PLAYING TO LEARN: THE PROMISE OF DIGITAL GAMES FOR IMPROVING HIGH SCHOOL MATH PERFORMANCE

by:
Abegail M. Sabado
Teacher I, Balsik National High School

Mathematics education in the Philippines continues to face persistent challenges, as evidenced by the country's performance in the 2022 Programme for International Student Assessment (PISA). Filipino students ranked 75th out of 81 countries in mathematics, with only 16% of 15-year-old students reaching the minimum proficiency level (OECD, 2023). This figure remains far below the OECD average of 69%. The minimal gains in mathematics and reading, coupled with a slight decline in science scores compared to 2018, indicate a lack of substantial progress (Acido & Caballes, 2024). Moreover, a strong positive correlation was found between the Human Development Index (HDI) and PISA scores, suggesting that mathematics achievement is a crucial driver of long-term national development.

In response to these persistent performance gaps, digital game-based learning (DGBL) has emerged as a potentially effective strategy for improving mathematics instruction in both public and private Philippine secondary schools. DGBL involves the use of interactive digital games to deliver curriculum-aligned content, engage learners, and promote problem-solving and critical thinking skills. The approach is grounded in constructivist learning theory and motivational psychology, both of which emphasize learner engagement, autonomy, and feedback as critical components of knowledge acquisition (Wang et al., 2022). In mathematics education, DGBL is particularly well-suited to demystify abstract concepts and reduce the math anxiety commonly observed among Filipino students (Bernardo et al., 2022).

Global studies have established the positive impact of DGBL on student outcomes. A meta-analysis by Wang et al. (2022) found that students receiving digital game-based instruction in STEM subjects demonstrated significantly higher learning achievement than those under traditional instruction. Similarly, a systematic review by Hui and Mahmud (2023) showed consistent improvements in both cognitive performance and affective engagement across multiple studies involving digital math games. These findings suggest that DGBL offers both academic and motivational benefits.

Evidence from the Philippines further supports these global findings. In North Cotabato, Cayang and Ursabia (2024) implemented a DGBL intervention among Grade 4 students, reporting statistically significant improvements in post-test performance for the experimental group. Morata (2024) employed the digital platform Quizizz in a Grade 8 classroom and recorded a nearly 50% increase in test scores. Learners responded positively to the immediate feedback and game mechanics, which encouraged repeated practice. Paglomutan (2024) integrated a mix of physical and digital math games with Grade 10 students and found gains not only in test scores but also in long-term retention of concepts. These studies demonstrate that when well-integrated, game-based learning can enhance both performance and motivation in a range of learning contexts within the Philippines.

The 2022 PISA data stresses the urgency of exploring alternative pedagogical approaches. According to OECD (2023), 81% of Filipino students scored below Level 2 in mathematics, the benchmark for functional quantitative literacy. The Department of Education (DepEd) continues to face structural challenges in improving teaching quality, especially in underserved areas where access to digital tools is limited. A 2022 report revealed that 43% of Philippine schools lacked sufficient qualified math teachers (OECD, 2023). While DGBL aligns with OECD's recommended shift toward learner-centered and technology-integrated instruction, disparities in infrastructure and training remain key obstacles to national implementation.

Despite its benefits, DGBL is not without challenges. Teachers often report difficulties integrating digital tools into time-constrained curricula, especially when they lack adequate training or technological support (Jukic Matic et al., 2023). In some cases, games may fail to align with learning objectives or focus excessively on entertainment, limiting their educational value. Leaderboards and competition mechanics may also demotivate some learners, especially those with low prior achievement (Boghian & Popescu, 2019). To maximize effectiveness, games must be carefully selected, aligned with national standards, and accompanied by appropriate instructional guidance.

Implementation prospects also differ between public and private schools. Private institutions often have better access to devices, internet connectivity, and teacher training, making them more agile in adopting DGBL. In contrast, public schools—especially in rural or economically disadvantaged areas—require investments in infrastructure, offline-capable software, and scalable teacher training programs. Pilot initiatives, cross-sector partnerships, and integration of DGBL into the national curriculum framework can help ensure equitable adoption.

Digital game-based learning offers promising opportunities to enhance mathematics performance in Philippine secondary education. The approach has demonstrated positive impacts on student achievement and engagement in both international and local studies. While infrastructure and teacher readiness remain ongoing challenges, these can be systematically mitigated through national policies, capacity-building programs, and localized game development. DGBL should be seen as a supplementary instructional strategy—one that complements traditional methods and contributes to a broader pedagogical transformation aligned with twenty-first-century learning goals.

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