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Enhancing Student Self Efficacy in Mathematics by Using Game-Based Learning

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Abstract

The application of technology in the teaching and learning process is in line with the needs of today's students. The rapid development of technology has influenced the development of student self-esteem and the implementation of the teaching and learning process of Mathematics. However, the review shows that the current teaching and learning process illustrates that students are burdened with existing learning approaches and feel bored. Therefore, the application of the game-based learning (GBL) approach is appropriate as it can enhance student engagement in Mathematics. High student engagement is driven by students' self-confidence that builds through the learning process. This study aimed at identifying about student self efficacy using GBL. Hence, this article was drawn from previous works of literature to create an overview of the issue pertaining to student self efficacy in Mathematics using GBL. The application of GBL creates positive self-efficacy in students. This is because a well-designed GBL is able to engage students in meaningful learning environment activities. The GBL approach enables pupils to develop self-knowledge where students collaborate during learning in achieving their learning objectives. An interactive and technology-based learning process will make puppies fun while learning and thus develop the motivation and positive self-efficacy of students towards Mathematics.

Keywords: Game Based-Learning, Mathematics, Self Efficacy, Technology.

Introduction

21st century of education has changed the pattern of teaching and learning of Mathematics in schools. Globally, the concept of Mathematics learning has shifted from the common belief that Mathematics is a collection of facts, rules, routines and boring into mastery of metacognitive-related Mathematics like creativity and problem solving (Bray & Tangney, 2017). These changes have led to the setting of the UNESCO Declaration of Incheon which requires teachers to develop effective learning environments to achieve the goals of education 2030 through quality education leading to relevant and effective learning outcomes.

In addition, the rapid development of technology has influenced the development of student self-esteem and the implementation of the teaching and learning process of Mathematics.

Learning of Mathematics now requires the application of technology in the teaching and learning process of Mathematics to create a conducive, fun learning environment, encourage high level learning and support the acquisition of basic digital skills among students from the beginning. However, the literature review shows that the current teaching and learning process illustrates that students are burdened with existing learning approaches and feel bored. In fact, there are also students who find education at school to be irrelevant, stressful and boring (Dele-Ajayi et al. 2019). This problem causes student motivation to learn Mathematics low and causes pupils' self-efficacy to learn Mathematics too. Self-efficacy is an individual's confidence in one's ability to organize and perform the actions necessary to complete a task (Bandura, 1997). Low self-efficacy causes students to be unsure about solving Mathematics problems and thus low mathematical achievement.

Students Self Efficacy in Mathematics

Self-efficacy is an individual's confidence in one's ability to organize and perform the necessary actions to complete a task (Bandura, 1997). Self-efficacy is also a belief system that functions to control one's thinking, feelings, motivation and behaviour (Ghufron et al., 2016). Students with self-efficacy believe that their desired outcome can be realized by taking action. High self-efficacy enhances students' confidence in their ability to perform tasks, solve problems and drive action toward achieving their desired goals and outcomes. Therefore, self-efficacy in Mathematics is defined as the belief or perception of the individual in his ability in Mathematics (Bandura, 1997). In other words, self-efficacy in Mathematics is his confidence in solving various tasks, from understanding the concepts of Math to solving problems in Mathematics.

In the teaching and learning of Mathematics, students 'self-efficacy levels will build confidence in students' solving of Mathematics problems. An engaging and enjoyable learning experience will enhance student self-efficacy. This will influence students' response to learn by demonstrating competence in computing and solving difficult Mathematical problems (Pajares & Kranzler, 1995). On the contrary, persistent failure in Mathematics learning will result in low student self-efficacy in Mathematics. This low self-efficacy causes students to be unprepared for learning, unwilling to engage in learning and unsure of what they are learning. This also leads to a decline in student confidence in learning that affects student self-efficacy and thus negatively affects student achievement in Mathematics.

In addition, the findings of previous studies by Bandura (1986) show that the degree of self-efficacy influences student achievement in Mathematics. This is because self-efficacy determines student engagement in learning. Low self-efficacy will cause students to be unsure of the learning that they are going through and will cause students to become less involved in learning. According to Bandura (1994), student self-efficacy is influenced by the impact of the learning experience in which the success achieved will enhance the student's self-efficacy. A meaningful learning experience will make the student's effectiveness level more realistic. This high level of effectiveness will create awareness among students about the capabilities they have over their peers. Therefore, teachers need to play an important role in implementing teaching and learning approaches that enhance students' self-confidence and effectiveness.

Therefore, the application of the GBL approach is appropriate as it can enhance student engagement in Mathematics learning (Beserra et al. 2019; Kiili et al. 2018). High student

engagement is driven by students' self-confidence that builds on student learning through the learning process (Gil-Doménech & Humble-Mirabent, 2019). This is because the application of an attractive and interactive GBL approach will interest students and make them more focused on learning. The students' level of confidence and interest in learning will impact student self-efficacy as students become more confident and bold in their learning.

Game-Based Learning in Mathematics

Mathematics learning occurs when students are able to form their own mathematical concepts that are constructivism. This is the result of creative activities such as a game-based learning approach implemented. The results of the study by Nurfazliah, Jamalludin, and Shaharuddin (2013) found that GBL has successfully increased student motivation and creativity in solving non-routine problem solving questions in Mathematics. This critical and creative thinking is shaped by the application of the GBL (Tokac et al. 2019). This is because it encourages students in problem solving and self-learning. As a result, students' self-esteem and self-efficacy can be improved and help improve student achievement in Mathematics.

Moreover, the findings of a previous study by Brezovszky et al. (2019) shows that the GBL approach has successfully increased the grade of Mathematics achievement among pupils. According to Brezovszky et al. (2019) one of the game that apply GBL is Number Navigation Game (NNG) and it demonstrates the enhancement of students' arithmetic skills and knowledge while providing teachers with flexible and practical teaching tools over time. This proves that the application of GBL in teaching and learning Mathematics helps to improve the teaching quality of teachers and thus impact student achievement.

In addition, the GBL approach is a combination of four aspects namely curriculum knowledge practices, pedagogical knowledge practices, scenario-based knowledge practices and daily knowledge practices (Steinmauer et al., 2020). The application of GBL in teaching and learning Mathematics 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 (Steinmauer et al. 2020). This will create a high degree of confidence in the students to strive for success in learning.

Student Self Efficacy and Game-Based Learning

The application of technology in the teaching and learning process is in line with the needs of today's 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 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. Therefore, the application of GBL creates positive self-efficacy in students. This is because a well-designed GBL is able to engage students in meaningful learning environment activities. The GBL approach enables pupils to develop self-knowledge (Giannakas et al. 2018) where students collaborate during learning (Asselstine et al. 2015) in achieving their learning objectives. An interactive and technology-based learning process will make puppies fun while learning and thus develop the motivation and positive self-efficacy of students towards Mathematics. This is

because past studies have found that student motivation influences students' self-efficacy in that students who believe in their own abilities are more motivated to engage in learning.

A recent study carried out by Hulse et al. (2019) show that the application of GBL has successfully improved the algebra achievement among students. From the analysis that has been done, it is shown that the application of GBL creates a significant relationship between new knowledge and existing knowledge of students. This allows students to apply all available knowledge at the same time to solve any given problem. This will encourage student engagement in learning and thus improve their Mathematics achievement (Denham 2019). Optimal student engagement in learning reflects high student self-efficacy in achieving learning goals or objectives. This is due to the potential in the GBL that responds quickly to student learning and makes students not afraid to make mistakes.

Conclusion

The application of technology and teaching and learning processes such as GBL can give students a whole new sense of learning. This technology-based learning environment will help increase student interest in Mathematics while helping to improve student achievement in Mathematics. Students' interest in higher learning will help influence student motivation and self-efficacy in more positive Mathematics learning. This new learning environment will also provide students with a fresh learning experience compared to chalk and talk. Therefore, the application of GBL in teaching and learning Mathematics should be applied to help improve the quality of teaching and thus improve student learning performance.

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