



Use of Technology in Teaching and Learning: The Need for Integration of Sustainable Technologies in the Instructional Process

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Abstract: Education plays a key role in sustainable development by helping change the behavior of people. Quality education is one of the pillars in the UN 2030 Agenda for Sustainable Development Goals (SDG) which aims to ensure inclusive and equitable quality education and promote lifelong learning. In this era of technological innovations, the nature, how and where learning takes place are all undergoing transformation. Technology provides students easy- to- access information, accelerates learning and fun opportunities to practice what they learn. They provide an alternative method for those who may be struggling to learn using the traditional methods. These technologies create a more engaging environment, in-cooperate different learning styles, improve collaboration and class management and prepare learners for the future. Students can also learn at their own pace. Such technologies not only engage students but also offer diverse platforms for students to work with new ideas and demonstrate learning understanding. In this regard some traditional methods of teaching and learning are slowly being changed to newer technology driven methods like Digital Content Learning, Learning Management Systems, Augmented and Virtual Reality, Artificial Intelligence, Gamification among others. This paper explores the place of technology in the instructional process with a view to advance a more technology based teaching and learning process. By integrating technology in the education environment the walls of the classroom will no longer be a barrier, new ways of learning, communicating and working will be adopted for a sustainable future. A review of literature was used to find out the use and benefits of a technology rich classroom.

1. BACKGROUND

Education is a key enabler of national development. It plays a key role in sustainable development by helping change peoples' behavior and help to achieve the Sustainable Development Goals (SDGs). Integrating technologies in education refers to the use of technology to enhance the student's learning experience. Different types of technology are utilized in the classroom including the virtual classroom where learners can actively engage in the learning process. Technology can be used to enhance education for sustainable development through influencing learners' behavior and evaluating such behavior change. Watson et. al (2008) says these technologies can be infused in the instructional process through activities like reading, writing, calculations, data analysis and general education management.

Sustainable technologies are innovations that consider natural resources and foster economic and social development. The goal is to drastically reduce environmental and ecological risks and instead create a sustainable product. According to UN sustainable technologies are a framework of digital solutions that can enable environmental, social and governance outcomes for an enterprise and its customers (UN General Assembly, 2015). The pillars of sustainability are economic viability, environmental protection and social equity. The goal of sustainable development is to meet the diverse needs of different communities and to create better quality life for all now and in future. These technologies have power to increase productivity, efficiency, cost saving, reduce product waste, chemical and resource measure and even track progress.

In the field of education sustainable technologies have dynamic and interdisciplinary character that can transform learning environments and pedagogy and also support and empower learners, teachers and administrators, OECD (2019) agree that sustainable technologies make education inclusive of all school

subjects and even extend beyond the classroom. They can provide today's children with real world skills which they can use to improve the planet and become self-sufficient for the future especially the world of work. Sustainable technologies in education include Artificial Intelligence (AI), Learning Management Systems (LMS), Augmented and Virtual Realities, Gamification, ChatGPT, Block-chains, Cloud Computing, 3D printing, social media, and Bio-metrics used in schools. There are also smart-boards, smart tables, projectors, power point presentations, internet homework assignments, online grading systems, adaptive learning, 5G technologies, automation, learning analytics, video conferencing platforms and smart video cameras. Also included are technologies that allow synchronous and asynchronous learning, app based learning and online text books. The aim of this paper is to advance the need for use of sustainable technologies in the instructional process. The developed countries that already adopted these technologies are far advanced in delivery of education. The developing countries need to improve education delivery methods because of the rapidly growing population and hence the need for education and skills development in these countries.

2. LITERATURE REVIEW

A study done by Chien, Wu and Hsu (2014) shows that students have a high expectation with regard to ICT integration in the classroom. The younger the students, the higher their expectation with regard to ICT integration in the classroom. Using technology in education has benefits for both teachers and learners. The instructional process has changed due to the amount of touch screen technology available for learners at different levels. Children use technology to make meaning of the world around them and sustain their interest (Disney, 2019).

Lui (2018) posits that digital storytelling is one way to generate creativity and motivation in students. Digital storytelling tools allow learners to showcase their creativity and understanding by creating multimedia projects. Such platforms help learners develop digital literacy while expressing their ideas in innovative ways. The learning experience is unlike any other when students are using different skills to tell stories, adding multimedia, and arranging ideas appropriately to effectively communicate personal stories and experiences. Digital storytelling also allows learners to be in charge of their own learning process by participating in exploring their own interests (Lighthouse 2020).

Advancement in technology and thinking has changed the way learning and assessment occurs in the classroom to a more personalized approach through games-based learning (Shute, 2017). Games based learning can be defined as using technology to learn or receive instruction rather than the use of games for entertainment (Persico, 2019). Games based learning is considered a highly effective way to gauge the progress of learners academically from the ongoing assessments (Shute, 2017; Vanbecelaere, 2020). These ongoing assessments are not just limited to the classroom setting. With the use of digital games, learning can occur anywhere, even in an informal learning environment (Persico, 2019). Moreover, Videnovik (2020) supports gamification by asserting that games-based learning is tailored to today's learner experience. Gamification coupled with simulation tools enrich the learning experience by making complex concepts engaging and easier to grasp. Learners develop problem solving and decision making skills. Virtual reality (VR) and Augmented Reality (AR) technologies offer immersive learning experiences helping students visualize abstract concepts and explore real world scenarios in a controlled environment. These can enable students to interact with instructional content while in different locations even with each other or the instructor. It can also reduce the cost of trips to relevant sites or meeting the instructor.

The trend of using technology in education has led to rethinking of how the traditional classroom is utilized (Blair, 2015). The flipped classroom technology, means that the content being taught in the class is presented to students digitally outside the classroom, then problem solving or group activity is done in class where the teacher can give more hands on exercises (Blair, 2015). The flipped classroom combines direct instruction and a learner centered approach in an in-class face to face environment and an online environment (Mohammed, 2018). While students are engaged in lessons online they are in control of where they learn and the pace at which they learn (Asef- Vaziri, 2015). When the classroom is flipped teachers no longer spend class time delivering content, but instead focus on active learning, group problem solving, case studies, and real world applications. This is a more engaging and integrated

approach to instruction. (Asef-Vaziri, 2015). In order for the flipped classroom to be successful teachers must value formative and summative assessments, face to face activities, and provide learners with collaboration opportunities to allow them to learn from each other (Blair, 2015).

2.1. Technological Pedagogical Content Knowledge Framework

Mishra and Koehler (2006) developed the Technological Pedagogical Content Knowledge (TPACK) framework. According to the TPACK framework, Mishra and Koehler posit that a teacher depends on three domains of knowledge for effective integration of ICT into teaching and learning (IITL). The domains are content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). Mishra and Kohler (2006) defined CK as knowledge about the actual subject matter that is to be learned or taught. Mishra and Koehler observed that a teacher must know and understand the subject that he/she teaches, including knowledge of central facts, concepts, theories, and procedures if the teacher is to integrate technology in teaching. Mishra and Koehler (2006) defined PK as the deep knowledge about the processes or methods of teaching and learning (e.g. values and aims, classroom management, lesson planning, and student evaluation). They argued that a teacher with deep PK is likely to integrate technology in his or her teaching considering how students can best learn in a given classroom context and nature of learners. Mishra and Kohler defined TK as knowledge about standard technologies, such as books, chalkboard, and more advanced technologies such as the Internet and digital video and how to operate those technologies. They asserted that a teacher with TK has good knowledge of operating system and computer hardware, the ability to use standard sets of software tools (e.g. word processors, spreadsheets, browsers, e-mail) and how to install and remove peripheral devices, install and remove programmes, create and archive documents among others.

Mishra and Kohler (2006) observed that the interaction of these three knowledge domains; CK, PK and TK gives rise to three paired knowledge domains namely pedagogical content knowledge (PCK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK). Mishra and Kohler defined PCK as the knowledge of pedagogy that is applicable to the teaching of specific content such as knowing what teaching approaches fit content, and likewise, knowing how elements of the content can be arranged for better teaching. Mishra and Koehler defined TCK as the knowledge about the manner in which technology and content are reciprocally related. They further asserted that a teacher needs to know not just the subject matter he/she teaches but also the manner in which the subject matter can be changed by the application of technology. Mishra and Kohler (2006) defined TPK as knowledge of the existence, components and capabilities of various technologies as they are used in teaching and learning settings and conversely, knowing how teaching might change as the result of using particular technology. TPACK is the intersection of all the three bodies of knowledge (CK, PK & TK). Mishra and Kohler argued that the development of TPACK by teachers is central for effective teaching with technology because understanding TPACK is above and beyond understanding technology, content, or pedagogy in isolation, but rather how these forms of knowledge interact with each other. Researchers have systematically reviewed literature on the TPACK framework.

3. FINDINGS AND DISCUSSION

From the findings of this research, sustainable technologies have a major role to play in the education environment. Technology allows educators to remove the physical barriers of the classroom, offering students a way to connect the curriculum with real life situations. Such enrich the students experience making learning enjoyable. These technologies promote the development of knowledge, skills, understanding, values and actions required to create a sustainable world.

Teachers can use these technologies to achieve new levels of productivity, expand learning opportunities and increase student engagement with content. By using technologies like internet, online schools, blended learning spaces, gaming and augmentation, visual and virtual elements are grafted back into ordinary classroom spaces. With online schools learning becomes more contextual and available to a higher population which can be cost effective for developing countries.

Some technologies can spark inquisitiveness in learners and boost their curiosity which is linked to academic success. Teachers can create engaging content by use of Augmented Realities, video podcasts,

simulations, internet homework assignments, 5G technologies, automation, which all engage the students actively. Technologies are setting the pace for more autonomous views of learning that promote student development, cooperative learning, socio-emotional and inquiry based learning. This is good preparation for learners who will finally join the world of work in a digitally active world.

Personalized learning opportunities can be created by use of technologies. They allow learning to take place anywhere anytime at the pace of individual students. Synchronous and asynchronous learning methods, linear learning (computer based) is possible by use of digital technology. Use of blended learning which supports physical and online learning is already in use by most institutions of learning since the outbreak of Corona virus (COVID 19). Teachers can create lessons based on students' interests and strengths. Burbules (2016) says teachers can review class materials through videos, social media or YouTube. The teacher can track students' progress through data generated by sustainable technologies and even use the data to offer additional support to students who need personalized assistance. Flipped classrooms also automate the process to allow teachers focus on tutoring and support activities for students. Teachers can now work collaboratively with technology to design learning environments that can identify students with difficulties and suggest instructional remedies.

There is increased collaboration and communication through use of technology. By use of the internet students and teachers can share research findings, communicate with each other, share their thoughts and ideas and just support each other. Technology enables one-on-one interaction with teachers where students can ask questions and seek clarification on difficult subject matter. While at home students can do assignments and upload them using laptops and mobile phones.

Technology provides students with easy-to-access information, accelerating learning and fun opportunities to practice what they learn. Apart from deepening their understanding of difficult concepts, technology can help students gain 21st Century technical skill that will prepare them for future careers. There is a remarkable shift in the way people receive and send information. We are shifting from pen and paper to digital technology which is a cost effective way of storing and sharing information; it is time saving and information can be accessed instantly. Communication is now much easier with use of technology. For example, use of teleconferencing platforms, smart video cameras, emails and virtual meetings can be used by students and teachers in exchanging information.

With use of sustainable technologies education administrators and managers can make informed decisions and plans. They can open up channels of communication with parents and the community to keep parents informed about their children's progress and even security matters. Most schools are now using biometric technology, CCTV cameras for security, Learning Management Systems (LMS), Cloud Computing, 3D, social media, emails, to fast track communication with stakeholders. OECD (2015) attests to the fact that technologies can be used to analyze educational data, generate useful information about student performance, problem areas, inequalities or long term trends at varying levels.

Collins (2009) points out that technologies accommodate multiple learning styles. The shift is from teacher centered to learner centered where learners can also be facilitators. With the eminent large enrolment in schools, technology gives room for collaborative learning, improve adaptability, increase student fun, enhance feedback, foster connections, promote technological skills and improve students' performance. All this can give room for innovation, inquiry, discovery, mastery and problem solving skills. Online learning, e books, Artificial Intelligence, gamification, cloud computing, apps software, blogs, discussion boards, digital white boards and other interactive tools diversify the learning process. Use of power point presentations keeps students engaged and hence retain more information.

Use of technology makes roles of students and teachers much easier through collaborative research, group work, presentations, timely feedback and corrections. The teacher is more of a facilitator of learning while the student engages more with content and can offer solutions to current bottlenecks. Burbules (2016) mentions that students can learn through direct instruction, video streaming, podcasting, project based or adaptive algorithm based software. Selwyn (2012) supports this view and adds that Artificial Intelligence, adaptive instruction and online learning can be used for different types of learners.

In the area of special education, sustainable technologies have significant influence on the classroom environment through early intervention, prevention technologies and transition plans. Conferences, individualized education, specific computers, cochlear implants and new prosthetics can be used to cater for students with special needs. This is in line with Education for All goal and inclusivity in education.

4. CONCLUSION

From the discussion advanced in this paper the benefits of sustainable technologies in education cannot be underscored. Through these technologies both students and teachers have countless access to online resources, interaction with content by use of varied media which simplifies learning making it interesting, simpler and memorable. This paper has highlighted different types of media and how they can be used in the instructional process. There could be challenges of infrastructure and implementation but this was not in the scope of the paper. These can be looked at in another research. As vividly discussed in this paper, sustainable technologies are the way to go. They should be in-cooperated in the instructional process in order to shift learning towards digital technology which is in use across the globe.

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