Game-Based Learning and Student Motivation in Mathematics

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Abstract

The application of game-based learning (GBL) is seen to have many benefits in helping to improve the quality of the teaching and learning process. GBL approach will encourage students to solve problems and self-learning and thus enable students to learn a mathematical concept without realizing it. The review findings show that GBL helps teachers to motivate student engagement in Mathematics. This is because GBL is regarded as a potential means for improving students' confidence and increasing their motivation by incorporating challenge, curiosity and fantasy to a specific problem. The application of GBL has a positive impact on student motivation and involvement in Mathematics learning. Further reading should be made on the motivational impact of student self-efficacy. This is because previous studies have also found that student motivation influences students' self-efficacy in that students who believe in their own abilities are more motivated to engage in learning

Keywords: Game Based-Learning, Mathematics, Motivation, Technology.

Introduction

The teaching style and approach used by teachers should change over time. The application of ICT technology to teaching processes such as game-based learning (GBL) is seen as one of the mediums of learning that can engage students in mastering Mathematics. This approach can also help to build on the concept of learning that is easier to understand (Steinmaurer et al., 2020). This is in line with the 10th KSSR Mathematics' objective which is effectively applying a variety of Mathematical tools including information and communication technology to build understanding of basic Mathematics concepts and skills (KPM, 2017). GBL's effectiveness has been proven by its potential for improving student achievement and confidence, fostering positive creativity and motivation, and increasing student engagement in Mathematics (Hulse et al., 2019; Lo & Hew, 2018; Mera et al., 2019).

However, teachers' teaching methods still retain conventional. This teaching method will only encourage students to passively learn with high levels of dependence on teachers (Blair et al., 2016; Zainuddin & Attaran, 2016; Darwish, Abdo, & AlShuwaiee, 2018). This has led to teacher-centered approach which most of it using chalk and talk. This conventional method is the

equivalent of learning for all students of different strengths, skills, experiences and interests. Such teaching methods also cause the learning process to be linear and tedious without the application of technology. This will cause students to lose focus during the learning process and not master the concepts and skills taught. As a result, students are not able to answer Mathematics questions well and hence lead to the low Mathematics achievement.

Therefore, teachers' teaching methods need to be adapted to the latest technology-based teaching and learning methods that contribute to the greater impact of Mathematics learning (Tokac et al., 2019). This is in line with the development of 21st century education that aims to produce students who are capable of communicating, resilient and informative (KPM, 2017) so that they can compete globally.

Game-Based Learning in Mathematics

In Mathematics learning, the application of GBL is seen to have many benefits in helping to improve the quality of the teaching and learning process. Setting clear learning objectives in line with curriculum requirements with student-centered implementation has made GBL more effective (Farber, 2015; Tan, 2015). The application of GBL to the constructivism approach is able to form the basic mathematical concepts and skills of students. This is because the GBL approach will encourage students to solve problems and self-learning and thus enable students to learn a mathematical concept without realizing it. As a result, students' self-esteem and self-efficacy can be improved and help improve student achievement in Mathematics.

In addition, GBL also promotes high learning by encouraging students to learn a mathematical concept without realizing it (Tokac et al., 2019) and developing good basic Mathematical skills (Okur & Aygenc, 2018) as a result of student learning interactions with GBL approaches. Because of this, GBL will help improve student achievement in Mathematics because while playing students will apply basic math concepts and skills, reading skills, problem solving skills to ensure that assignments are successfully completed.

However, there are some researchers who use gamification compared to the GBL approach. Although both incorporate a culture of innovation in teaching and make it more interactive (Rohaila & Fariza, 2017), gamification focuses more on the application of games that have design elements in non-game contexts (Cunha et al., 2019) where their role is more to support students' learning. The GBL approach is an approach that emphasizes the application of games in helping to achieve learning objectives (Tao et al., 2019). Therefore, the main purpose of gamification is to motivate and stimulate student interest (Kiili et al., 2018) by making rewards as the key medium for encouraging students to play. This is in contrast to GBL's more focused approach to achieving learning objectives rather than in-game rewards. Therefore, the choice of the GBL approach is more appropriate to achieve the objectives of the study.

According to Steinmaurer et al. (2020), the GBL approach is a combination of four aspects namely curriculum knowledge practices, pedagogical knowledge practices, scenario-based knowledge practices and daily knowledge practices. Thus, the GBL approach will enable students to carry out their own learning in a free and safe learning environment. This allows students to learn freely without the fear of making mistakes as the GBL provides instant feedback.

Student Motivation in Mathematics

Motivation is the impulse inherent in one's inner or outer self to do something. Motivation is defined as the cause, intensity, passion or interest that drives a particular behaviour (Maslow, 1987). Motivation can also be understood as an affective and emotional stimulus that motivates one to achieve a set goal (Guthrie & Coddington, 2009). Self-motivation motivates the individual to do something to achieve enjoyment and to overcome challenges rather than external factors such as pressure or reward. This is due to the natural curiosity and desire to learn something new without any rewards. Motivation from within is known as intrinsic motivation that motivates a person to work with pleasure for the pleasure and satisfaction that come from their performance (Deci & Ryan, 1991).

Several previous studies have shown that student achievement is influenced by the level of student motivation (Beserra et al., 2019; Leibham, 2005). This is because motivation plays an important role in student learning and achievement. Uninterrupted learning approaches and pupils' perception of maths are difficult and unpleasant (Dele-Ajayi et al., 2019; Lai & Hwang, 2016) influence student motivation. Low levels of student motivation make students less interested in mathematics learning. Losing interest in Mathematics is a hindrance for students to succeed. This creates a sense of discomfort in the pupil that causes the student to quickly become bored and difficult to understand what the teacher is teaching. This is because low levels of motivation affect pupils' focus on learning and develop a lazy attitude toward students.

Low motivation also causes students to not try to solve math problems given by teachers and not interested in Mathematics. The process of learning Mathematics also only occurs in the classroom because students are not motivated and enjoy doing the mathematics and doing the mathematics exercises at home (Skaalvik et al., 2015). This results in students not mastering Mathematics well and resulting in low Math achievement. Therefore, the level of student motivation in learning needs to be taken into account by teachers. This is because recent studies have shown that low student motivation in learning influences student engagement in learning and affects student achievement in Mathematics.

Therefore, the teaching approach of teachers should be enhanced so as to attract students to learning and thus increase student motivation towards Mathematics. Implementing an engaging and appropriate learning approach with students will create positive student needs and thus enhance student motivation to learn. Therefore, the application of a learning approach such as GBL will encourage students to feel the need to complete the game activities implemented and thus influence their motivation for the goals they want to achieve.

Game-Based Learning and Student Motivation

The review findings show that GBL helps teachers to motivate student engagement in Mathematics. This is because GBL is regarded as a potential means for improving students' confidence and increasing their motivation by incorporating challenge, curiosity and fantasy to a specific problem. Study by Gil-Doménech and Talent-Mirabent (2019) show that GBL as a tool for motivating students. This is because GBL provides interesting activities for students that can build up their intrinsic motivation. Besides, a study by Dele-Ajayi et al, (2019) show that GBL help to stimulate interest and engagement with mathematics among students. The result shows that the using of GBL tools name SpeedyRocket has demonstrated the significant improvements in

attitude and the engagement with mathematics. This is because GBL has a potential to enhance the experience and motivate learners by providing context and live examples of curriculum content in the classroom.

Students' intrinsic motivation is an important factor that influences student learning and achievement. Learning experiences and environment throughout the teaching and learning process can be motivating factors as the stimulus received by the pupils will motivate the pupils to achieve the desired learning objectives. This is because a good and effective teaching and learning process will be a key driver in keeping students engaged in the learning process. This intrinsic motivation will generate students' excitement during the teaching and learning process and influence learning outcomes (Li & Shieh, 2016).

Previous studies have shown that the application of GBL has helped to increase students' instructional motivation in Mathematics learning (Beserra et al., 2019; Kiili et al., 2018; Wang et al., 2018). This is because technology-based GBL approaches make the learning process more interactive and engaging. This is in line with the needs and learning needs of students of this age who are often exposed to sophisticated technology devices in everyday life. According to McClelland et al. (1989) necessity is the process of forming knowledge that students learn through their own experiences. Learning needs that are in line with student needs will encourage student engagement in learning. Therefore, the application of attractive and appropriate learning approaches to pupils will create positive pupils 'needs and thus enhance students' motivation to learn. Therefore, the application of learning approaches such as GBL will encourage students to feel the need to complete the play activities and thus influence their motivation for the goals they want to achieve.

Conclusion

The changes of time have changed the teaching and learning style of Mathematics today. The application of technology in the teaching and learning process is in line with the needs of nowadays' students. The application of GBL with the help of technology has a great impact in helping to improve the quality of teaching and learning of Mathematics. The application of GBL has a positive impact on student motivation and involvement in Mathematics learning. Further reading should be made on the motivational impact of student self-efficacy. This is because previous studies have also found that student motivation influences students' self-efficacy in that students who believe in their own abilities are more motivated to engage in learning (Bandura, 2006). This indicates that low levels of student motivation result in lower student self-efficacy in Mathematics. Therefore, the application of GBL in Mathematics needs to be explored in order to impact the quality of teaching and learning of Mathematics.

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