DIGITAL LEARNING FOR DEVELOPMENT


# Responses from the Global South

# DIGITAL GAME-BASED LEARNING: A SOUTH ASIAN PERSPECTIVE

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## 1. Introduction

This paper is a response to Chris Dede's paper, "The potential of digital game-based learning for improving education in the global south," where he compared digital game-based learning (DGBL) in the Global North and in the Global South. He also offered some insights on what can be done in the Global South to provide education quality, equity, and efficiency through this medium of learning. The Global South has a long history of colonialism and neo-imperialism, with social inequalities due to differential economies. Therefore, it is nearly impossible to replicate the DGBL model of the Global North in the Global South without making some adjustments according to the needs of the education system, availability of resources including hardware and digital content, teacher readiness to adopt new approaches to teaching, and evidence-based advocacy to reform educational policies. This response will focus on a South Asian perspective, highlighting key opportunities and existing examples of DGBL in the region, discussing driving factors and foreseeable barriers, and the role of multiple stakeholders in implementing DGBL in South Asia.

## 2. Understanding the Educational Context in South Asia

An analysis by the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2015a) of education reforms in South Asia indicated an association between education quality and enabling factors such as curriculum and assessments, quality assurance, professional development of teachers, education policy, and the language of instruction. The key challenges still applicable today in attaining quality education in the South Asian region are the requirement of revised curricula to integrate 21st century skills, lack of differentiated learning and teaching resources, teachers' capacity to meet the needs of 21st century learners, and predominantly examination-driven educational practices. Behind these challenges are the complex political, social, religious, and cultural influences that have fostered the unbalanced development of economies, thus leading to educational gaps between the developed and undeveloped areas in the region. A shortage of quality teachers, limited access to educational resources, and policy limitations on the right to education further worsen the divide between the privileged and underprivileged, because of which

an estimated 11.3 million primary and 20.6 million lower secondary children are out of school in South Asia (UNESCO, 2017). While these challenges offer opportunities for emerging learning technologies such as DGBL to enhance educational quality, equity, and efficiency, they need to be examined in the South Asian context.

This author agrees with the perspective of Dede (2018) that, for all countries, including those in Global South, "the 'flat' world places new demands on schooling to prepare today's students with knowledge and skills previous generations did not need. This challenge has profound implications for teachers and the work of teaching, both in terms of what it means to teach and how one teaches" (p. 3). He acknowledged that all the literature and best practices in DGBL mostly originated in the Global North, but could be replicated in the Global South with some adjustments to meet the success criteria. However, before one considers modifying the Global North model of DGBL, understanding the problems of the current education system in the Global South is imperative.

The extremely low literacy rates and high numbers of out-of-school children in South Asia (UNESCO, 2017) are a cause for increasing concern that something is tremendously wrong with the region's education system. The purpose of education is to prepare children for the real world, which is changing very fast, but South Asia's schools have not changed for hundreds of years. The education system was designed for the industrial age mainly to produce factory workers, and it reflects this industrial age mentality of mass production and control (Letchamanan & Dhar, 2017). Today countries in the Global South seek to understand the digital economy and how the workforce could take advantage of the emerging opportunities. However, they are undermined by the problems of an outdated, industrial-age, education system.

The following section highlights the major problems of the current education system in the South Asian region derived from studies led by Letchamanan and Dhar (2017), Siddiqui (2012), and Dundar, Beteille, Riboud, and Deolalikar (2014).

## 2.1. Problems of the Education System in South Asia

2.1.1. Industrial age values. The first and foremost problem is the industrial age values. The current education system educates children by batches and governs their lives by ringing bells. All day long, students do nothing but follow instructions and do exactly as they are told. Such values might be important for factory workers where success would depend upon following instructions. However, this is not true in the modern world. The modern world demands people who can be creative, identify and locate information, then transform that information into new knowledge to develop innovative ideas; who can communicate their ideas and collaborate effectively in various forms; who possess problem solving skills and are able to identify problems and develop novel solutions, and; who are lifelong learners with a capacity to continuously self-improve (Darling-Hammond, 2009). But unfortunately, children in this region never get this opportunity to develop such skills in a system that is based on industrial age values.

2.1.2. Lack of autonomy and control. In most schools in the region, children experience complete lack of autonomy and control. The system controls every minute of a child's life. Children are not allowed to manage their own time effectively; rather, they are expected to follow the rigid system, which, in turn, sends a message to children that they are not in charge of their lives and are incapable of managing their time effectively. They just have to follow whatever is planned for them instead of

taking charge and making the most of their time. Experts believe autonomy is incredibly important for children. Lack of autonomy imparts in students a feeling of boredom and demotivation, which sometimes results in their dropping out of school.

2.1.3. Inauthentic learning. Most of the learning happening in schools is deemed inauthentic since it relies heavily on memorization and rote learning. The system defines a generic set of knowledge that all children must know. Then, every few months, how much has been retained is measured by administering exams. The learning is inauthentic because most of it is forgotten the day after the exam. Learning in today's world can be deeper and more authentic; it can be much more than memorization and retention. Nonetheless, the only thing the education system values is the test scores, which has subsequently created an unhealthy culture for students, parents, and teachers. Children are bound to go through endless hours of extra tuition, staying up all night memorizing random facts that are often forgotten soon after the exams.

2.1.4. Lack of passion and interest. The education system in South Asia is extremely standardized, with little to no differentiation, where each child must learn the same thing at the same time, in the same way, as everyone else. This contradicts the basic fact of being human, that each person is unique and different. Every human being has certain interests and passions, and the key to fulfillment in life is to find passion. Vallerand (2015) theorized that "harmonious" passion, as opposed to "obsessive" passion, leads to adaptive behavior in children, enabling them to acquire life skills to get along in their environment with greater success and the least conflict with others. The education system in the South Asian region limits the creativity of young children and does not develop their passion to lead a successful life. Also, there are no means to measure the talent and potential that goes unrecognized in the current system.

2.1.5. Differentiation in learning. Research in educational psychology has established that every learner is different and may have a unique learning style. Some children learn fast, while some take their time to assimilate information. However, the current system does not appreciate such differences, but requires each student to follow the same instruction at the same pace. If the students are a bit slow in learning, they will be deemed failures, when all they need is a little more time to catch up.

2.1.6. Lecturing as the method of instruction. In the current education system, the most commonly adopted method of instruction is lecturing. Students are expected to sit quietly, listening to the teacher without much interaction for at least five hours a day. But any given classroom has students at different levels of understanding. Whatever the teacher does, there will certainly be students who are either bored because they are ahead or confused as they are behind in understanding the concepts being taught. Because of the Internet and other digital media, children have at their fingertips all the information in the world. Technology has made it possible for anyone to learn anything. However, for fear of losing control, the system is not leveraging these incredible resources.

To conclude, in today's knowledge-based economy, the education system of South Asia is an industrial age remnant that has become obsolete. Hence, to turn children of the Global South into autonomous learners and prepare them to contribute in the modern "flat" world, the education system needs a fundamental revamp by making learning more effective, engaging, and fit for purpose.

## 2.2. Limitations of Education Policy on the Inclusion of Learning Technologies

A staggering number of children in South Asia are out of school despite efforts to provide universal primary education. The overall situation of school exclusion is significantly grimmer in Pakistan than in other South Asian countries (United Nations Children's Fund [UNICEF], 2014), with 34.4% out-of-school children at the primary level and 30.7% of children out of school at the secondary level. Bangladesh has 16.2% out-of-school children at the primary level and 30.7% at the secondary level, followed by India with an estimated 6.4% and 5.7% at the primary and secondary levels, respectively (UNICEF, 2014). Data from Sri Lanka, excluding five conflict-affected districts in the north, show 1.9% primary- and 3.2% secondary-level children out of school (UNICEF, 2014). Research on digital learning technologies has proven them to have a positive impact on the quality, equity, and efficiency of education in the Global North; therefore, they may be considered a solution to improve the education crisis in Global South countries (Evans & Popova, 2016).

Considering the severity of the condition, this section focuses more on a situation analysis of Pakistan while giving a brief overview of the education policies of the remaining South Asian countries.

2.2.1. Situation analysis of Pakistan. Organized efforts to use information and communications technology (ICT) in the teaching-learning process first appeared in the National Education Policy 1998-2010 (Ministry of Education [MoE], 2009), which focused on enabling a child to learn and think with ICT and learn about ICT, and preparing teachers to adopt ICT-intensive pedagogies. However, these policy options could not be realized due to lack of commitment and hence, funds. In 2003, Microsoft Corporation extended its global program to Pakistan by signing a memorandum of understanding with the Federal Ministry of Education with an aim of preparing children for the digital world by equipping them with employable IT skills and setting up a chain of computer labs and teacher-training institutes across the country. Most of the efforts zeroed in on supplying computer labs in schools, conducting courses, and training in basic IT skills, which were less meaningful in the context of teaching and learning in the short and long term. National Education Policy 2009 placed no emphasis on devising an implementation plan, hence the system was once again deprived of the opportunity for digital learning to flourish. The draft National Education Policy 2017 (MoE, 2017) stresses reviving the endeavors to implement the ICT policy by providing low-cost laptops specifically designed for learning at the elementary level and preparing teachers for their new role of teaching with ICT. The policy paper suggested that the government collaborate with big IT giants such as Microsoft, Oracle, and Cisco in developing certifications to train students in line with market needs. Such training may be appropriate for secondary school and tertiary-level students, but primary school students would continue to experience the same industrial age regime of learning through following instructions and rote memorization. An outside-the-box approach is required to engage students in interactive learning at primary levels where they can learn through experiments and problem-solving approaches, and gain new knowledge through collaboration and sharing ideas. Moreover, the flexible learning strategies for out-of-school children included in the education policy require some serious thought. The current policy seems to repeat the same mistakes by trying to revive the plans presented in previous education policies, which could not materialize earlier because of the lack of government commitment, poor organization and coordination, and a gap in technical expertise in designing specialized programs to raise the literacy rate of the out-of-school masses. Therefore, an innovative approach and awareness are required in planning to use

digital technologies to provide quality education and access to out-of-school children.

2.2.2. Situation analysis in other South Asian countries. The educational policies of Bangladesh, India, and Sri Lanka have included more robust plans compared with Pakistan with regard to ICT integration in teaching and learning. Besides providing qualified ICT-trained teachers in schools, the governments in these countries have been successful, to some extent, in giving all schools ICT access by installing computers, connecting them to the Internet, and delivering appropriate multimedia educational content for every primary, secondary, and higher secondary school. In Bangladesh, the government also provides solar energy panels as a non-disruptive and cost-effective energy solution where necessary. Similarly, in Sri Lanka, teachers are mostly qualified and possess basic IT skills. The literacy rate in Sri Lanka is 92% (Ministry of Education Sri Lanka, 2016), higher than that of other developing countries in the region. However, these statistics hide the unequal distribution of teaching resources and unqualified teachers in rural areas—critical problems jeopardizing the education quality in nearly all South Asian countries. The high teacher-to-student ratio in rural areas and suburbs of major cities, as well as the didactic teacher-centered approach to teaching, present a major threat to the quality of education, especially in today's knowledge-based economy.

In light of the challenges of education and the opportunities it presents in the Global South, Section 3 below discusses the significance of DGBL in improving the quality, equity, and efficiency of education in South Asia.

## 3. Relevance of DGBL in Enhancing Education Quality, Equity, and Efficiency in South Asia

Dede (2018) pointed out that the effectiveness of a learning medium largely depends upon its adept or inept adoption by teachers as a pedagogical tool. Technology could not simply infuse children with knowledge unless it is proficiently and purposefully used to impart learning. The same may be true for digital game-based learning, which has the potential to bring quality in education if, first, it is integrated expertly and, second, spread over an appropriate duration. Although DGBL is an emerging field, early interventions in the Global South have established the possibility of fostering positive behavior, including increased motivation and engagement, and achievement and access to education for students belonging to varying socio-economic backgrounds, genders, and cognitive levels, either enrolled in schools or out of school (Ahmad & Khan, in press; Ahmad & Maqsood, 2015; Kam, Kumar, Jain, Mathur, & Canny, 2009; Kampuchean Action for Primary Education, 2017; Khan, Ahmad, & Malik, 2017; Kim et al., 2012; Halloluwa, Usoof, & Hewagamage, 2014).

Most DGBL interventions in the Global South have explored the use of mobile technologies such as low-cost tablets and smartphones in the classroom, which makes it a cost-effective solution to funds-constrained economies, generally with a limitation of using 2D games. These studies highlighted some useful results relating to accessibility equity, quality, and efficiency which could be considered in the future planning of projects for marginalized children of developing regions.

First, the results of nearly all the studies resoundingly demonstrated that children with little or no experience in handling technology were able to efficiently use handheld devices such as tablets or mobiles, and solved a series of incrementally challenging problems by playing games, initially with little guidance and later, on their own, without specific instruction from adults.

Second, children who lived in areas with ubiquitous technologies around (e.g., near major cities) were much better at handling devices and solving problems in a shorter span of time than those who were not familiar with technology at all.

Third, children with little work experience selling in local markets or begging on streets were quicker at doing calculations and solving complex problems, which suggests that factors such as technology exposure and prior knowledge seem to have a positive influence on performance. In short, the significant main effect of DGBL is that all children can learn with handheld devices, but at different rates, which endorses DGBL as an equitable and accessible medium to provide quality education.

Now, considering the definition of education quality as "the extent to which educational systems and institutions provide learning experience and gains" (Gasevic, 2018, p. 4) specific to the needs of learners in particular situations (Ossiannilsson, Williams, Camilleri, & Brown, 2015), it is important to understand the needs in a localized context and the criteria for achieving quality in developing regions. Countries in the Global South rely heavily on an assessment-based education system. The focus of teaching in schools is to prepare students for exams and progression to the next level. Simply infusing learning technologies will not bring about quality in education. Hence, the need is to either develop digital games to practice the educational content or to transform the assessment system from exam-oriented to skills-oriented, evaluating 21st century skills gained by students. Information is at the fingertips of students; the real skill is to convert it into new knowledge, enabling them to collaborate and share ideas with the rest of the world. In the current exam-oriented system, the focus of digital games in South Asia is mainly enabling students to learn and practice the educational content, while motivating and engaging them enough to attend school regularly and, ultimately, to pass the exams.

The educational crisis in South Asian countries has promoted privatization in the region. In Pakistan, around one-third of the education system is served by low-cost private schools. There are around 90,000 such schools, growing at a rate of 5.5% annually and run by roughly 60,000 edupreneurs who have almost no knowledge or background in education (Nguyen & Raju, 2014). The quality of these schools is questionable, but this market is growing fast because the perceived quality is still better than public schools, and second, financial support is easily available through banks for such startups, further encouraging people in this business. The criterion for hiring teachers in such schools is not a teaching qualification but just a basic undergraduate degree to serve at primary level. Hence, lack of trained teachers is seen as another major roadblock to providing quality education in this region. Considering the benefits of DGBL, teacher-proof games designed with a sound pedagogy could address the issue of unskilled teachers in the schools, which means that all students can experience the same quality of instruction and interactions with the content through the digital games.

Dede (2018) is correct in his view that an embedded framework of instruction and motivation constitutes an effective game. If the instructional design of the game is not challenging enough, it might disengage students from using games as an automated tool for "teaching-by-telling" and "learning-by-listening" (Clark, 1994). Therefore, in addition to the motivational framework, Dede (2018) pointed out the key design lenses of learning to evaluate the quality of DGBL. Assuming that South Asia has access to resources and infrastructure to implement DGBL in its schools, next is to discuss the effectiveness of this medium of learning in this region. The following section will describe a few examples of DGBL in the region.

## 4. Design and Implementation of Existing DGBL: Examples in South Asia

This section gives an overview of digital games that have been used in some studies across South Asia, specifically in Pakistan, as the country with least resources in this region. These examples will be assessed against the four key design lenses for learning—learner-centered, knowledge-centered, community-centered, and assessment-centered (Donovan & Bransford, 2005)—and behavior (motivation and engagement), as discussed by Dede (2018), to promote deep learning through digital games to bring educational quality, equity, and efficiency.

Most of the research studies used mobile games among primary school children in this region. Some evidence is also found on their use among secondary school students; however, no studies have been found on the use of mobile educational games in higher education. The following paragraphs describe some of the DGBL examples used in various research settings in urban or suburban areas of Pakistan.

### 4.1. MeasureLand

An example of a quick, simple, teacher-proof, non-immersive mobile game designed for mathematics learning is *MeasureLand,* developed for primary school pupils with a concept of self-paced fast-track learning in and out of school using low-cost tablets. The game is a combination of knowledge-centered, learner-centered, and, to some extent assessment-centered approaches to learning. The community-centered approach is to be integrated by teachers in the form of discussions and collaborative problem-solving tasks.

The game was deployed in a study (Ahmad & Khan, in press) to investigate the impact of DGBL on achievement, motivation, and engagement of marginalized out-of-school children in an urban setting. Through guided narration and bilingual game instructions, the concepts of measurement—a topic selected from the National Curriculum—were explained to the students, who were then involved in a series of interactive activities to master the content. The game comprised four levels, where the first level aimed at achieving grade 1 learning outcomes, the second level targeted grade 2 learning outcomes on the same topic, and so on. After completing all four levels, students were expected to master the learning outcomes on the topic of measurements from grades 1 to 4. The difficulty level and challenge were gradually increased across the levels so as to retain student motivation and avoid frustration from repeated failures. Game scenarios and objects used in the games were related to real-life situations, which were recognizable to the children. Moreover, positive reinforcement was given in the form of constructive feedback and rewards. At the end of each level, students were shown the progress achieved, which further encouraged young learners to learn mathematics with more enthusiasm.

The results of the study showed significant improvement in engagement and achievement data without teacher presence, with an effect size of 0.9 (Cohen's d). Although the motivation data were not significantly different, the motivation of the players was consistently higher than that of the control group, who had been taught the same topic through paper-based worksheets using conventional pedagogy.

### 4.2. Chotay Sciencedan

*Chotay Sciencedan* (literally meaning little scientists) is an example of a knowledge-centered, learner-centered, and assessment-centered interactive learning and assessment game application developed

for 10- to 12-year-olds by digitizing grade 5 Science content and transforming it into interactive, hands-on, learning experience for public school students. It was developed for Android-based tablets with the "one tablet per child" instruction model under the Education Innovation fund by Ilm Ideas. The objective of this project was to create pedagogically sound and enriched content marked by interactive game-based activities, embedded assessments, and animated characters to foster interest in a subject that is otherwise regarded as being dull by most students because of fallacies in the learning system. It was also intended to promote and increase the retention of students in science, technology, engineering, and mathematics by generating interest in science. A combination of learning strategies was used in the game. For instance, the content knowledge was delivered as bilingual digital storytelling that immersed students into a game scenario where they listened to the story and followed instructions to carry out the challenging game tasks with no direct teacher input. Moreover, unobtrusive assessments were embedded with instructions so that learning could be evaluated in runtime using formative assessment methods. Based on their responses, the students also received immediate diagnostic feedback. Moreover, a website was built to serve as the teachers' portal and to display the students' progress as analytics in real-time, so teachers can monitor the whole class or individual student progress, and identify any modifications to the instruction plan or to the content itself. The use of this application as a pedagogical model shifted the role of teachers to that of facilitators. During the session, teachers helped the students only if they were stuck on something. After the sessions, the teachers initiated a discussion with students to share ideas and build knowledge based on the learning acquired from the game.

In the pilot phase, the game application was deployed to around 200 public school students belonging to disadvantaged suburban areas in the Punjab and KPK districts of Pakistan (Ahmad & Maqsood, 2015). The results presented statistically significant improvement in attainment data with an effect size of 0.81 (Cohen's d). Moreover, noticeable improvement in attendance was observed since the students were more motivated to learn through digital games.

Besides the aforementioned funded projects, some evidence of small-scale DGBL projects has also been found in this region, which yielded encouraging results. Some of the prominent projects are summarized as follows:

### 4.3. Work and Energy – An Interactive Physics Learning Game for Secondary School Students

This is a low-cost, quick and simple Android game developed for secondary school students who are unable to grasp the conceptual understanding of physics topics delivered through a lecture in most of the schools in South Asia. Work and Energy is one of the topics that students find hard to understand theoretically. The application is a combination of four real-life scenarios related to work and energy in which students select the scenario, follow the on-screen instructions, and, using the game controls, perform activities with embedded assessments followed by constructive feedback. The game was deployed among 60 public secondary school students in an urban setting for a period of two weeks (Khan & Malik, 2015). The students were involved in game-based problem-solving activities followed by teacher-led classroom discussion.

The game was mainly learner-centered: students would build knowledge while solving the problems, and the classroom discussions further deepened that knowledge. A statistically significant difference was reported on the cognitive, behavioral, and emotional engagement of the students that used the interactive learning game as compared to those who were taught the same topic in a traditional way.

### 4.4. Chemistry Learning Game for Secondary School Students

Patterns of Reactivity is an interactive desktop game that helps students learn and consolidate the knowledge and understanding of the chemical reactions of reactive and non-reactive metals with acid, air, and water. The game was created especially for low-cost private schools that have no access to laboratory resources for conducting experiments. The content knowledge in the game was delivered through real-life videos on chemical reactions instead of on-screen text followed by interactive game activities at a variety of difficulty levels to consolidate the knowledge obtained through videos. The desktop version of the game was developed because schools lack access to tablets. An existing computer lab was used to play the game on desktop computers.

A sample of 72 students from a low-cost private school in a suburban area was surveyed to investigate the impact of this game on their achievement and engagement (Khan, Ahmad, & Malik, 2017). The study results revealed that learning through the digital game had a significant impact on student engagement, with positive body language, consistent focus, confidence, and fun and excitement. However, no significant difference was found in the achievement of learning outcomes in contrast to the conventional teaching approach, although the students who played the game scored consistently higher in post-tests than those taught in a traditional way. The results of the study may have been influenced by the short period of intervention that spanned half-hour sessions for five days. Further research is required to examine the effect of time on the use of DGBL to produce quality education.

### 4.5. Nutrition Run

This was another tablet-based, non-immersive, quick, and simple edutainment game targeting secondary school students (Jamil & Ahmad, 2017). The game integrated educational and entertainment aspects to engage students. The game content covered the topic of food and nutrition taken from the national curriculum of secondary science. The game was composed of two sections: the content knowledge and the game. The knowledge section gave an overview of the constituents of a balanced diet through an interactive visual story displayed on the screen. In the game section, students were involved in an entertainment game like Temple Run, where the goal was to achieve the target by collecting health food objects, which increased the overall health score (health bar), followed by an increment in the score of healthy items. The game also indicated the main nutrition value of each food item selected. The overall assessments were handled in the form of constructive feedback on the selection of food items, explaining the deficiencies of nutrition in their selection. The feedback also indicated alternative food items with better nutrient values that could have been selected for a balanced diet.

The purpose of this game was to familiarize students with identifying the nutrition value of healthy food items, enabling them to make better food choices in real life. Students were made aware of the consequences of consuming an unbalanced diet through the game play and through follow-up discussion in the class. The study indicated significant achievement in the pre- and post-test results based on the national secondary science curriculum.

### 4.6. VR Ed-explorer

After initial research on designing quick and simple games for academic learning, game designers and educationists are exploring the use of virtual reality (VR) as a preparation to modern approaches to learning complex subjects. VR Ed-explorer is an immersive virtual reality game used in a research project involving 70 secondary students of two urban public schools which sought to investigate the impact of VR as a pre-lesson tool on conceptual

understanding, engagement, and motivation using mobile phones and Google Cardboard as VR headsets (Khan & Malik, 2017). The game consisted of three 3D models taken from the secondary school science curriculum, namely the human eye (related to Biology), the layers of the atmosphere (related to Chemistry), and the cathode ray oscilloscope (related to Physics). The research study adopted a quasi-experimental research design where the experimental group was involved in learning through VR Ed-explorer, whereas the control group was exposed to conventional teaching (Khan & Malik, 2017). Students were randomly assigned to the two groups. The experimental group students interacted with the VR game at the start of the session, followed by a teacher-led session for deeper learning. The experimental group students demonstrated better understanding of the complex topics after interaction with the VR game; they were more able to participate in discussions and problem-solving, and relate learning to real-life situations (Khan & Malik, 2017). On the other hand, the control group students remained passive learners contributing little to the discussion during the sessions. The study results revealed significant differences in the engagement, motivation, and conceptual understanding of experimental group students compared with the control group (Khan & Malik, 2017).

In all of the above examples, the major impact of game-based learning is seen as shifting from a teacher-directed to a student-centered environment like flipped classrooms or blended environments with opportunities for self-paced and deep learning. The games vary on the scale of knowledge-centered, learner-centered, community-centered, and assessment-centered design principles, as discussed by Dede (2018). However, the limitations of the design principles were covered through the pedagogy applied in the classrooms. The research results in this region also suggest that foundation skill games can be teacher-proof, where students could play, practice, and get feedback directly from the game, and still be able to make progress in a traditional examination-driven system. Moreover, the results are consistent with research in the Global North (Shute, 2011; NRC, 2012), suggesting that, irrespective of the socio-economic status of children, digital games have a capability to develop "academic tenacity" if the challenges set out in the game are difficult yet attainable at the student's current level of skills, coupled with appropriate support as constructive feedback and encouragement for steady improvements in repeated attempts to overcome the challenges.

In short, the significant increase in achievement, motivation, and engagement data in various studies in South Asia suggests that DGBL is a promising strategy to gain access to quality education. However, most of the interventions lasted a few weeks to a few months, which calls for longitudinal research to study the long-term effects of digital games on education quality, equity, and efficiency. Such studies may give insights into student learning behavior and its impact on achievement over a sustained period of time.

Building on the summary of South Asian research studies and successful examples, the next section discusses the barriers and facilitating factors in DGBL adoption in South Asia.

## 5. Challenges in Implementing DGBL in South Asia

The examples of DGBL in South Asia in Section 4 demonstrated the use of simple, quick, less complex, non-immersive to long, more complex, immersive, virtual reality games with evidence of improved learning and behavior. The implementation of such a learning environment on a large scale in this region requires gauging the key drivers along with the perceived barriers, some of which were mentioned by Dede (2018).

## 5.1. Key Drivers

One key driver of the positive outlook for DGBL in South Asia is the evidence base established in a few of the studies discussed in the previous section. Following are other key drivers:

5.1.1. Ubiquity of technology. The high penetration rate of mobile devices makes it a feasible platform to access hard-to-reach populations. The telecom industry is already working in collaboration with governments in some South Asian countries to provide access to affordable 3G/4G-enabled smartphones packaged with educational apps. Expansion in mobile data usage is also seen in rural areas. For instance, an increase of 1.16 million 3G/4G mobile data users was recorded in Pakistan from November to December 2016; 58% of the users lived in rural areas (Siddiqui, 2017). The access and ubiquity of mobile devices can be considered a key driver in implementing DGBL solutions in the Global South.

5.1.2. Reduction in cost. Smartphone and 4G prices are rapidly declining, with the market launching newer, more capable, and cheaper devices ordinary consumers can afford. Some telecom companies grant unlimited access to download educational apps, making game-based learning a viable solution for quality education.

5.1.3. Knowledge-based work. Many Global North companies are outsourcing work to Global South countries, causing a shift from industrial-age work to knowledge-based work, which requires higher levels of communication, collaboration, and thinking skills. The greater demands of such work and innovation require curriculum revisions to enable students to carry out their roles effectively in the 21st century. Examples from Section 4 suggest that teaching with digital games may foster problem-solving and thinking skills in students, and equip them to contribute in a knowledge-based economy.

5.1.4. Self-paced learning. Gaining new knowledge requires personalized learning, where students can learn at their own pace, experiment with problems, make mistakes, and learn through the mistakes. Examples from the previous section suggest that teaching and learning through digital games is a cost-effective solution that allows students to interact and experiment with the content in various situations, to make mistakes, and consequently learn from their mistakes. Also, the games developed with authentic pedagogies will require minimal teacher expertise in areas where there is a dearth of trained teachers, thus enabling self-paced learning (Ahmad & Maqsood, 2015; Ahmad & Khan, in press).

5.1.5. Student-to-teacher ratio. Large class sizes with an approximate 40:1 student-to-teacher ratio in almost all the schools pose classroom management issues, which restrict teachers from providing one-to-one timely constructive feedback in class. Digital games can deliver instant feedback and conduct traceable assessments to identify at-risk students for personalized attention.

The aforementioned key drivers are creating a demand for new forms of learning, which may enable teachers to implement flipped pedagogies, from teacher-directed to learner-centered, using low-cost portable devices. However, alongside the key drivers, the challenges in implementing this model can never be underestimated. Some of the major challenges, along with coping solutions, are discussed next.

## 5.2. Challenges in Implementing DGBL

Dede (2018) suggested in his paper that the 1:1 student-computer ratio may be desirable for complex and immersive game-based learning scenarios in a school setting, whereas presentation stations can also be used effectively for “whole-class sessions in which students collectively make choices and see the consequences of their actions” (p. 14). However, in my opinion, students in the South Asian region

would benefit more from having a 1:1 access to a portable device, be it a computer or a low-cost tablet. Situations where teachers can lead an effective whole class learning experience is dependent upon the teacher's experience and capability of designing a lesson using digital games. With a low teacher expertise in this region, there is a high possibility of turning an interactive lesson into a passive digital instruction with perhaps little involvement of only few students in the class. Also, in the Global North, students may have access to digital resources and internet connection at home, due to which, it is possible for teachers to draw upon students' experiences with entertainment-oriented video games outside of the school setting. However, the situation is quite opposite in the Global South, where access to resources at home may be questionable. Therefore, teachers would have to rely on resources available to students within schools.

In this regard, the first and foremost challenge to implementing DGBL in the Global South is the differentiated access to resources. Although there are low-cost solutions available in the market, procurement of such devices and the cost of broadband may still prohibit under-resourced schools and low-income families from investing in such technologies. This issue, if unaddressed, would increase the digital divide between the "haves and have nots." Learner-centered games such as role-playing games or virtual reality may require high-end devices and could pose a threat to an equitable distribution of resources. Therefore, schools should allow a BYOD (Bring-Your-Own-Device) policy so that government funds could be spared for disadvantaged and low-income schools. Secondly, technology infrastructure with an inadequate power supply is another barrier to adopting not only DGBL, but also any technological model in schools. On a positive note, in some South Asian countries like Bangladesh, the government has already taken the initiative to provide solar energy solutions to schools. Other countries can also adopt similar models to resolve power issues as the solar energy market is flourishing tremendously in South Asia. Hence, a collaboration of solar energy companies and governments could propose affordable power solutions to schools to mitigate the issue of interrupted power supply.

The other major barriers in adopting DGBL are at the teacher level, out of which the first-order barriers are related to the lack of resources, time, training and institutional support and the second-order barriers are associated with teachers' personal and pedagogical beliefs, especially about adopting technology to aid teaching, and willingness to change (Ertmer, 1999). However, there is another dimension identified as third-order barriers by Tsai and Chai (2012), which are related to the lack of "design thinking skills" in teachers. The design capacity enables teachers in using technology for instruction at the right time and right place. If the first and the second-order barriers were removed, lack of design thinking with an appropriate blend of content knowledge and pedagogy would still pose a challenge in using digital game-based learning effectively. Moreover, teachers' experience of using digital games is another threat for DGBL. Some examples of games mentioned by Dede (2018) may require hours of gameplay to develop a feel of the game, which is not possible to achieve within restricted class timings. The teacher must, therefore, be savvy while choosing gameplay experience that both demonstrate something important and are "bite-sized" to be incorporated within the class timeframe or as a homework assignment (Holmes & Gee, 2016). Designing such experiences demand teachers to be well-versed in gaming to pick up the right games and to be able to modify experiences based on their specific class needs. In the Global South, the qualitative data analysis from studies mentioned in section 4 revealed that majority of teachers did not play games and had limited IT skills, restricted to using social media or word processing at a basic level (Ahmad & Maqsood, 2015; Khan, Ahmad, & Malik, 2017).

In addition to the gaming exposure, another impeding factor in the adoption of DGBL is the gender disparity to which surprisingly Dede (2018) overlooked to consider in the Global North. We can assume that

gender difference may not be an issue there, however, in the Global South, it may pose a threat to the effective adoption of DGBL in schools. The example of studies from Section 4 also indicated that female teachers were more hesitant in playing games compared to their male counterparts. Nevertheless, they appreciated the power of DGBL in arousing engagement and motivation in students, yet at the same time did not feel competent enough to use such technologies in their lessons. Further research is advised in this regard as major adjustments are required from the teacher's end to implement effective DGBL lessons.

The fact of whether teachers play games or not is trivial, but their design skills of creatively integrating games to develop deep learning is crucial for successful implementation of DGBL in the Global South, especially when the assessment system focuses on memorization of random facts rather than conceptual understanding. Dede's (2018) paper would have been more authentic if a comparison of assessment systems in the Global North was made against the Global South. The South Asian region relies heavily on an examination system that restricts teachers in using innovative pedagogies for deep learning. Most of the times, these teachers teach the way they were being taught. Their limited teaching skills foster surface learning and thus prepare students to compete in standardized exams by mere rote memorization. Therefore, alternate assessment strategies to assess students' 21st century skills, such as collaboration, problem solving, critical thinking, etc., should be introduced alongside the standardized testing, which will allow DGBL to seamlessly integrate into the education system. Also, in agreement with Dede (2018), more opportunities of professional development of teachers are needed in this region to include DGBL as an instructional approach to impart deep learning. However, until they truly acquire the new vision, "teacher-proof" games designed on the principles of Technological Pedagogical and Content Knowledge (TPACK) framework with a right blend of technology, pedagogy and content knowledge would be an asset to create quality learning experiences for students.

Another barrier observed in the implementation of DGBL is the availability of games in the local context. I agree with Dede's (2018) notion that, "the Global South cannot rely on hand-me-down games from the Global North to achieve educational needs," firstly, because of language restrictions, and secondly, due to cultural differences. The language limitation inhibits learners' comprehension of the information, thus confining them to surface learning, whereas the cultural difference may influence their abilities to apply learning in their own context. It is often observed that children, even from marginalized communities, are able to play games they download on mobile phones or tablets; however, they play them solely for fun without understanding the knowledge they provide. Hence, there is a need to collaborate with the booming game industry in South Asia to design educational games in local languages and contexts based on effective design principles of learning and motivation to implement a sustainable DGBL environment in this region.

## 6. Role of the Government and Other Agencies in Supporting DGBL

Improving education quality, equity, and efficiency is the top agenda of governments in South Asia to meet the Sustainable Development Goals by 2030. Many reforms and new policies introduced aim to address the educational crisis. However, the vision depends on the political will to transform the educational landscape in this region. Many "education-industry partnerships" (Eickelmann, 2011) are working collaboratively on exploring and implementing innovative and sustainable solutions to address the critical education challenge. UNESCO

is one example of a large-scale educational stakeholder working in this region to promote multi-stakeholder partnerships as a means to "create equitable, dynamic, accountable, and sustainable learner-centered digital ecosystems" (UNESCO, 2015, point 19).

This section highlights the role of government and other agencies in driving and supporting the adoption and scaling up of DGBL in South Asia.

### 6.1. Role of the Government in Supporting DGBL

Harvesting the benefits of technology in delivering quality education has been a protracted struggle for governments in South Asia. Education policies have been revised several times in the past decade to integrate learning technologies in education. However, these revisions could not be implemented due to exponential advancements in technology. By the time the government is able to implement a particular technology intervention, it has already become obsolete. Hence, the full potential to reap long-term benefits is still a dream in this region. The challenge is to revamp the complete infrastructure of schools to make them digital-friendly with access to devices, the Internet, and power supply in most areas. Teacher readiness to accept technology and change the pedagogy is another challenge that has yet to be addressed. Some of the initiatives taken by governments include digitizing of the curriculum and inclusion of simulations, videos, and some basic foundation level games. eLearn Punjab (https://elearn.punjab.gov.pk/) is one such program. It is collaborating with the Punjab government in Pakistan to provide students free access to digital content in line with the national curriculum. The content produced is more like a digital book and follows the same textbook pedagogy, but the main difference is the inclusion of simulations and videos that help readers understand the phenomenon better than simply reading books. After digitizing the curriculum, eLearn Punjab aims to offer these digital books at public schools, for which they are setting up 200 multimedia classrooms in Punjab Province with access to one semi-smart TV (40 inches), one Android tablet, and offline content placed in the internal/external storage of the tablet and on content servers. However, the challenge with this arrangement is again the industrial age teaching, where the teacher will be using the digitized content in a lecture format and students will be passively listening and watching the presentations or videos, which is merely another version of multimedia presentation teaching. Such ventures really need to be forward-thinking in giving control of learning to students by providing one tablet per child and transforming the pedagogy from teacher-directed to student-centered.

### 6.2. Role of NGOs in Promoting DGBL

International donor agencies, non-government organizations, and philanthropic organizations are all committed to supporting the government in addressing the educational crisis in South Asia through innovative integration of technologies. An example of developing large-scale integration of technology in teaching and learning is called Integrating Technology in Education in India, which began its work in a remote area of the eastern part of the country (Charnia & Davis, 2016). Tata Trusts, a philanthropic organization, is spearheading the partnership with other NGOs with the same vision of bridging the digital divide and using technology to enhance deep learning experiences among upper primary and secondary school children and adolescents. The focus at the moment is not on using digital games as pedagogical tools. However, exploring the effective use of DGBL in providing education quality, equity, and efficiency could be viable through such multi-stakeholder partnerships.

Another growing example of multi-stakeholder partnership in Pakistan is Ilm Ideas 2 (http://www.ilmideas2.pk/), which aims to engage a wide range of players, primarily from the private sector, to develop innovative approaches to improving the

supply and demand of quality education in Pakistan. It supports education innovations that benefit the poorest children and young people. There are three strands to how the Ilm Ideas 2 program works. First, it helps startup businesses seeking to improve education quality or access, develop their ideas into a successful business. The program works with business incubators in Pakistan who find and support education startups in the early stages of developing their ideas. Second, it provides grants and advice to organizations or businesses that are already working on educational challenges, such as access or quality, to scale up to reach more children and improve the educational outcomes of their interventions. Third, it aims to mobilize support and interest for education innovation in the private and public sectors to ensure that support for new innovations continues after the program closes.

The "Ilm Apps Challenge" is another featured initiative by Ilm Ideas through its Education Innovation Fund that aims to encourage professionals, entrepreneurs, innovators, educationists, developers, designers, content creators, and social sector activists to create Edtech platforms and content to address Pakistan's educational emergency through solutions that address quality, access, and governance in K-12 education (Osama, Imran, & Jamshan, 2015). The fundamental purpose of the Ilm App Challenge was twofold. First, it sought to bring together the developer and designer communities, including mobile apps and game designers, that traditionally do not engage with the education sector. Second, it opened an opportunity to create the evidence base imperative to scale educational technology ventures. The Phase 2 funding for Ilm Apps Challenge engaged successful initiatives with funding to fully develop and pilot test their proposed solutions in real-life settings within schools.

Another independent venture is Innovative Learning by Association for Academic Quality (http://afaq.edu.pk/innovative-learning/), which envisions improving the literacy rate of Pakistan through services such as curriculum development, textbooks, teacher training, and innovative learning, including a web portal with free access to interactive storybooks and gamified worksheets targeting mostly the literacy, numeracy, and social skills of primary school students.

### 6.3. Game Industry

Pixel Art Game Academy (http://www.pixelartga.com/) is one startup in Pakistan which aims to build a community and a platform for people who are passionate about game development, want to master the skills, and play a role in nurturing the game industry in Pakistan. This startup brings scholars, creators, and technologists to teach and conduct research together, and develop new approaches for applied game design and formation. Their mission is to explore, educate, and engage young talent in designing and creating games through training courses and bringing new ideas to real-world challenges. Although their focus is on entertainment games for commercialization, this platform has the potential to contribute by designing and developing serious educational games in local contexts.

Another aspiring game design startup in India is Callystro (http://callystro.com/) which aims to develop curriculum-aligned, self-paced games covering all the competencies schools focus on. They have a catalogue boasting more than 250 competency-based games covering the K-8 curriculum, packaged with corresponding assessments and a performance dashboard in a learning portal called CoBELS, available to schools on low-cost tablets and PCs. They are penetrating markets through B2B models for private schools by providing low-cost games and following a B2C model for individual consumers with Mapoosa, a free multiplayer online learning game embedding math, literacy, and science learning.

### 6.4. Role of Universities

Universities and research institutes play a major role in finding innovative solutions to existing problems in a country. Few universities in this region carry a vision of improving the educational standards of the masses by using digital technologies. One example is the Department of Innovative Technologies in Learning (http://itl.seecs.nust.edu.pk/) at the National University of Sciences and Technology, which aims to develop and deploy research-based, effective digital games based on pedagogical design principles. Various studies conducted by this department have highlighted the significant improvement in achievement, motivation, and engagement of students, especially those belonging to marginalized sectors of society. Another initiative is by the Information Technology University located in Lahore, Pakistan, which offers the semester-long program Design of Interactive Learning Application and seeks to target the 60-billion-dollar industry of Interactive Learning Applications and create edutainment games to open up possibilities for teaching and learning by increasing the outreach.

In summary of the discussion in the preceding paragraphs, DGBL implementation in South Asia could be truly possible if governments, the social sector, startups and universities work synergistically towards achieving the common cause of access to quality education for all. Collaboration is the main ingredient of success. Disjointed efforts could be beneficial in the short term, but long-term success is not inevitable without developing and implementing research-based solutions to address the education needs of quality, equity, and efficiency. Moreover, rather than reinventing the wheel, successful DGBL models from the Global South could also be implemented in countries struggling to devise a plan to integrate technology into education. Also, advocacy and awareness sessions are crucial to inform governments of the successful DGBL implementation in various settings. Evidence-based awareness sessions will help devise relevant and more succinct policies to integrate learning technologies into schools.

## 7. Conclusion

DGBL can be relevant to fostering education quality, equity, and efficiency in the South Asian region only if certain conditions are met. The uniqueness of this region in language, culture, political atmosphere, and socio-economic status makes it vulnerable to accepting a DGBL model from the Global North prior to making a few adjustments. First, it requires a shift in the mindset of teachers, leadership, and policymakers alike, who would appreciate the importance of 21st century skills required by students to collaborate in a “flat” world. This requires change not only in teaching pedagogies using the right tools, but also in the prevailing heavily examination-driven system of education. Second is to design bilingual games considering the local context, as the majority of students do not understand English. Also, not all schools teach English as a second language, which further puts students at risk by not understanding the knowledge component of the game. Third, until teachers’ readiness to use games is established, this region could benefit from comprehensive teacher-proof games coupled with constructive feedback and embedded assessments. Fourth, collaboration among governments, research centers, the game industry, the telecom industry, and the social sector is required to develop good quality games and teacher capacity building to improve the reach. Last, longitudinal research in the South Asian context is required to further investigate the effectiveness and implementation of digital game-based learning towards improving education quality, equity, and efficiency.

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