



Emerging Technologies in Education

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Abstract The main goal of education is to impart knowledge and understanding that will form the foundation for lifelong learning. Education and technology have always developed hand-in-hand. Technology has a significant impact on education and society. It has always dictated how we teach and LEARN. It will continue to impact education in the future. Today, we are depending more and more on technologies. Newly emerging technologies, such as artificial Intelligence, 3D printing, social media, and gamification, are being introduced into the classroom. Education is already seeing some uses for these technologies. These technologies will force schools to eventually abandon their conventional modes of learning and teaching in order to align themselves with the times. This paper provides the emerging technologies in education, what they are and what they offer for education.

Keywords technologies, education, emerging technologies in education

Introduction

Traditionally, education has relied on face-to-face strategies. Although these face-to-face strategies have various obvious advantages and have been regarded as the gold standard in education, they require that students must live near a school. In modern times, students demand and need alternatives to face-to-face instruction. Meeting the need may involve using the current as well as emerging technologies such as computers, Internet, mobile technologies, 3D printing, and virtual reality.

In this digitalized global age, technology is everywhere in education. Technology is essentially the organized application of knowledge to solve practical problems. It is sweeping through classrooms as developers create more and more products designed to enhance education. These new technologies are changing how students learn and how educators deliver knowledge. Technologies are making learning and teaching easier than ever before.

Pressure is mounting for institutions at all levels all over the United States to improve student outcomes, reduce rising tuition costs, and engage in educational reform. In response, institutions are embracing technologies that promise to help them do more with less. Some are even using technological tools to recruit and retain students [1].

What are Emerging Technologies?

Technology may be regarded as a collection of systems designed to perform some function. It can help alleviate some of the challenges facing today education system. It is affecting the way we live and act in the society,



particularly in education. In recent years, these technologies have been given various names such as Information and Communication Technologies (ICT), Technologies in Education, Digital Technologies, Technologies for Learning, Technologies for Empowerment, and Emerging Technologies (ETs). Emerging technologies are new technologies that are at an early stage in their development. They refer to resources, tools, concepts and innovations that have a disruptive potential to generate changes [2].

Some of the characteristics of emerging technologies are [3]: (1) they may or may not be new technologies; (2) they change rapidly so are always in a state of coming into being; (3) they go through cycles of hyped expectations; (4) they are in a continuous state of being understood and researched; and (5) they have potential for transforming social practices. Figure 1 illustrates emerging technologies [4]. Emerging technologies are used in nearly every field imaginable such as with education, engineering, medicine, and mathematics.

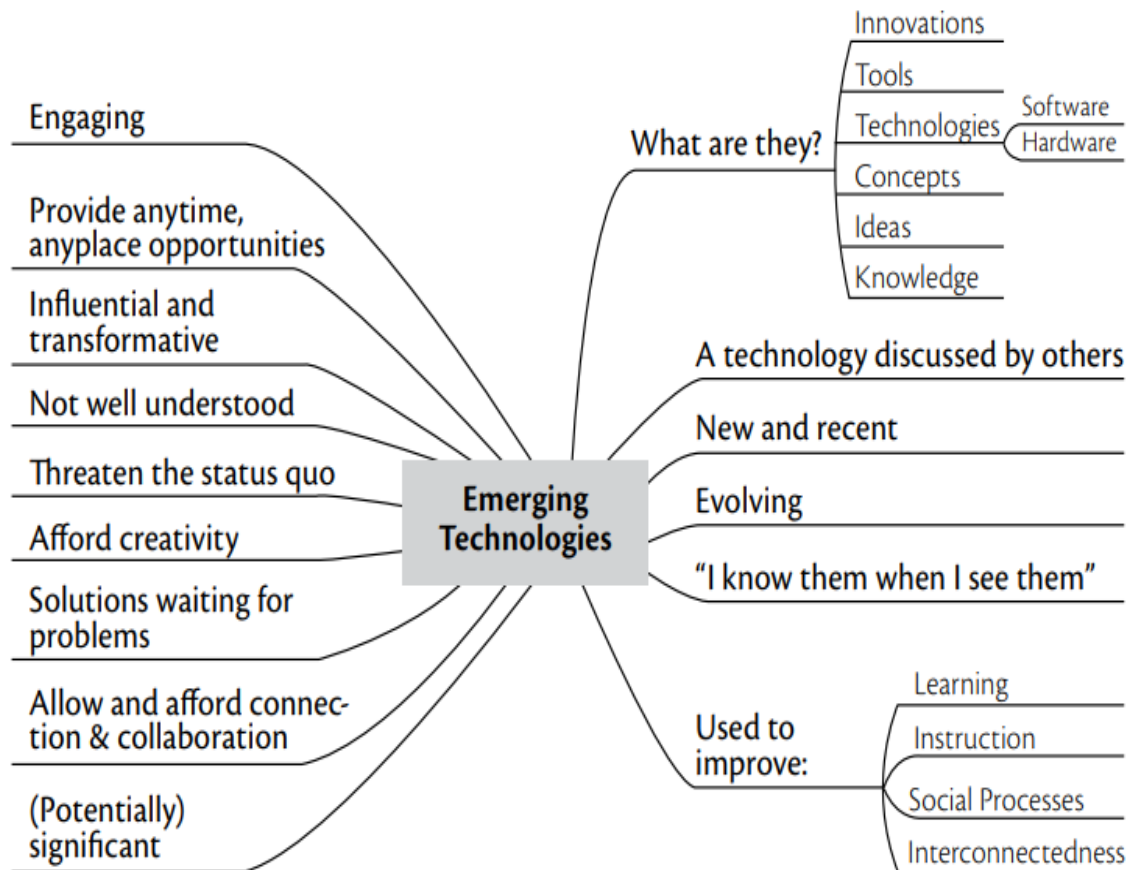


Figure 1: An illustration of emerging technologies [4].

Emerging technologies (ETs) in education are essentially tools, concepts, and innovations used in educational settings to serve various education-related purposes. They are used in different areas in education such distance learning, online education, virtual laboratory, teacher training, language learning, distance education, e-learning, and adult education. They promise to revolutionize the way students and teachers work and interact [4]. These educational technologies try to make learning more efficient, engaging, relevant, and entertaining. They are especially helpful in allowing teachers and students to generate and share academic work. They can have considerable positive impacts on student performance. Many educators' jobs have become easier and enjoyable through these technologies. To understand the true impact of emerging technologies on education, we must consider those who will use the technologies.



Digital Natives

The kind of students who will be using the emerging technologies for learning and teaching are digital natives. Technology has always been at the forefront of education at all levels and at all times. Different devices such as chalkboard, pencil, radio, television, overhead projector, photocopier, and handheld calculator made significant impact in the pre-computer years. Today's "digital natives" are a new generation of students who want all kinds of digital gadgets such as personal computer, laptop, tablets, and personal digital assistants (PDAs) [5].

Digital natives use and understand various digital technologies such as Internet, smartphones, and social media. They know more about these technologies than their parents. They exhibit Internet-related addictive behaviors. Erika Smith, of the University of Alberta, describes eight unsubstantiated claims in the different present discourses on digital natives [6]:

- They possess new ways of knowing and being.
- They are driving a digital revolution and thereby transforming society.
- They are innately or inherently tech savvy.
- They are multitaskers, team oriented, and collaborative.
- They are native speakers of the language of technologies and have unique viewpoints and abilities.
- They embrace gaming, interaction, and simulation.
- They demand immediate gratification.
- They reflect and respond to the knowledge economy.

Some Emerging Technologies

Emerging technologies (ETs) are tools utilized in diverse educational settings face-to-face, distance, online) to serve various education-related purposes. Emerging technologies are paving the way for the future of education in ways we may have yet to see. We can will just come of these technologies [7].

- *Online Education:* Students who are enrolled in online schools do not attend a bricks and mortar school. Both core courses and electives including lab courses can be taken online. Online learning opportunities can increase educational productivity by accelerating the rate of learning; reducing costs associated with instructional materials or program delivery; and better utilizing teacher time. Blended learning opportunities incorporate both face-to-face and online learning opportunities to accommodate students' diverse learning styles. Online universities such as Athabasca recognize the value of online learning and are well positioned to offer a blended education.
- *Artificial intelligence:* The umbrella term of "artificial intelligence" (AI) refers to a set of tools and capabilities like machine learning, expert systems, robotics, and natural language processing. AI is poised to play an important in education as it is expanding to different parts of a school setting. AI harnesses big data, using machine learning, to make predictions and decisions. For example, educational service robots have appeared in the United States, Canada, Japan, South Korea, and Taiwan.
- *3D Printing:* 3D printing (also known as additive manufacturing (AM) or rapid prototyping (RP)) was invented by Charles Hull in the early 1980s. Since then it has been used in manufacturing, automotive, electronics, aviation, aerospace, consumer products, education, entertainment, medicine, space missions, the military, and chemical and jewelry industries [8]. The 3D printer allows students to perfect their design before making an actual prototype. Moving learning from two dimensions (2D) to three dimensions (3D) allows students to consider all sides of a concept. Engineering students could directly benefit from 3D printing technology.
- *Social Networking:* Social networks, such as MySpace, Facebook, Twitter, Facebook, LinkedIn, Pinterest, and You Tube, are part of how students communicate. Many universities have adopted the online virtual world, Second Life to provide students with an online platform to socialize with each other. **Class can be fully connected to social media**, including a Twitter stream, a Google Plus account, and a Facebook account. Many teachers use social media to communicate directly with their students and provide one-on-one attention to student's concerns.



- *Virtual Reality*: The application of virtual reality (VR) in education seems obvious. In education, VR hardware is being used to provide experiences that are hard or even impossible to bring to students today. VR learning experiences will shift the concept of an educational “classroom” to that of a “virtual global class.” Virtual reality equipment will become cheap and high enough quality to provide a comfortable immersive user experience. For example, students in a healthcare (nurses, doctor, dentists, and pharmacists) and manufacturing can expect to see VR being increasingly used for training or learning technology. Use of virtual reality in schools is typically shown in Figure 2 [9].



Figure 2: Use of virtual reality in schools [9]

- *Game-based Learning*: Game play has proved to be a useful training and motivation tool. Students can have fun and learn while they play interactive games. They are already used to playing with YouTube, Facebook, and smartphones. Computer-based games play an important role in the education of students with disabilities. Online sites such as Vocabulary.com provide opportunities for gamification. Figure 3 shows educational game technology [10].

Other newly emerging technologies that may directly or indirectly affect education are distance education, simulations, cloud computing, Massive Open Online Courses (MOOC), augmented reality, 5G, biometrics, mobile technologies, e-textbooks, cybersecurity, wearable technology, automation, and the list is practically endless. Emerging technologies in education all share a similar objective: to revolutionize or reshape the learning process of learning for students. Educators can seek online and offline supports in order to use emerging technologies in meaningful ways.



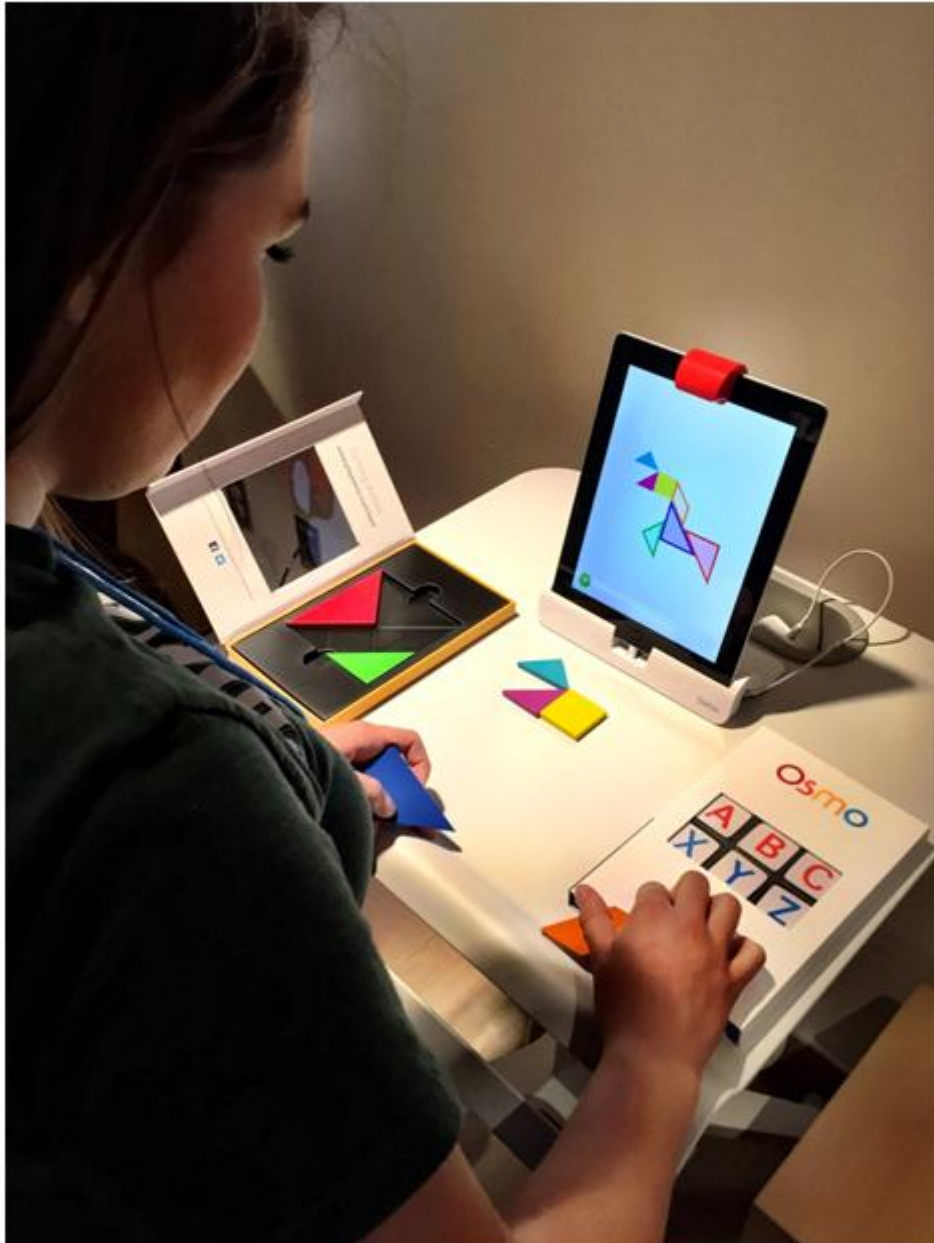


Figure 3: Educational game technology [10]

Benefits

There has been widespread excitement and hope about the transformative potential of emerging technologies in education. ETs transform both the teaching and learning practices. Some of the benefits are presented as follows.

- *Improvement in Productivity:* Technology ushers in changes that help in achieving significant improvements in productivity. It supports both teaching and learning. It can expand course offerings, supports learning 24/7, builds 21st century skills, increases student engagement, and accelerates learning. Online learning has the potential to improve educational productivity, pay less tuition, and reduce the cost of instructional materials [11].
- *Improvement in Computer Proficiency:* Technology increases computer usage and improves computer proficiency. Computer-assisted learning programs have improved academic achievement, especially in mathematics.



- *Blended Learning:* Many educational institutions are adopting emerging technologies to bring high quality educational outcomes to their students and to stay relevant in the changing world. The adoption has enabled them to provide “blended learning” approach to deliver course content. Blended learning incorporates both face-to-face and online learning opportunities to accommodate students’ diverse learning styles.
- *Learning Aid:* Emerging technologies can have a far-reaching effect on teaching and learning. With their laptop, students can access distant experts and archives, communicate with peers, and participate in social media, and be part of virtual communities. Technology better prepares students for their future careers.
- *Equity:* One important aspect of technology in education is its ability to level the field of opportunity for students of all ages, colors, and backgrounds. All students deserve having the best education. Emerging technologies can shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all students. They help in removing barriers, such as race, ethnicity, national origin; sex, and disability, that students face.

Challenges

It is challenging to pinpoint the roles and functions of technologies in education. Claims on what technology can do are hard to verify. In 1931, Thomas Edison falsely predicted that books would soon be obsolete in school and that films would alter education as no other technology had before. The barriers or challenges faced by emerging technologies in education include the following.

- *Change is Hard:* Education is a field that is resistant to change, but technology is leading the educational experience to change. Change is hard, budgets are tight, or leadership cannot agree on the best tools to purchase and use. Technological change is accelerating at an exponential rate. With the rapid evolution of technology, educational capabilities are growing and changing daily.
- *Digital Divide:* Technology can be either inclusive or exclusive. Knowledge and ideas flow in one direction, North-to-South. The digital divide between the technology-haves and technology-have-nots is growing wider and wider. The development of education technology has occurred in a persistent inequality and the process of making it equitable is still evolving. Some parents in rural, remote or low-income areas lack Wi-Fi access and struggle to provide lunch, let alone laptops, for their children.
- *Disruptive Technologies:* Emerging technologies are potentially disruptive. Their potential to transform educational practices is both welcomed by some and opposed by others. Technologies are important and useful, but they are merely just the means to an end. People must take ownership over what they learn, how they learn, where they learn, and when they learn. Lifelong learning requires people must unlearn and relearn as the world changes.
- *Cannot Deliver Promise:* A main critiques of the implementation of emerging technologies is that they have fallen short of delivering on the promise of transforming existing teaching and learning practices. In spite of the inundation of technology within the classroom, critics notice that the role of technology is yet to be determined and there has been virtually no improvement in the learning outcomes of students in the Western world over the past decade.
- *Too fast to Master:* Newly emerging technologies for education are arriving and changing exponentially, too fast for the teachers to keep up. Teachers will always be behind the curve in using these technologies. Yet our students are comfortable with the technologies and clamoring for their use as part of their education.

Global Impact of Emerging Technologies in Education

The newly emerging technologies allow people to collaborate across distance and time.

To remain relevant, academic institutions all levels must respond to global, social, political, technological, and learning research trends. The globalization of education will only be successful only if there is collaboration among nations.



The New Media Consortium (NMC) has been charting the landscape of emerging technologies in teaching, learning, and creative inquiry on a global scale. There is an ongoing collaboration between the NMC and the EDUCAUSE Learning Initiative (ELI), an EDUCAUSE program. Massive online open courses (MOOCs) are online education technology that provide opportunity for every person to learn what he or she wants to learn, in his or her own time, at his or her own speed. Educators across the globe are doing some amazing things with MOOCs. We now consider how emerging technologies are being employed by the following nations.

- *United States:* Education is fundamentally local. A lot has been written about the failure of the American educational system, from pre-K through postsecondary education. Critics argue that the American higher education system has become nothing more than a “failure factory,” with graduation rates even lower than those of high schools. Technology can help alleviate many of the challenges facing American education system. The federal government is making a massive effort to make affordable high-speed Internet and online teaching resources available freely to even the most rural schools [12].
- *South Africa:* South African higher education is currently facing challenges posed by a diverse student population with varied levels of preparedness, multilingualism, and large classes. The educational system is under pressure to provide equity of access to education. Directors of teaching and learning and senior academics at all South African were also targeted.
- *Burkina Faso:* In Sub-Saharan Africa, educators are introducing the idea of using technology as an educational and developmental tool. Education has faced several challenges in the African nation of Burkina Faso, where teachers are routinely confronted with material shortages, lack of equipment, and lack of opportunity for self-conducted learning. To overcome these challenges, educators are using Emerging Learning Technologies (ELTs) to help improve the quality of teaching and to increase student access to these learning opportunities. The education system is divided into the following subsectors: pre-school education, primary education, secondary education, and a tertiary sub-sector [13].

Future of Education

What does the future hold for education? What will classrooms of the future be like?

How will faculty and students interact, collaborate, and leverage technology in the next generation of education? How will future technology change the classroom? These questions, among many others, are often asked in conferences and discussions among educators. Social skills are rising in labor-market relevance. Developing such social and emotional capabilities requires non-conventional approaches to teaching and learning. The future of the workforce influences the future of the classroom. Learners will not be bound by physical address or time of day.

Education is becoming more connected and integrated with an emphasis on the interrelation of subjects and the integration of students. Learning models are become increasingly personalized. Every student is unique and learns differently. Technology lets educators to accommodate the different unique learning styles on a case-by-case basis. Adaptive learning provides learning activities to students, based on their needs and learning style. For example a math education software DreamBox allows students to learn at their own pace. Tailor-made learning models provide students with independence in the classroom [14]. Figure 4 depicts some forces shaping the future of education [15].



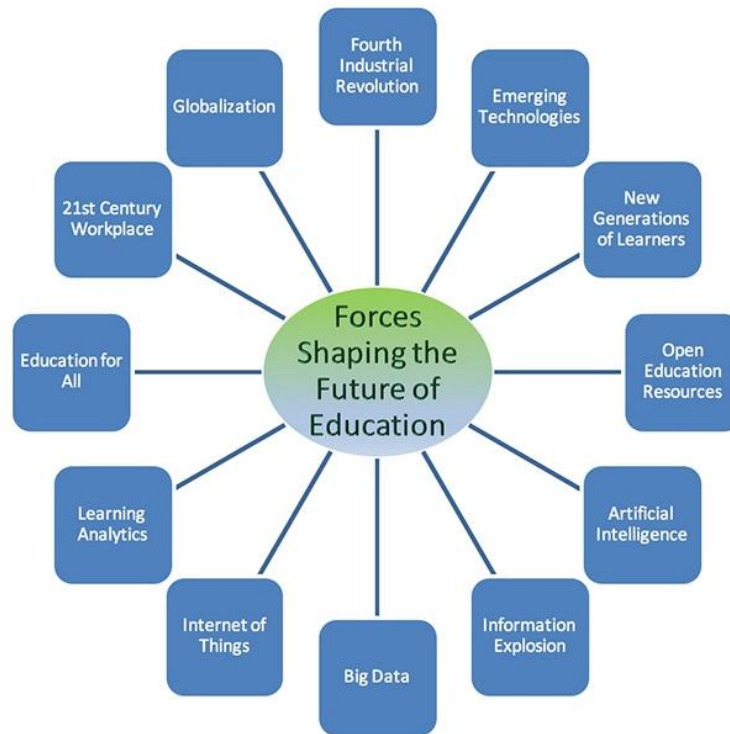


Figure 4: Forces shaping the future of education [15]

Conclusion

Technologies go through natural cycles of infatuation, adoption, maturity, and impact. New technologies rise, gain popularity, and then disappear. Today's emerging technology may be tomorrow's fad. Technology is a tool and is only helpful if it is properly implemented. Otherwise, they can leave us disorganized, frustrated, disoriented or confused.

There is unanimity that technology is unavoidable and vital part of our daily life. Education technologies like the radio, TV, and computer have failed to replace the teacher aided learning. Education will experience a great transformation from the emerging technologies, which are the learning tools for developing 21st-century knowledge and skills. Education technology will bring about social change and better use of resources. Understanding the impact of technologies on education will advance the learning process.

Today, a lot of institutions around the world offer courses on emerging technologies in education and prepare teachers on how to handle the technologies. For more information on emerging technologies in education, one should consult the books in [16-27] and other books available on Amazon.com and books.google.com. One should also consult the following related journals devoted:

- *International Journal of Emerging Technologies in Learning*
- *British Journal of Educational Technology*
- *Educational Technology*
- *Educational Technology & Society*

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