



How will education look like in the future?

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ABSTRACT

There are many factors affecting educational practices. Changes in these factors create serious transformations in education. Some of the transformations are visible that imply a predictable future, while others have blurred influences which make the future forecasts difficult. Educational technologies often come and go but they all leave their marks on education when they are prevalent. In order to get prepared for the future, educators need to know which technologies will be dominant in the future practices of education. This article attempts to highlight the technologies that will be used commonly in the future education. It appears that virtual classroom, artificial intelligence, learning analytics, mobile applications, smart devices, extended reality, open educational resources, gamification, cloud computing, network society, post-truth, digital learning objects, online collaboration will be popular elements of educational practices in the future. On the other hand, social media, metaverse, and wearable technologies will lose their popularity in education to some degree. It is also likely that some of the current technologies will be modified while new ones will emerge to accommodate educational needs of the future.

Keywords: future education, future educational technologies, emerging learning environments, education in the future

INTRODUCTION

Humans have always been concerned about the future. They simply want to foresee the future based on the current indicators. They feel better if they can prepare for the future. Aside from the ordinary people who are anxious about the implications of changes for the future, professionals would like to know what kinds of innovations that the future will bring for their businesses. Furthermore, experts try to forecast the future based on leading trends and orientations in their respective fields of interest. With a similar approach, this article will try to identify and discuss possible futures in education from the point of educational technology. However, several points need to be underlined in advance to set the ground and make the scope of the article clear.

First of all, this article is about the future of education. It is usually the futurists who try to foresee the possibilities in the future. However, they predict the future based on tentative indicators and personal intuitions. They partially rely on material facts or results of empirical research in forming and defending their opinions. They mostly use projections that seem to be intellectually attractive but factually unproven yet. Stated differently, the futurists put forward a mixture of personal and professional speculations rather than sharing solely objective realities.

Secondly, the futurists used to make inferences about the far future in the past but nowadays most of their projections are about the near future. The reason for this is that the speed of changes was relatively slow and things were moderately stable in the past. However, these days everything changes rapidly and

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drastically. Therefore, it is almost impossible to forecast the far future. This is particularly the case when it comes to technology.

Third, the nature of education as a field of practice is largely conservative. Although many developments and innovations emerge related to education every day, most of them cannot find their ways to affect educational practices. In other words, there is a huge gap among the theories, research, and applications of education. This often influences the accuracy of predictions suggested by the futurists. That's why many speculations of the futurists related to education do not come true and we observe that schools continue their traditional practices as usual.

Finally, a futurist is called by various names such as futurologist, prospectivist, foresight practitioner, horizon scanner and the like. The author of this article is not any of them but he as an educational technologist is highly interested in the conceivable prospect of education. With this understanding, the current article will just try to highlight the leading trends in technologies that may be effective in future educational practices. Considering a wide variety of alternatives, only the trends that receive high attention among the educators at the global scale will be selected and highlighted. In short, the main focus of this article is limited to an educational technology perspective, leaving out the issues that may be discussed by other areas of educational sciences.

This article begins by discussing the factors which have obvious influences for the future of education, then it highlights leading as well as emerging educational technologies which may play a dominant role in future education, and finally it concludes by emphasizing what needs to be done for successful technology integration in future educational practices.

FACTORS AFFECTING THE FUTURE OF EDUCATION

What creates or shapes the future of education? There are a number of factors that have serious influences or implications for education in the near future. Some of them have obvious effects that even the general education community around the world is aware of. For example, almost all educators know the impact of the Internet in education. Some other factors, on the other hand, have blurred implications that only hyper-sensitive professionals or highly-seasoned experts of education can identify. For instance, educational technologists predict that artificial intelligence (AI) will produce a lot of learning analytics and they will be very useful for designing personalized learning environments in the future. However, neither the limits nor the range of these factors can be clearly identified and controlled. Nevertheless, we can draw attention to the most distinct dynamics that shape education today and will probably impact it in the future.

Changing Learner Characteristics

Overall composition of learner population is changing dramatically all around the world. The number of individuals attending educational programs, courses or modules increase every semester or quarter they are offered. Both young learners and adult learners take the same courses or attend the same programs together. A considerable number of students work somewhere while they attend the school. This situation has increased the average time of completion for many programs. For example, the majority of students complete a four-year college program in about six years. Multiculturalism is another issue as more students come with different ethnic backgrounds. Heterogeneity is particularly the case in programs or courses which accept international students. Along with regular university courses, a typical massive open online course (MOOC) is taken by thousands of learners from different countries representing a variety of cultures. Such a situation creates an intriguing environment which has both beneficial and detrimental effects for learning. This requires a global understanding or intercultural awareness for educators. It is also true that today's students are more technology-oriented. They are active users of digital technologies, more so when compared to the instructors. Besides, the new population of learners are more likely to take personal responsibility over their own learning. This highlights the concept of lifelong learning and flexible learning either as the principal or supplementary mode of learning. This situation creates high demand for seamless learning that rely heavily on open and distance learning technologies.

Facilitation Role of Instructors

The concepts of teachers, instructors, and trainers lose their importance. Instead, the terms such as facilitators, mentors, guides, and coaches gain significance. Moreover, instructors are demanded to be available both face-to-face and online. They are expected to answer students' questions or provide feedback more than lecturing or presenting information. Learners can have access to educational resources to get information, but they need to uncover, interpret, and enhance information with the help of educators. Educators are perceived as "guide on the side" rather than "sage on the stage" for each student. They are intended to provide flipped learning experiences integrating both within-the-school and outside-the-school experiences. Such an approach will put the learner into the center of the learning process and assign supportive responsibility for the educator. Unfortunately, a vast majority of teachers are not trained and equipped with this kind of understanding so that they face tremendous challenges as a consequence of such a paradigm shift in education. However, they have to learn how to cope with such challenging transformations. Otherwise, virtual environments incorporating smart and sensitive technologies such as cognitive tools, artificial intelligence, and social robots will serve better than human instructors. In short, delivering information is not considered a human activity anymore because technology can do a fabulous job in this regard based on alternative sources and data-processing power. Instead, human educators should focus their efforts more on the deliberation process which is a unique task that technology can do very little about, at least for the time being.

Emerging Educational Technologies

The role of technology is highly critical. Technology is not a mere vehicle of instructional delivery anymore. It facilitates the learning process. Interactive, participatory, adaptive, integrated, and collaborative nature of current technologies change the very spirit of instructional situations. Technological developments never stop; technology either renews itself all the time or provides new applications that enrich learning. Instructional design efforts are often based on emerging technologies so that the novelty effect frequently creates high level excitement and motivation among learners. However, instructional designers are aware that "it's not the technology but the strategy" that improves learning performance. Therefore, educators should not take the illuminating features of media as the basis for their arbitrary use in the classroom but think about how to integrate the most appropriate media for effective, efficient, and engaging learning experiences. They should also keep in mind that demand characteristics of media as perceived by learners have serious impact on learning. One thing is clear: Emerging technologies will continue to come and some of them will dominate the future practices in education. Thus, we should always consider the promising aspects of emerging technologies regarding all domains and levels of education.

Participatory Pedagogical Approaches

Traditional teaching approaches are not effective anymore. Even when they are effective from the achievement perspective, learners do not find them appealing or engaging from the motivational perspective and this causes academic disinterest in many students. Dominant pedagogical approaches have been developed for presenting/delivering information but not for constructing knowledge together with students. In other words, typical pedagogical applications employed in schools are behavioristic and teacher centered; thus, they are frequently insensitive to learner characteristics or individual differences of students. Furthermore, we can even claim that they do not accommodate common needs and demands of learners. It seems that the domain of teaching is considered more of a priority than the learner. Thus, instructional strategies that involve interactivity, gamification, decision-making, collaboration, creativity, and problem solving are becoming more popular in the recent designs of learning environments. It is expected that such participation-based components will play a greater role in the future of education. Emerging technologies either force or pressurize in this direction.

Declining Power of the School

School is not really at the heart of learning activities anymore. Learners can learn anytime and anywhere via technology. In this respect, learning is free of time and space. Open and distance learning is provided by any kind of establishments including public and private enterprises such as universities, schools, corporations,

partnerships, organizations, communities or groups. Distance learning provides open, flexible, autonomous, and limitless educational resources for all learners. This implies that anybody can learn anything from the Internet so there is no need for the school as an institution. This in fact represents an illusion because education and learning are two different things. The school is more or less the same in all countries: It represents a fully-instructional, partly learning-oriented, and less of an educational institution. If learning may take place anytime and anywhere, organizational characteristics of the school – in the limiting sense – will not be a key variable in designing and providing learning experiences for the future. This will somewhat free education from the political pressure of the government. Then, education may play its long-dreamed empowering role for learners from all segments of the contemporary society.

Social and Political Aspirations

Social changes and transformations have always had great influences on education. The modern society is undergoing a number of severe changes. Well-educated individuals may understand and adapt to these changes in a healthy manner than less-educated people. Therefore, almost all governments have expected the ground-breaking role from the school to educate its citizens toward the anticipated needs of future times. Being a political instrument in the monopolistic hands of the government, the educational system has to be sensitive to social and political desires to transform the citizens. History is full of educational reforms done with this understanding, and it appears that the same mechanism will continue in the future. However, the citizens will be less dependent to formal education in the school than the previous decades because alternative educational resources will decrease the impact of school-based practices as socio-political interventions. Many governments around the world have already raised their concerns that they are losing their control over young generations because the largest portion of education takes place in virtual environments which cannot be controlled as easy as the school. Nevertheless, social and political aspirations of a society as imposed by the government affect how education will look like in the future.

LEADING TECHNOLOGICAL TRENDS IN EDUCATION

Based on the problems of current educational systems, promising features of emerging technologies, supporting social structures, and needs of the future society, it appears that certain technologies will be prevalent in the future of education. Although they vary enormously, the following technological trends are expected to be fairly visible in educational practices around the world in the near future.

Virtual Classroom

“Brick and mortar” institutions are losing their weight. “Click versus brick” applications are gaining momentum. Depending upon the potential of the emerging technologies, virtual and cyber environments are replacing conventional classrooms. This trend will continue, and more learners will take advantage of these technologies in future education. The recent pandemic showed that the virtual classroom, regardless of the supporting platforms, is preferred over physical classroom by the majority of teachers and students. The e-learning market size surpassed \$315 billion in 2021 and it's projected to grow by 20% annually from 2022 to 2028 (Debetaz, 2023). It is even a usual expectation of learners that at least some courses in degree-based curricula will be offered online. It seems that virtual classrooms will be the new normal of education. However, it will force teachers to change how they teach.

A number of platforms, which promise students a high-quality education through a subscription-based learning model, have increased significantly since 2020. These platforms provide recorded sessions, lectures, and study materials for learners' convenience, allowing them to access their knowledge whenever it is feasible. Typically, access to the courses and study materials is granted for a monthly or annual price. These systems are particularly useful for the disadvantaged groups and appear to expand in the future.

However, there is no commonly-used virtual classroom application which is developed specifically for educational practices. Instead, educators are obliged to use several applications designed for business meetings or communication processes. Consequently, their architecture and structural components are not good enough for educational activities. Both teachers and students have used whatever are available or make necessary adjustments toward their purposes. This, of course, creates complications from the point of

educational effectiveness, appeal, and efficiency. We hope that a number of virtual classroom applications will be developed for educational practices in the future, and they will meet the needs, wishes, and demands of both teachers and learners.

Artificial Intelligence

Human brain has limited power. Computers and similar technologies have proven to be more powerful than humans in certain operations, particularly algorithm-based functions. Educators have tried to take advantage of this information-processing or computing capability. Recent efforts have focused on the use of artificial intelligence in various operations in education. AI applications vary from keeping student records to analyzing their responses, explaining a phenomenon to arguing with the user, designing new artifacts to making functional suggestions depending upon the context. Endlessly-competent artificial intelligence has made omniscient and omnipotent educational practices a reality. Now enormous amount of data may be collected, stored, recalled, analyzed, and re-generated through artificial intelligence. As a simple example, *ChatGPT* application has caused tremendous treats to the current paradigms of education including their peripheral extensions.

Artificial intelligence represents a virtually-unprecedented revolution in the history of educational technologies as it characterizes the ability of machines to perform tasks that are typically associated with human intelligence. Perceptions and attitudes of educators toward artificial intelligence vary. Depending on their self-efficacy ranging from simple exposure and to purposeful experience, they may be ignorant, afraid, resistant, excited, supportive, devoted etc. More and more educators tend to learn about the potential of artificial intelligence, try it for personal curiosity, and integrate AI-based applications into teaching. However, as the diffusion of innovations theory suggests (Rogers, 2003), the more knowledgeable the educator, the more he/she takes the advantage of artificial intelligence.

Artificial intelligence will continue to tailor learning experiences to individual needs and adapt content as well as pace to optimize learning. We predict that artificial intelligence will play a greater role in educational practices in the future. Such applications will be instrumental to detect learning problems, develop individualized solutions, give functional feedback, provide the most appropriate materials, motivate learners in a friendly manner, help educators deliver instruction effectively and efficiently, shorten academic learning time, encourage the use of various learning strategies, evaluate the outcomes fairly, and contribute to retention of learning. These are just a few possibilities based on early indicators that we have observed. Artificial intelligence is the next big thing to shake up the education industry. The global size of the AI in education market is estimated to advance from \$2.13 billion in 2022 to \$25.77 billion in 2030 (www.psmarketresearch.com, 2023). It would not be a utopic dream to foresee that artificial intelligence may provide self-sufficient learning experiences from early childhood education to post-doctoral work without any teacher intervention. Machine learning and deep learning are highly encouraging in this regard.

Artificial intelligence has also serious drawbacks. It uses an incredibly large database, and it is remarkably fast in doing so. It cannot update its data quickly so that outdated data may cause problems. It has a machine logic and has no feelings, which is a critical ingredient in education. It functions based on patterns and algorithms but no good in heuristics. It is not always consistent because it provides different answers to the same questions. It may also be convinced or misled by strong counter arguments in a conversation. It is not capable or has limited capacity in providing visual responses. Considering all these limitations, artificial intelligence alone is not a fully-reliable source for learning. It may be used as a supplementary educational tool or be integrated into social robots to provide humanly learning experiences in the future.

Learning Analytics

Everything is data in the information society. There is even a term called "datafication." Data may be related to all aspects and dimensions of education. Computerized systems save the data, analyze the details, generate new data, and use operational data as the basis for various kinds of decisions in education. This process may go through openly or invisibly. When decisions are made based on relevant data, they may be more appropriate and contribute to accuracy as well as functionality. Today all services in education require data ranging from administration to counseling, instruction to assessment, and recruitment to placement. Range and density of educational services using big data will increase in the future.

All data regarding learners' choices, decisions, accomplishments, failures, attitudes, responses, movements, behaviors, needs etc. may be stored and analyzed toward the purpose of understanding and serving them better. Learning analytics in this regard has recently been popular in a number of educational applications. The market for big data analytics in education was valued at \$13.58 billion in 2020, and it is expected to reach \$57.14 billion by 2030 (Allied Market Research, 2021). This trend will continue in the near future and computer analyses will force educators to shed light on the dark or invisible side of instructional processes. Such a momentum will speed up the efforts toward accommodating individual differences better by providing adaptive learning experiences. Learning analytics will guide educators in making informed decisions about curriculum, teaching, and assessment.

Educators need a variety of data in designing, implementing and evaluating instructional systems. In fact, the whole instructional design process is based on collecting operational data and employing such data in an iterative manner. By doing so, we establish a strong rationale for instructional applications, obtaining valuable feedback for teaching and learning processes, and making revisions that may be needed to guarantee the effectiveness, efficiency, appeal, and sustainability of instruction. All these procedures require functional data gathered automatically by the technologies used as learning environments. A learning management system (LMS) serves this purpose without increasing the burden on the shoulders of the instructor. This is particularly important in open and distance learning because educators and learners do not meet face-to-face due to physical distance between them, and this results in the lack of verbal and nonverbal cues in educational communications. In other words, LMS will decrease the likely disadvantages of physical proximity in the learning process and create more opportunities to increase the likelihood of social presence. Therefore, we expect to see more and varied uses of LMS in the future of education.

We need learning analytics that cannot be collected by educators during a learning experience. This may consist of communication data including non-verbal cues in the teaching and learning process. A camera may record all the necessary data and a connected computer with an AI application can analyze functional data quickly. The educator may benefit from this analytical feedback in improving instructional processes that he/she manages. It seems that conventional text-based data kept by a regular computer will not be good enough to provide unknown or unattended information for educators. That's why we need revolutionary learning analytics in various forms in the future.

Mobile Applications

Most people have a kind of nomadic life-style in the modern society. People are born in one place, go to school in another, work in a city they have never seen before, and live in a location far from their workplace. People commute on a daily basis for various reasons. However, they need ubiquitous communication to feel connected with the world wherever they go. Thanks to the recent developments in mobile technologies, it's not just a dream anymore.

Along with some others, mobile technologies (i.e., phones, tablets, and laptops) allow people to have access to information anytime and anywhere. This reality represents exceptional opportunities for education because individuals can experience lifelong learning via mobile tools. Mobile learning (m-learning) has become a widespread practice of school education, corporate training, and lifelong learning. It appears that this trend will be widespread in the future and millions of learners from all venues of life will take advantage of m-learning.

Of course, m-learning has both advantages and disadvantages. Besides the well-known problems such as mobile addiction, nomophobia, and mental distraction, there are some interesting research findings. For instance, mobile technologies have affected brain functions of new generation of learners. A Microsoft study conducted in 2015 among 2000 young Canadians reported that since the year 2000 (about when the mobile revolution began) the average attention span of a person dropped from 12 seconds to 8 seconds. On the positive side, the same report indicates that ability to multitask has drastically improved in the mobile age (cited in Keshirim, 2023). Despite the potential pitfalls, the uses of mobile technologies will be much more common in all countries, and they will be very instrumental for particularly open and distance learning.

Smart Devices

Technology was often considered an “aid” to teachers in conventional education. It was partly attributable to its supplementary nature. The teacher was at the center of educational practices and the technology was utilized to increase the performance of the teacher. However, current technology is much more superior due to its extraordinary capacity. Contemporary technology had the potential to replace the teacher in delivering information to various audiences. Smart technologies may even present information adaptively by demonstrating incredible sensitivity to individual differences of learners.

As the technology has cultivated over decades, it has changed how teachers relate to their students, classrooms, and subjects. With a wealth of information at their fingertips, students today have rich tools they need to uncover a tremendous amount of knowledge on their own. In this environment, many students value less of a top-down delivery method. Instead, teachers now function more in a facilitative role. Their job has evolved into a position where they help students understand how to learn and uncover the information they find in alternative sources (Debetaz, 2023). Of course, they frequently spend time to confirm the accuracy of information obtained from various sources.

Smart devices such as social robots, wearables, smartphones, AI-powered applications, and many other tools extend digital spaces and transform educational environments. Under such circumstances learners expect that the technology will diagnose their needs and provide the optimal instructional contents for each user. Students also think that they can learn almost anything from smart learning environments. They even value these devices more than their teachers as they are more handy and friendly. We can foresee that particularly network-based smart technologies will be more popular, widespread, and convenient in the future. It would not be a surprise if we see smart technologies running not only smart/virtual classrooms but also smart/connected cities with great success.

Extended Reality

The nature of reality has long been discussed. Some philosophers have advocated material reality, while others have believed in metaphysical reality. Today the discussion has shifted to physical versus virtual reality (VR). New media, even the textbook, help us to combine multiple versions of reality to present immersive experiences. In this regard, we can talk about infinite reality (Blascovich & Bailenson, 2012).

In general, virtual reality immerses the user in an environment, while augmented reality (AR) enhances his/her environment. However, they both offer immersive experiences that help learners explore historical events and scientific concepts in an engaging and interactive manner. For example, students can visit an ancient civilization and learn about historical facts by using virtual glasses or conduct a chemistry experiment in a virtual laboratory. Virtual technology is also used to train doctors to perform a surgery, offer museumgoers a deeper experience, provide a more enjoyable involvement for visitors of theme parks etc. It is estimated that 14 million AR and VR devices were sold in 2019. This market is expected to grow to \$209 billion by 2023 (Duggal, 2023). According to a Market Research Future (MRFR) study, the market for AR/VR in education is expected to increase about 18% between 2022 and 2027 (VdoCipher, 2023). Of course, this trendy technology will require a lot of professionals with specialized knowledge.

Extended reality (ER) is probably the most complicated form of reality. It comprises all the technologies that simulate reality from virtual reality, augmented reality to mixed reality and everything else in-between. It is a significant technology trend as we all crave to break away from the real boundaries of the physical world (Duggal, 2023). Social presence in cyberspace or metaverse will probably be more important than physical presence in the real world. Therefore, the spectrum of educational experiences offered in/through digital worlds will be enlarged seriously in the future. Consequently, how instructors teach, and students learn may be considerably transformed by using ER applications in education. Typical examples include STEM education, medical simulations, industrial training, flight simulators, arts and humanities education.

Metaverse

The term “metaverse” comes from ‘meta’ (meaning beyond) and ‘verse’ (meaning universe), implying “beyond the universe.” Metaverse is a collection of every virtual world built using blockchain technology. It is not a single place, rather it is the aggregate of the new digital spaces that some people call “the next iteration

of the Internet.” It is a commonplace for all elements including media companies, music publishers, game developers, sportswear brands, rock stars, cryptocurrency platforms, education providers, movie makers, art galleries, realtors, rappers, Smurfs and so on. In a sense it mirrors the real world that is familiar to us. Considering the most recent applications, you can travel through a network of virtual landscapes with a single identity without facing any obstacle across various cities and countries. Some popular games (i.e., Pokémon Go) even speak of “real-world metaverse” because they add virtual elements to the physical world with the help of the mobile phone camera without the need for specific devices. However, there are hundreds of metaverse platforms, and they all have different policies. Some platforms serve as gateways to the metaverse granting users the ability to manifest as an avatar inside the metaverse, while some platforms (i.e., entertainment places) build their own sections in metaverse and monetize the entrance. This makes it clear that there is no single person or organization that has complete control over the metaverse imposing its own policy.

Is there really another universe of things which is different from the physical world that we are familiar with? For example, we live in Istanbul, and we are acquainted with the landscape, Bosphorus, European and Asian sides, streets, parks, buildings and so on. We think that there is only one Istanbul, and we live based on this assumption. However, there is another, alternative or virtual Istanbul in metaverse. People even sell and purchase certain parts of the city. This is not a joke because they use bitcoin (eventually real money) for such transactions. These people assume that we can live in the world that the metaverse represents.

If that is possible, can we complete our education and obtain an accredited diploma from the most prestigious universities of the world via metaverse? This idea may find its supporters and thousands of people may attend the Ivory League colleges in metaverse. On the other hand, their diploma should be recognized by the authorities in the physical world. This appears to be necessary in the near future, but direct recognition of diplomas or transfer of credits may take some time, if ever possible.

It is true, however, that metaverse was much more popular and promising several years ago. Many technology-envy people were very excited about the prospect of metaverse. They used to believe that the movement of metaverse would be widened soon, and we were going to have an alternative world available in cyberspace. They even projected that metaverse would create a \$800 billion market by 2024 (Lopez, 2023). It seems that the potential of metaverse in education is overstated since it caused more dreams than realities. Nowadays the noise that metaverse has created appears to slow down silently and the decline will continue in the near future, although cyberspaces promoting popular culture elements such as virtual games may still be common in the educational world.

Open Educational Resources

When introduced about two decades ago, the open educational resources (OER) movement challenged the conventional school-based formal education systems. Several well-known universities in the United States provided free educational resources for everyone around the world. They both opened up their existing course materials and introduced newly-developed learning resources through the Internet. Their leaders announced that this movement would contribute to access and equity supporting particularly the disadvantaged groups of learners as well as vulnerable universities.

Although OERs are not constrained to learning materials, MOOC movement is the most common example of open educational resources. It is all over the world, and millions of learners (formally or informally) attend MOOCs in various countries including both wealthy and poor nations. The variety of distance learning platforms has led to an increase in participation in MOOCs. In 2020, approximately 180 million students (excluding China) attended 16,300 courses in 950 universities worldwide. Participants were distributed to 67 MOOC-based degree programs and 1,180 micro credentials (Shah, 2020). The underlying philosophy of the OER movement is to provide free learning resources for all individuals by considering them universal learners who are eager to learn from certified or endorsed resources provided by reliable institutions.

One clear aspect of the OER movement is that everybody is sharing information resources through the Internet whether the information is accurate, malicious or supportive of a hidden agenda. Therefore, the learners are expected to develop certain skills to differentiate which information is scientifically correct or intellectually reliable. Moreover, against the common promises, many MOOCs are usually low-quality from

the point of instructional design, the completion rate is less than 10% on average, credits earned through MOOCs are not often recognized, and their contents are not sensitive to individual needs of learners. However, more schools appreciate the potential contributions of MOOCs to education, and they attempt to take advantage of them as supplementary materials (Simsek, 2015).

Gamification

Games are exciting activities. Being a part of a game and having good time generates motivation. Learning certainly requires motivation; assumingly intrinsic one is better. Many people think that learning is a serious activity. However, this very seriousness creates anxiety or scares many learners, ultimately causing the lack of desire and dropout rate. Educators have recently developed remarkable interest in games that serve as a mediator and active ingredient of learning. A burgeoning number of classroom activities have been developed based on various gamification strategies.

It appears that more and more educators advocate gamification in a number of subject matter areas and this trend will continue in the near future. Gamification will be integrated more extensively into educational practices, using game elements and mechanics to motivate students, increase participation, promote social interaction, and enhance knowledge retention. According to 67% of students, gamified learning is more inspiring and engaging than standard classrooms (Finance Online, 2023). However, whether gaming generates and maintains higher academic achievement is not clearly known because research evidence is inconclusive or mixed at best.

Research generally suggests that gamification creates dopamine in the brain, which makes learning more pleasurable and enjoyable. Gamification increases the chances of the practical application of educational concepts because it encourages learners using their imagination to solve problems and complete tasks. It also affects the roles and responsibilities of instructors. Through gamification, teachers are turned into learning coaches or guides who connect game components to real-world applications of subject matter areas (Debetaz, 2023). Such a critical transformation requires proper training that will help educators gain an understanding of gamification of various tasks that apparently have nothing with games.

Cloud Technology

Memory capacity is critical to save, keep, and retrieve data. Much of the data that we use commonly are multifaceted and hyperlinked. Big data requires large memory capacity. No single medium has enough capacity to save all the data that a user needs. Therefore, a large memory capacity has been considered an external component of computerized systems for several decades. Cloud computing provides extreme amount of data storage. It appears that educational contents will be stored through cloud technologies and activated as needed by learners. This may be done in a multimedia or hypermedia format which allows to create the contents based on various symbol systems and link them in a directly accessible and interactive manner. Educational institutions, instructors, and learners may use cloud technology as a repository of learning resources for a variety of purposes. However, privacy and data safety are still a concern for cloud computing.

Many schools around the world use cloud technologies as portals for flipped learning, where a huge number of educational materials are provided through cloud computing. This type of learning involves that educators record structured content for students to study at home, students come to the classroom with some knowledge of the subject matter, and the classroom time is spent to further their knowledge through theoretical elaborations and practical activities. Flipped instruction allows students to review the assigned materials at their own pace, identify the topics that need elaboration, and conduct research if necessary. It aims to increase student engagement, generate academic interest, share personal views with others, use the class time efficiently, develop advanced skills, and promote achievement.

As a recent and popular extension of cloud computing systems, blockchain technology may provide secure and verifiable methods of storing, retrieving, and sharing educational materials, credentials, certificates, records, and accomplishments. It allows students to own their achievements and share them whenever they want, simplifying the verification process and saving institutions time and money. Through this technology, alternative credentials (a la carte learning) in education may be more fashionable in the future due to the

current situation, in which there are more and more online courses, seminars, and workshops in asynchronous formats (Villanueva, 2022).

Network Society

Castells (2010) points out that the power lies in networks rather than states, groups or individuals in the contemporary society. The networks are prevalent both in social and personal lives. If the combination of traditional and digital media networks dominates all aspects of our societal systems, it is called the network society. van Dijk (2012) claims that the inclusion principle works, and nobody can escape from networks so that people do not want to be out of networks due to advantages that they provide for sustainability and meaningfulness of life.

A visible implication of the network society in education will be blended learning. Neither face-to-face instruction nor online instruction will dominate the future education. Also, students do not want to complete their education relying fully on either format (Simsek, 2015). A third way seems to be needed. This new alternative may be implemented in two ways. The first will be blended learning. This means that course design will incorporate both face-to-face and distance teaching. Within a course, some subjects will be taught face-to-face, while others will be taught online depending upon the nature of the subjects or topics. These two modes will be integrated carefully to maximize the benefits for learning. The second approach will be hybrid instruction. This is not the same thing with blended learning. This involves face-to-face delivery for students who are present in the classroom, but physical teaching will be broadcasted live for those who are not available in the classroom. In this sense, hybrid teaching is basically in-class teaching while extending instruction to students who attend the class in distance.

Blended learning requires serious instructional design efforts to integration of various modes of delivery, but hybrid learning is limited to using technology to provide access with those who cannot come to the classroom. Blended learning is a serious business, whereas hybrid learning is a practical approach to include more participants. In either case, the combination of physical and virtual environments will become more common, with students and teachers interacting seamlessly through a combination of face-to-face and online experiences.

Seamless learning is another outcome of the network society. Because the combination of traditional (physical) media and new (digital) media will be dominant in all venues of life, access to educational opportunities will be possible anywhere and anytime. This will encourage individuals to benefit more from educational opportunities. Consequently, the difference between formal and informal learning experiences will disappear so that the quality will determine the value of education. Functionality, engagement, and benefit will be the underlying issues. According to a recent survey, 90% of employees prefer a microlearning approach to training, where complex concepts are broken down into smaller and more manageable portions (2-10 minute multimedia lessons) using the nano-learning approach, often known as bite-sized learning (VdoCipher, 2023). The crucial point is that people will be using various technologies to attend or receive education, and this will continue as a lifelong process. Out-of-school education will be as functional as within-the-school education. Short, skill-focused, flexible courses and micro credentials will gain power, allowing learners to acquire specific competencies throughout their lives. This will increase the demand for seamless learning in the future.

Post-truth

Today the reality has to compete with the perception. As often emphasized, one's perception is his/her reality. However, perception is a subjective and delicate concept. It can be constructed and changed quickly. Many factors affect this situation. Stimulus material, which is mainly information, comes from a number of sources. The government, political parties, non-governmental organizations, the school, marketing channels, media, influencers, the family, religious institutions, opinion leaders, international organizations, intellectuals, friends etc. share information with us on a continuous basis. Some of these sources are reliable and provide accurate information, while others are unreliable and purposefully distort the reality.

As coming saying goes, information is power. If so, everybody wants power at his/her hands. With the current technology, individuals, organizations, and states know that they can hide or exaggerate selected information to create the intended perception which will support their status, ideas, and stance. When the

reality is not on their side, they produce and share their own versions of the reality so that they can cause questions, fallacies, doubts, and even chaos. This is called perception management. Individuals in the modern society is pretty weak against such organized manipulations. This is more so on the Internet, social media, and even artificial intelligence applications. When the reality is manipulated, there are always differences among what really happened, what is presented, and what is perceived by the individual.

Then, it becomes a challenging task to differentiate between the correct information and the incorrect stuff. Dirty, biased, obsolete, political, incomplete, distorted, and fake information is everywhere. This chaotic situation eventually results in post-truth, a term accepted as the word of the year in 2016 by Oxford Dictionary. Post-truth means relating to circumstances in which people respond more to feelings and beliefs than the facts. Particularly young and not-well-educated individuals have trouble to find the current, truthful, and sufficient information to avoid pot-truth. This makes the conversion of information to knowledge much more difficult, which is already a challenging task.

Today's learners should develop critical skills regarding how to cope with disinformation. The post-truth is clearly the enemy of the truth because people are less influenced by factual information than by emotions or beliefs (Mcintyre, 2018). Education needs to promote only the truth nothing but the truth. This need will be more desperate in the Internet age so that digital literacy skills should be at the center of educational processes at least in the school. All stakeholders of education should be concerned and mobilized to produce effective solutions for this problem since it undermines the whole idea of schooling, which is perceived to be more dependable compared to other alternatives.

Digital Learning Objects

Digital technologies (i.e., the Internet) provide global opportunities for all aspects of life. Numerous services are available on digital platforms. Humans buy/sell goods, pay/credit money, post/share comments, support/criticize ideas, send/receive messages, organize/attend activities, vote/elect candidates, design/evaluate products, travel/visit touristic sites, observe/perform operations, command/control vehicles and so on. The Internet alone appears to have an endless spectrum of goods and services. Moreover, not only human beings but also machines, artifacts, interfaces, agents, and avatars can do all these through digitalization.

Digitization and consequently the Internet of Things (IoT) are the essential phenomena behind the operations in virtual or cyber environments. It appears that IoT is a new world, and it requires a new language. There are three interrelated dimensions of this language as applied to education (Dieffenbacher, 2023). First, physical or analog data such as paper documents should be converted into digital formats (digitization). Then, digital environments should be used to improve educational processes to produce value for learners (digitalization). Third, digital technologies should be integrated into all aspects of education (digital transformation). When the described cycle of operation is completed, each learning object gets a digital identity, and by using this identity, we can access to the target objects and use them multi-purposefully in a modular fashion wherever we need.

Digital environments consist of ample number of educational materials in all subject matters taught in the school. IoT plays the biggest role here as a digital repository of learning objects. It will be more popular in the future both for educators and learners. It will provide a wider spectrum of educational services in the virtual environments with a particular emphasis on digital access and equity. It may be a ruthless exaggeration that the Internet contents will continue to be digitalized and the Internet as an alternative world of existence will be more vital than the family and the school as an educational agent. Families already complain that children spend extended hours on digital platforms for various activities; they even live and act like cyborgs. Unfortunately, neither educators nor parents know how to help children in this matter. We should expect that this problematic situation will be deteriorated and trigger many abnormalities in the future, if necessary measures are not taken.

Online Collaboration

Education is a social process even in the cyberspace. Learners interact with each other to accomplish both mutual and individual goals. Traditional technology paradigm in education often assumes that students work on computers individually. This may bring a few advantages, but it is detrimental for many points. Therefore,

collaborative use of technology has gained momentum in recent years. Collaboration has beneficial effects both for educators and students, or for the society at large.

Online collaboration happens when individuals use a digital meeting platform to work together on certain tasks from various locations. Team members participate in the collaborative work from different locations in distance, but they interact with each other through an online program such as Skype, Microsoft Teams, and Zoom. Online collaboration may be synchronous (group members join the team work simultaneously) or asynchronous (team members don't work at the same time).

Online collaboration, when successful, is based on collective intelligence. In general, collective intelligence is the body of knowledge that grows out of teamwork. When people work collaboratively in small teams, they create synergic intelligence that cannot exist at an individual level. Getting information from alternative sources, discussing them in the group, generating solutions, making joint decisions, reaching consensus, motivating each other, and evaluating the work done together all contribute to collective intelligence. It appears that online collaboration will be a common practice in future education. However, educators should not equate collaborative work with traditional group work. Online collaboration should include the basic elements of positive interdependence, individual accountability, promotive interaction, social skills, and critical evaluation of group work. Similarly, potential problems such as social loafing, free ride, domination of the group, sucker effect, and dysfunctional split of task should be avoided for successful collaboration (Simsek, 1993).

Community of knowledge (also known as community of practice) is a special form of online collaboration. In recent years, particularly in lifelong learning contexts, many learners share their experiences with each other to learn more and better. Experienced learners, semi-professionals, seasoned practitioners, and veteran experts often form a community where they help young and novice learners. Thanks to the digital networks, such interactions take place in technology-mediated environments. This provides an invaluable network of scaffolding which is one way or another available through the Internet. It appears that learners in all areas and levels of education will continue to take advantage of such exchanges so that communities of practice will continue to serve as networks of learning.

The idea of community of knowledge/practice may be realized more effectively with up-to-date digital technologies. Many e-learning platforms, virtual community applications, online meeting applications, and videoconferencing systems are used for the exchange of ideas within a community of knowledge. Some social networking sites (SNS) are also utilized for interaction among the members of a learning community. Informal nature of sharing personal experiences, insightful knowledge, useful lessons learned from mistakes, professional warnings as well as suggestions for best practices will continue to be valuable contributions of communities of practice in the future of online learning.

Social Media

Web 2.0 applications gave way to social media. People have caught incredible chances to socialize their communications by utilizing social networking sites. This revolution has transformed all types of communication, particularly interpersonal communication practices. Previous communication patterns assumed that the sender transmits a message to the receiver and the receiver provides feedback as an indication of how the message was perceived. No further involvement of the receiver was possible in communication with traditional media. Educational communication followed a similar pattern for years.

Social media created a paradigm shift in all elements of communication. The sender is not only a sender, or the receiver is not always a receiver. These roles may change anytime in communication with social media. Message is not static or restricted to what the sender has originally sent because it continually changes depending upon active involvement of the parties. A social media user can post, commend, discuss, share, change, reduce, enhance, criticize or reconstruct the message he/she receives. A user can also share the message with other people. Moreover, this can be done by taking advantages of multimedia/hypermedia applications as the case in many popular social media platforms such as Facebook, YouTube, Twitter, Instagram, LinkedIn etc.

What percentage of the global population uses social media? The world population currently stands around 7.91 billion. Of this population, approximately 64% uses social media. It is projected that this number

will rise to 75% by 2028 as more people worldwide get access to the Internet (www.statistica.com, 2023). Although a number of social media applications have created some level of excitement among educators as well as learners, what we have seen over the last two decades is more of disappointment than realization of dreams. Social media in general has not delivered what it has promised for education. Today social media applications are mostly seen as communication tools rather than educational technologies (Simsek et al., 2020). Therefore, we should expect that social media will not be used commonly in educational practices in the near future.

CONCLUSION

The future of education is likely to involve a combination of face-to-face and online education. There will be a clear focus on personalized, analytics-based, and self-regulated learning. Technologies such as virtual classroom, artificial intelligence, and extended reality will play a larger role in education. Mobile devices, cloud computing, and digital networks will be used widely toward the purpose of providing “education for all.” There will be an increased emphasis on collaborative, game-based, and interactive learning. Open educational resources, microlearning, community of knowledge, and digital learning objects will be helpful for educating global citizens. On the other hand, technologies such as metaverse, social media, and wearables may lose their popularity to some degree.

Educators will be more concerned about developing skills such as critical thinking, creativity, and problem solving. This is important for two reasons: to avoid the detrimental effects of post-truth and accommodate anticipated needs of the future society. The mobilization of all stakeholders will be a priority in accomplishing these essential goals. We should expect more supportive government policies, funding, public involvement, investment in technology, and international cooperation for reforming educational systems all around the world.

Considering great transformations in education, the world will eyewitness a burgeoning number of future-oriented projects and reform attempts sponsored by national governments and international organizations. These initiatives will offer knowledge, attitudes, values, and skills that new generations need to thrive in and shape the future. Educational programs will also emphasize conscientious technology usage, eco-friendly practices, digital ethics, online safety, sustainable consumption that prepare students to be responsible digital citizens.

The new normal of education in the future will probably be based on the above-mentioned trends and orientations. These are the possibilities in the near future, and nobody knows exactly what the magnitude of innovations will be because the scope and the speed of transformations will depend on varying circumstances. However, one thing is clear: The concept of education with all of its systemic components will change and the cutting-edge technology will take over many responsibilities with smart tools and applications. Nevertheless, we have to keep in mind that nothing is certain and the future by definition is still unpredictable.

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