more questions students solve, the better the students' memory regarding the concepts being studied. Therefore, the game presented must be able to motivate students to continue to answer as many questions as possible. Several ways can be done such as giving a score for each answer, penalty for answering mistakes, game leveling system, and displaying score rankings, as well as equalizing the results of tests/tests/evaluation of actual learning outcomes.

2) Scaffolding (explanation) of material

Students have various levels of understanding, especially in understanding mathematical concepts, they are not guaranteed to have uniform information. Some students are already proficient in mathematics, but in other conditions there are also those who have limited knowledge, so they need informational assistance in solving math problems. This condition is also often experienced by students in one class. Sometimes, even though they come from the same class, it is possible that their knowledge varies. This condition results in various learning readiness, so that knowledge assistance is needed to help their learning readiness.

Teachers can play a role in providing service facilities in providing information for students, especially when solving mathematical problems. Teacher assistance for students in achieving understanding of the concepts being studied, can be referred to as Scaffolding. This method is an effort to ensure students can learn the concepts being studied properly.

In game-based learning, the role of scaffolding is needed. The knowledge assistance given can be aimed not only to increase students' knowledge, but also to ensure that the game can run as expected. Scaffolding in game-based learning should be presented in a complete form but can only be accessed according to student needs.

Role setting

The teacher's role is very important in learning, apart from being a center of knowledge, it also acts as a manager of the learning process, including a trigger for student learning motivation. The teacher's important role in learning must remain optimal. The task of the teacher as class manager must still be maintained until complete. Likewise, as a center of knowledge, the teacher must remain a reference for students in understanding the concepts they are studying.

In game-based learning, the important role of the teacher must be maintained and running optimally. Increasing student learning participation does not mean decreasing the role of the teacher in the classroom. Therefore, the teacher's role must be maintained in game-based learning.

Other conditions on the role of students, through game-based learning, should improve compared to normal learning. Game-Based Learning as a result of a study to improve mathematics learning facilities, should be able to guarantee the participation of all students in class.

Motivation and Endurance

Intrinsic elements within students become an important part of learning. The expression of work in learning that appears to students reflects the mood they feel. Conditions of reluctance to learn will be a very big obstacle in achieving understanding of the concepts being studied. This condition is seen when students are not enthusiastic about participating, including thinking to understand the concept.

On the contrary, students will be motivated to learn when intentions and encouragement arise from within themselves. Enthusiasm, totality, participation, which is high will be seen from the activities of students in learning. This encouragement may occur because there is attraction, a sense of need, or a sense of comfort in learning activities. In such conditions, the teacher's role will become lighter, planned, and measurable stimulus support will help students to learn with focus. Likewise, the endurance of student learning, in conditions that are comfortable and challenged, will help study longer. Game-based learning is a cyclical, iterative process that includes motivation, action, and feedback (Hartt et al, 2020).

In general, it is agreed that game-based learning motivates students, so they are more enthusiastic about learning activities (Kusuma et al, 2022; Pho & Dinscore, 2015; Plass et al, 2015; Wati et al, 2020). Motivation and endurance are important parts of game-based learning. As the goal of designing game-based learning, convenience, and interest in learning are part of the development focus. Motivation and endurance in learning need to be a measure of success in designing game-based learning. The higher the motivation and endurance of student learning, the better the game-based learning design.

Focus on understanding the concept

The interest of teachers and students in participating in the game should not leave the focus on achieving understanding of the concept being studied. The quantity and quality of understanding the concept being studied must be the main goal. Time-consuming games with low quality attainment of understanding should not be an option. Teachers can look for games that really support the understanding of the concepts being studied or design their own games that are more appropriate.

The further stage, game-based learning has the challenge of being able to uncover students' mistakes in understanding the concepts presented. According to Ambarwati et al (2022: 71) revealed five types of student errors in understanding mathematical concepts, namely 1) mistakes in identifying concepts; 2) mistakes in absorbing information; 3) misuse of principles; 4) settlement procedure errors; and 5) calculation error.

Conclusions and Recommendations

Conclusions

Game-based learning is an option in increasing

student learning participation. To optimize game-based learning, it is necessary to consider the following aspects 1) Integration of the learning system, 2) retention of learning outcomes, 3) role regulation, 4) motivation and endurance, 5) and focus on understanding concepts. These five aspects need to be a reference for review in designing game-based learning.

Recommendations

The results of this study provide the following recommendations:

a) Integration aspects of learning systems, retention of learning outcomes, role settings, motivation and endurance, as well as focus on understanding concepts need to be considered in designing game-based learning.

b) The aspects presented in the results of this study were obtained based on a literature review, therefore, they can still be developed in further research.

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