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Smart Education: An Overview

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ABSTRACT

Education has taken a quantum leap with the advent of the Internet. Smart education is an interactive, collaborative, and visual model, designed to increase student engagement and enable teachers to adapt to students' skills, interests, and learning preferences. It is about the transformation of the conventional way of pedagogy to contemporary methods using information and communication technologies. It is a model of learning adapted to the new generation, known as digital natives. It helps the student to acquire 21st-century skills, including digital literacy, inventive thinking, effective communication, teamwork, and collaboration. Smart education applies different information technologies like social networks, virtual laboratories, augmented reality, artificial intelligence, big data, and so on. It uses smart classrooms, which are a seamless teaching environment where students and faculty have access to information quickly and effortlessly. This paper provides an overview of smart education, its principles, and its applications.

KEYWORDS: *learning, teaching, education, digital education, smart education, smart learning, smart technologies*

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INTRODUCTION

We live in a world with an abundance of technologies and the technologies are developing and improving rapidly. Recent advances in the field of technology have led to the emergence of innovative solutions known as smart technologies. Technology is considered smart if it performs a task that an intelligent person can do. Smart technologies can be understood as a generalization of the concept of smart structures, which encompass mechanical systems equipped with sensors, actuators, and pre-programmed controllers. Application of such technologies can transform conventional cities into smart cities, conventional homes into smart homes, traditional education into smart education, etc. Today, we are surrounded by many things that are called smart. They include a growing array of technologies such as smart education, smartphones, smart homes, smart grids, smart cities, smart energy, smart transportation, smart manufacturing, smart agriculture, smart living, smart environment, smart medication, smart materials, smart appliances, smart equipment, smart heating controls, smart lighting systems, smart factory, etc. These technologies will ensure equity, and fairness, and realize a better quality of life [1,2]. They have made better quality education possible, particularly in remote, rural areas.

In this digital era, everything around us is evolving at a rapid pace, especially education. The students in the 21st century are different from the students of the past. Unlike many prior generations, this generation grew up with technology and is called digital natives. Their characteristics indicate that digital natives (people who are born after 1980) are quite different from digital immigrants (people who are born before 1980). The instructors dealing with digital natives have to be aware of their peculiar characteristics. Our learning and teaching strategies must be suitable for the current and following generations. As shown in Figure 1, the SMART Goals framework is an acronym-based framework used in education to help students set clear and structured goals related to their learning [3]. With rapid technological advances, anything could be interconnected and infused with intelligent design, and so is education.

TRADITIONAL EDUCATION

Education is a trillion-dollar industry and has been growing at a staggering rate.

In the past**,** education was imparted in schools across the world in classrooms using the tools of a blackboard, chalkboard, textbooks, projects, and assignments. The classes were headed by teachers who stood at the head of the class and gave out instructions by writing on the board for the students to write down. Traditional education faces several challenges today. First, since not all teachers are equally skilled enough to teach children, access to quality education is compromised in most traditional classrooms. Second, traditional education is not personalized but is rather a one-size-fix-all approach. Third, traditional education is still driven by the fear of exams, not the love for learning. Fourth, due to the shortage of teachers, the teacher-student ratio in classrooms is high, especially in developing nations. Lessons can become dry and uninteresting quickly. These challenges must be addressed in order to bring more fun to the learning experience for the children. One way of addressing them is shifting towards online learning or so-called smart learning and investing wisely in technology. Figure 2 shows a traditional learning environment [4].

Most of us would agree that learning can be quite a tedious process and inflexible. With the integration of technology into the education system, smart education was born. In contrast with traditional education, the smart education system uses a variety of digital tools ranging from smartphones, tablets, laptops, projectors, starboards, digital textbooks, etc. Here the focus is on using audio-visual tools to engage the student [5]. The integration of technology into the education system has great opportunities for student learning. Technological innovations can improve education more than hiring and spending on new staff for teaching services. They impact our children and youths as well. The traditional way of teaching and learning is being replaced by smart education.

SMART EDUCATION

Most uses of technologies in education today do not support 21st-century learning skills. Smart education encompasses a paradigm shift from traditional education to more advanced approaches and practices in line with the digital age. The features of smart education will not be the same as in traditional education. Smart education is not just about technology. It is also about new teaching and learning approaches. Figure 3 shows the relationship between smart education, learner, educator, and technology [6]. In a smart education environment, both learners and educators should be effective technology users.

Ubiquitous educational technologies provide significant opportunities to geographically disadvantaged students. The learner should be autonomous and collaborative, while educators should be able to provide technical support to students if needed. Smart education framework focuses on the three essential elements, which are learner presence, teaching presence, and technological presence. Some technologies used to support smart education are displayed in Figure 4 [7].

There will be other technologies that support smart education. Smart technology refers to the implementation of smart devices such as laptops, smartphones, Mac books, and notepads, all related to technology with better accessibility. These technologies are essential for smart education and they transform traditional education into smart education combined with new or improved teaching methods. These technologies are learning management systems, smart/ambient intelligent classrooms, and virtual classrooms.

Smart education is about making children love and easy to learn at their own style and pace. It provides a fun learning experience for children making them fall in love with learning. It uses state-of-the-art technology, which facilitates an interactive classroom and makes children love learning, think, and use their creativity. Interactive teaching resources include Zoom, Panopto, Google Hangouts, and Skype. The education sector has seen profound developments due to novel technologies and will continue to observe the same in the future. With emerging technologies, the means of receiving education have increased exponentially worldwide.

APPLICATIONS

Education is an integration of two activities: teaching and learning. The method of implementing education varies. Development in twenty-first-century technologies has brought changes in the approaches to producing and sharing information. The learners are changing into independent providers from the consumer of information. In order to teach the students effectively with this trend, changes in education are inevitable. Smart education is used in the following ways.

- *Smart Learning:* Smart learning has become one of the popular emerging learning methods. It reflects how advanced technologies are enabling learners to digest knowledge and skills more effectively. It is best viewed from the perspective of the Three T's – Total, Transformational, and Thinking. Visualization has often been a better way for students to understand and learn things. Smart learning is the use of visual aids like videos

to deliver educational content to increase children's interest. The learner becomes a proactive leader rather than a static follower of the educational process. The teacher focus on being a mentor and a coach rather than just being a teacher. A smart learning service or provider is based on three pillars: accessibility, flexibility, and affordability. Smart learning assumes that learners have different learning styles, as illustrated in Figure 5 [8]. Learning should be accessible to all, should be flexible to all regardless of gender, race, and religion, and should be affordable [9]. A typical example of a smart learning classroom is shown in Figure 6 [10]. Smart classrooms can be incorporated while students are present in the classroom through augmented reality, artificial intelligence, and virtual reality.

- *Higher Education:* Higher education is having a difficult time hiring enough workers. As enrollment in higher education continues slowing down, colleges and universities need to get creative in order to strengthen their margins and maintain profitability. With chatbot technology, colleges and universities can overcome labor shortages by increasing operational efficiency and enabling staff to do more with less. Chatbots can improve operational efficiency as well as make life easy for staff and student experience. Many higher education institutions are already reaching out to more learners through non-traditional approaches smart learning is the best path to ensure the brightest future for higher education. Technology is how everything connects in higher education today where students and faculty are mobile, communications are app-based, and collaboration is digital. Cybersecurity risks are present for any institution of higher learning, regardless of the size of your organization or where you're located. All colleges and universities are being challenged with providing fast, reliable, and secure bandwidth to students and faculty. Colleges and universities are focusing on how to improve the student experience and ensure data security. When you invest in leading chatbot solutions, you empower students to self-serve information at their own convenience. With the time saved by implementing a chatbot, you will be able to repurpose your existing staff to handle the more significant and complex interactions with students [6].
- *Smart Cities Education:* Cities are becoming larger, more sophisticated, and more important as the population of urban communities increases. As a matter of duty, every city needs to provide its citizens with housing, food, water, energy, jobs, health, education, transport, security, etc. Cities are under pressure in both developed and developing nations to get smarter by addressing large-scale urbanization challenges and finding ways for creating livable, competitive, and self-reliant cities. The need is met by the deployment of smart city technologies [11]. Smart cities and smart education are intertwined. Smart education is a key ingredient in smart city development. Some years ago, smart cities were a futuristic idea of a few elitists. But they are a new normal. Smart cities are urban environments that leverage IoT and networking, sensor technologies, and data analytics and computing to make the urban space interconnect and communicate with each other. The residents of smart cities must have the necessary education needed to enable them to develop, manage, and live in the cities. For the citizens of a smart city to thrive, education must be placed at its center. The skills, value system, knowledge, and application of an education system determine how the residents will manage themselves and the environment. Modern education should be compatible with the knowledge and technological advances needed in smart cities [12]. Smart cities need education facilities and school systems that ensure students acquire 21st-century skills.
- *Healthcare Education:* Health is regarded as one of the global challenges for mankind. Healthcare is a complex system that covers processes of diagnosis, treatment, and prevention of diseases. It constitutes a fundamental pillar of modern society. The healthcare industry is one of the largest industries in developed nations in terms of job creation, number of employees, and expenditure. The demand for educating healthcare professionals in a smart education environment is rising due to the increasing demand for specialist healthcare workers such as physiotherapists and nurses.

BENEFITS

When schools shut down at the beginning of the pandemic, we saw how the education sector immediately tried to adapt to remote learning. Educational institutions are increasingly adopting smart education to sharpen the employment prospects of students. Increasing digital literacy will facilitate the smart education market growth. Smart education enables teachers to meet the needs of students with specific modes of learning. It offers much greater

flexibility to learners and teachers as compared to traditional education, rather one-size-fix-all approach of traditional education. It provides flexibility to students to learn from anywhere, anytime.

Other benefits of smart education include the following [13]:

- Transforming the learning process due to access to more information
- Better interaction between students and teachers.
- Easy to maintain technology tools
- Creates a simplified and solid ground for information sharing
- Nurtures the creative imagination of students
- Chatbots work 24/7 and don't need to eat, sleep, or take breaks
- Save time
- Reduces expenses in terms of transportation
- Reduces the global digital divide between the rich and poor nations
- Familiarizes students and educators with the latest technology
- Provides channels of communication with teachers
- Delivers a personalized, connected student experience through innovative communications
- Scales quickly to meet emerging demands of students, new technologies, and applications
- Reduces operational costs with efficient communications, infrastructure, and new business models

CHALLENGES

Technology is always under question for it is time-consuming and distracting in the classroom. Society is normally resistant to change. The major challenge is that smart education goes against the rigid nature of traditional education. Although the ongoing global movement towards smart learning marks an important paradigm shift in modern learning, many people still find the concept vague. Budget constraint is a major factor hindering the market growth of smart education. The cost of purchase and maintenance of the necessary devices seems to take a toll on the school budget. While many complain that education is expensive, the reality is that ignorance is costlier.

Designing IoT applications for different level students in one class is a challenging issue. As people interact with each other in educational environments, the risks of personal data hacking of educational services should be minimized. Smart education environments are inheriting both security threats from traditional systems and facing completely new threats in the information space. They should ensure the privacy of students. The developers of smart cities should take into account the risks associated with privacy and personal data. There are issues of AI ethics. There are concerns about when and why should robots substitute humans in education. These concerns have forced nations to implement legislative regulations of the conditions and rules for use of robots in various services [14].

CONCLUSION

Education is essential to any modern society and can influence its future. The worldwide digital transformation inevitably has a strong impact on the education system in every nation. Smart education, a concept that describes learning in a digital age, has gained increased attention. It utilizes 21st-century skills by following the latest technological innovations. It has been rapidly developed for transforming education systems leading to engaging empower students and educators more effectively.

Our society is changing rapidly due to emerging technologies and these changes have a direct impact on education around the world. Society in general and the academic community, in particular, should embrace smart learning as a solution to many problems. The governments of several nations are encouraging online/smart education.

A smart classroom is rapidly transforming the way teachers teach and students learn in schools with innovative and meaningful use of technology. Smart classrooms can certainly be the future of education. Learning continues throughout the lifetime of an individual. The educational system must accompany a person almost throughout his life. More information about smart education can be found in the books in [2,15-18] and the following related journals:

- Frontiers in Education
- Journal of Smart Cities and Society,
- Interactive Technology and Smart Education
- Smart Learning Environments
- International Journal of Smart Education and Urban Society
- International Journal for Educational Media and Technology

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Figure 1 The SMART Goals framework is an acronym-based framework [3].

Figure 2 A traditional learning environment [4].

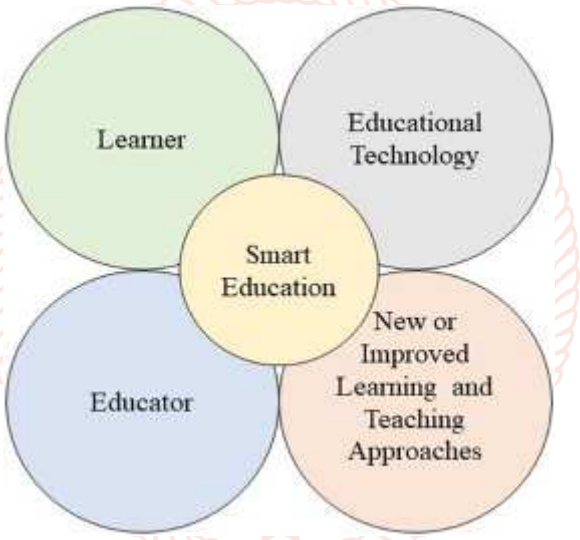

Figure 3 The relationship between smart education, learner, educator, and technology [6].

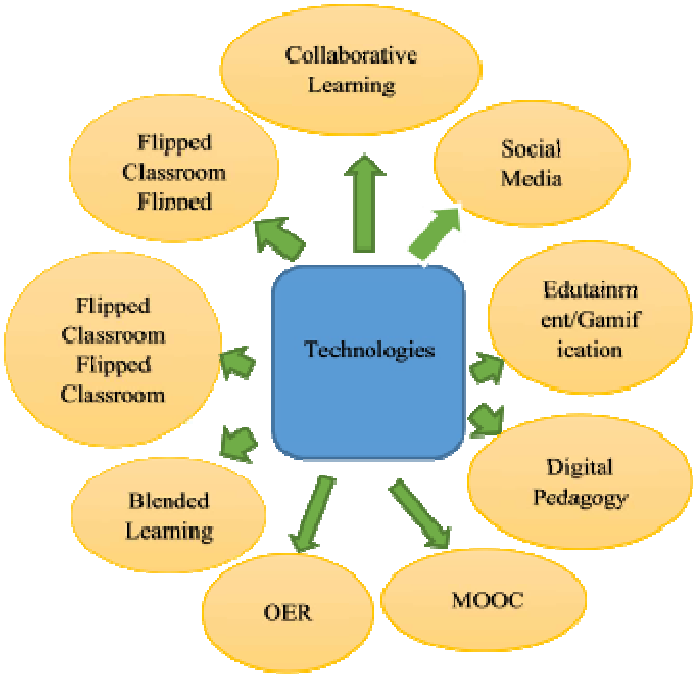

Figure 4 Some technologies used in smart education [7].

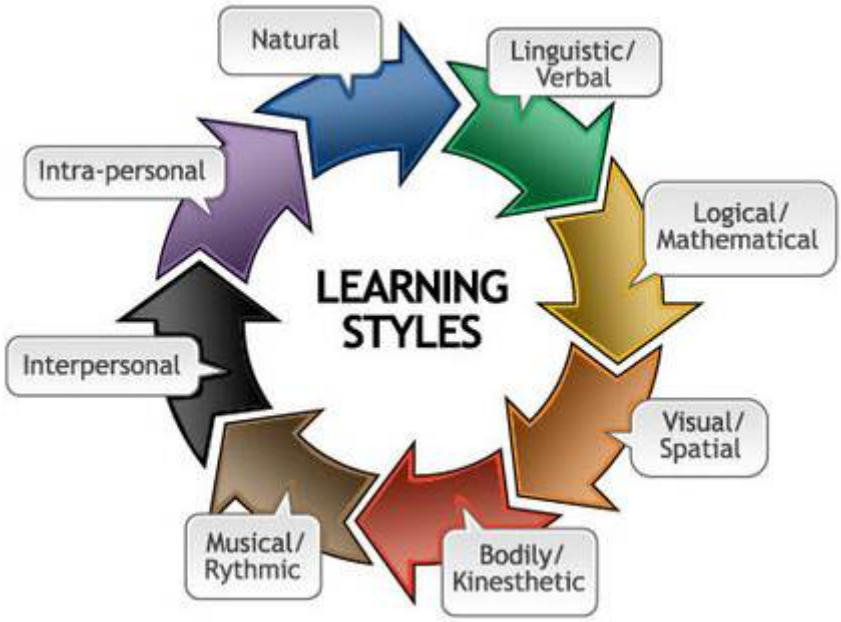

Figure 5 Learners have different learning styles [8].

Figure 6 A typical example of a smart learning classroom [10].