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A Systematic Review on the Correlation between using Video Games as Instructional Strategies and Academic Success among Learners in Secondary Schools in Kenya

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[1] *Jean Nyawira Murigu*

[1]Universityof Nairobi

ABSTRACT

Developing countries, including Kenya, are still making inroads in adopting technology in learning. Mainly, the Covid-19 pandemic led to the proliferation of technology integration in learning to salvage learning time at basic education levels. The increasing use of technology in education has enabled the adoption of multi-disciplinary approaches in instructional designs. In Kenya, educators are embracing innovative ideas, including using video games as instructional strategies in learning.

This study investigates the efficiency of digital video games-based learning in promoting self-efficacy to improve academic achievement among learners at basic education levels. The systematic review gathered data from a credible Google Scholar online database and selected credible and reliable articles, especially peer-reviewed sources from high levels of evidence.

The study's findings indicated a direct correlation between utilizing video games as instructional design and increased self-efficacy among learners.

Thus, the study findings will prove valuable to education stakeholders in Kenya, especially the KICD, in identifying instructional designs that can promote academic achievement in Kenya.

Key Words: *Video Games, Instructional Strategies, Self-efficacy, Secondary Schools, instructional design*

INTRODUCTION

Accessibility to technology has revolutionized instructional designs. Tacoma et al. assert that technology has made learning fun, efficient, and engaging for teachers and learners (2018). The use of digital game-based learning has become the primary teaching method, especially in those classrooms that have access to technology. Tacoma et al. add that using digital games in learning has changed the teachers' role from an instructor who manages the learning process to a multifaceted role as an instructor, playmaker, guide, and explorer (2018).

Science, technology, and mathematics (STEM) subjects are challenging to most students and require an interesting instructional approach to keep the students engaged. Coertjens et al. explains that using digital games in learning keeps students engaged with educational content, and improving their overall skills and knowledge (2016). The idea of digital game-based learning uses similar gaming concepts in the classroom, blurring the gap between in-class lessons and educational gameplay (Schiepe-Tiska, 2019).

However, digital game-based learning (DGBL) is a new concept, especially in Kenya's curriculum, calling for increased research on the effectiveness of video games in promoting academic success.

The purpose of this literature review is to analyze available research on the impact of digital game-based learning on academic achievements among learners at the secondary school level. The findings of this systematic review can help curriculum developers to consider using digital game-based learning as instructional strategies to promote academic achievement among learners at the secondary school level.

The research will demonstrate that the digital games-based learning instructional method can motivate learners and increase self-efficacy, thus, increasing their academic achievement. In this regard, the research question for the systematic review is:

1. What effect does the use of video game-based learning have on self-efficacy among students?

METHODOLOGY

This systematic review was performed per Preferred Reporting Items for Systematic Review and MetaAnalysis (PRISMA). The study included full-text articles published in the last ten years, including systematic reviews, cross-sectional, and observational studies. The study excluded articles from lower levels of evidence, including case studies, commentaries and studies with abstracts only and articles published before 2010. The systematic review obtained the sources from the Google Scholar database. Search Strategy. The following search terms were used *Video Games, Instructional Strategies, Self-efficacy, Secondary Schools, instructional design.*

After applying the inclusion and exclusion criteria to 15 articles, seven articles were excluded: due to irrelevance and one due to low evidence (conference proceedings, case studies and commentaries). As such, the researcher retrieved n=5 full-text articles for the systematic review.

Digital game-centred learning sources were identified and located from Google Scholar. During the search in Google Scholar, the study focused on major keywords such as game-based learning and digital game-based learning. After identifying and locating the appropriate sources, the researcher identified the articles that focused on digital-game-based learning at the basic level of education, especially in secondary schools. During source location and identification, the most recent journals and articles were prioritized, which ranged from 2011 -2022.

To ensure that the sources met the scope of the systematic review, the keywords: guided the identification of reliable and relevant articles. Identifying relevance involved reading and analyzing the article abstracts focusing on the impacts of digital game-based learning on learners. The review applied a tabular format to help record the analyzed articles and the collected information for easier processing of thematic issues. An illustration of a table of six columns identifying the (publication date, name of author and article title), number of participants, type of measure, level of education, the form of assignment and the result guided tabulation.

Finally, to determine the necessary articles for the literature review, the study focused on specific criteria, which included peer review, the relevance of the study topic, year of publication, high school level and quantitative or qualitative study.

RESULTS

Three articles identified learner achievements through assessments (Liu et al., 2011; McCarthy, Tiu, & Li, 2018; Ter Vrugte et al., 2015), which were formulated to illustrate the degree to which the learners captured the skills concerning the focus area in every study. Liu et al. (2011) administered a science knowledge 20-question test to identify learner achievement.

The test questions were selected from researchers who tested the learning performance and student knowledge after briefly introducing science lessons through the digital game idea mechanism. The study identified that the strategy increased scientific knowledge among students. McCarthy et al. (2018) encouraged students to participate in the Test of early mathematics Ability to measure learner ability and achievement. The test was introduced by Western Psychological Services and measured the formal and informal knowledge of mathematics (Bower, 2017).

Besides, McCarthy et al. (2018) engaged the Mathematics Assessment Resources, founded by the Melinda and Bill Gates Foundation, which measure the performance of different tasks. In the study, the scholars introduced the Mathematics Vocabulary Assessment and administered a post and pre-assessment addressing mathematical knowledge and skills. Ter Vrugte et al. (2015) identified learner achievement by engaging students in completing an arithmetic test introduced by De Vos in 1992, commonly known as Tempo Test Rekenen, which establishes computational fluency among students in an arithmetic computation (subtraction, addition, division and multiplication).

In addition, scholars introduced a test to examine proportionate reasoning among students. Usually, the test comprises 16 items, with 12 items presented similarly to the digital game-based learning technique. The other four items were developed to assess if student learning from a similar game could be proportionately transferred to the game presentations.

Scholars identified those learners' ability and prior knowledge before introducing the digital game-based learning encounter affected if competition with collaboration boosted motivation.

Among the studies, two meta-analyses were identified to assess the impact of digital game-based simulation on learner performance and achievement. In the meta-analysis, Byun and Joung (2018) explained and evaluated the impact of digital game-based learning on learner success. The study's literature review focused on the article title, publication year, academic journal field of concern, author expertise, research methodology, grade degree of participants, country of publishing, and the mathematical informing content. Byun and Joung (2018) introduced the journal selection criteria considering the literature review codes applicable in other Meta studies confirmed. They estimated the impact through a calculated size identified using the size selection procedure for meta-analysis. The calculation established a high impact of digital game-based learning on learner performance and achievement in arithmetic and mathematics among secondary and middle-high school students.

Also, a meta-analysis study by Chen, Tseng, and Hsaio (2018) focused on the effectiveness and efficiency of digital game-based learning in language and vocabulary. Applying comprehensive Meta-Analysis Version 3 to examine data from articles was effective (Hanghøj, Lieberoth & Misfeldt, 2018).

The strategy provided calculated estimates which offered effective results on the usefulness of digital game-based learning in English and vocabulary. They indicated a rise in literature and vocabulary acquisition among the students, which was a recommendable impact.

DISCUSSION

Based on the findings, Digital Game-Based Learning is an effective teaching strategy that improves student educational achievement. The studies by Liu et al. (2011), McCarthy, Tiu, & Li (2018) and Ter Vrugte et al. (2015) conclude that DGBL promotes engagement during the learning process keeping students interested in and outside the classroom. The study's results by Liu et al. (2011) demonstrated that students using the PBL program significantly increased science knowledge. There was a significant correlation between their motivation scores and their science knowledge post-test scores. These findings concur with a study by Ryan and Deci (2020), who argue that competent, relatable, and autonomous video games motivate students. Intrinsic motivation in DGBL entails enhancing the students' behavioural momentum to continue learning the subject after devoting time and effort (Ryan & Deci, 2020). For instance, a student who learns physics by playing digital games will have the motivation to continue learning about the subject after finishing the game.

According to Ryan and Deci, students are motivated extrinsically through fear and coercion or intrinsically through engagement, excitement, and confidence (2020). It implies that the Instructional use of digital games provides intrinsic motivation through competence, relatedness, and autonomy, factors that improve students' ability to gain knowledge and skills.

Also, the results of the study by McCarthy et al. (2018) demonstrated that using transmedia among first-grade learners increased their cognitive engagement and motivation towards learning new concepts. These conclusions align with a study by Harvey (2018), which asserts that DGBL increases students' academic achievement through increased motivation inside and outside to complete school work.

Interestingly, teaching mathematics using DGBL increased class time spent on tasks from 72 to 93% since students are highly motivated, and teachers receive feedback from software on the effectiveness of their teaching (Mosley, 2021). In arithmetic-based subjects like mathematics, physics, and chemistry, students develop anxiety and frustration if they fall behind or fail to understand concepts.

Also, a study by Murphy argues that cumulative-based DGBL increases students' knowledge and understanding due to its effectiveness in teaching and active engagement (2017). Still, a study by Stiller and Schworm concurs that DGBL increases the capacity of students' working memory (2019). Learning through digital games stimulates the brain to engage cognitively and effectively by increasing the focus and engagement of students.

When students actively engage in digital game-based learning, there is a profound change in attitude. Ter Vrugte et al. (2015) found that the introduction of video games in learning positively impacted the student's proportional reasoning skills. Similarly, Nino explains that learning using DGBL stimulates the brain through cognitive, affective, behavioural, and socio-cultural engagement (2019). In previous research by Kalyani et al., students learning math through a digital game reported a positive attitude towards the subject (2019). Also, the research concluded that students preferred learning math through the digital game with the teacher giving live instruction.

Accordingly, the students highlighted the significant role of their mathematics teacher, who had extensive knowledge of the digital game's technology, content, and pedagogy.

Therefore, the use of DGBL in learning directly increases student motivation and engagement.

CONCLUSION

The developing world, including Kenya, needs to adopt Digital game-based learning as an integral component of instructional design. In this age of future technology, DGBL is an effective and innovative alternative teaching method to improve secondary school student's academic achievement. Besides, DGBL is practical, sustainable, and cost-efficient, especially when systematically embedded with other teaching methods, which can encourage self-learning. Finally, DGBL allows the student to experience a sense of choice and control while playing the game.

DGBL promotes blissful productivity since students find meaning in rewarding activities. It implies that students learning through digital games will work harder than in real life to achieve blissful productivity. While digital game-based learning should not replace the formal educational system because it involves social and psycho-social education, their adoption as a learning strategy will help meet the current need for education in Africa: promote the utilization of interactive computer technology as a teaching strategy to improve the accessibility of education.

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