

Emerging Issues in Educational Technology

13

Chapter Outline

- Emerging technologies in education
- Issues involving in emerging technologies
- Challenges for educational technology.

By the End of This Chapter, You Should Be Able To

- Identify the essential technologies in technology.
- Identify immersing issues when using technology.
- Identify seven challenges for educational technology and some recommendations to meet the challenges.

Main Learning Activities

1. Discuss with peers on the emerging technologies for education, and describe what do you think the future leaning and teaching will be?
2. Discuss with peers on the issues of using technology in education, and list all the items you mentioned.
3. Describe a specific example of integrating an emerging technology into a unit of instruction (lesson or entire course). State the rationale for using that technology and indicate how its impact on learning will be determined. Note likely issues to arise in making effective use of the new technology in an actual learning setting.

13.1 Introduction

It is obviously true that educational technology changes, and that changes are happening at an accelerating pace. The challenge is to make effective use of new technologies in different learning scenarios in the twenty-first century. In this chapter, four kinds of technologies will be discussed: learning analytics, artificial intelligence, adaptive technologies, and wearable devices. These chosen technologies in each of these four areas are changing and likely to continue to change and evolve for some time. It should be noticed that a technology need not be a specific device, as a technology could be generally understood to be a systematic and disciplined application of knowledge. Implementation issues and the likely impact on learning and instruction of these emerging technologies are also addressed in this chapter.

13.2 Emerging Technologies

Technologies have changed and continue to change education. For example, social networking and digital conferencing have helped improve student–teacher and student–student relationships and collaborative learning in some cases. Digital game technologies and interactive simulations have also helped make some learning situations more effective and engaged. In this chapter, we focus on the four kinds of technologies that have demonstrated their potentials to improve learning and instruction: learning analytics, artificial intelligence, wearable devices, and adaptive learning.

13.2.1 Learning Analytics

In some sectors, the relatively recent emergence of big data and analytics is now viewed as having the potential to transform economies and increase organizational productivity (Manyika et al., 2011). Learning analytics is the measurement, collection, analysis, and reporting of data about learners and their contexts for understanding and optimizing learning and the environments in which learning occurs (see <https://tekri.athabascau.ca/analytics/>). Unfortunately, educational systems—primary, secondary, and postsecondary—have made limited use of the available data to improve teaching, learning, and learner success. Despite the field of education lagging behind other sectors, there has been an explosion of interest in analytics as a solution for many current challenges, such as retention and learner support (Siemens, 2013). For example, a learning dashboard (see <https://www.khanacademy.org/about/blog/post/58354379257/introducing-the-learning-dashboard;>) can provide overview learning data through data visualization tools much of the software that is currently used for learning analytics.

13.2.2 Artificial Intelligence

Artificial intelligence (AI; also called machine intelligence or MI) is intelligent problem-solving behavior displayed by machines in contrast with the natural intelligence displayed by humans and other animals. In computer science, AI research focuses on the study of intelligent agents, which are devices that can perceive a situation or environment and take actions that maximize the chance of success in attaining a goal, and the goal may be determined by a person or generated by a system in the case of higher order AI agents. The traditional problem areas of AI research include problem-solving, complex reasoning, knowledge extraction and representation, planning, learning new rules and concepts, natural language processing, and the ability to move and manipulate objects (Russell & Norvig, 2003).

AI is a branch of computer science that attempts to understand the nature of intelligent behavior to design and create devices that perform in ways that are similar to how an informed human would perform in that situation. AI research and development areas include robotics, spoken language recognition, image recognition, natural language processing, and expert systems to support decision making and problem solving. Artificial intelligence can simulate the information process of human consciousness and thinking. Artificial intelligence is not human intelligence, but it can think like people, and it may surpass people's intelligence.

13.2.3 Wearable Devices

Wearable technology refers to computer-based devices that can be worn by users, taking the form of an accessory such as jewelry, eyewear, or even actual items of clothing such as shoes or a jacket. The advantage of wearable technology is that it can easily integrate tools to track sleep, movement, location, and social media interactions. In the case of Oculus Rift and other VR headsets, wearable devices can support virtual realities. There are even new classes of devices that are seamlessly integrated with a user's everyday life and movements. New smartwatches from Apple, Garmin, Samsung, Sony, and Pebble are already allowing users to check e-mails and perform other productive tasks through a small interface. Thanks to the quantified-self movement, today's wearables not only track where a person goes, what a person does, and how much time spent on doing something, but now what a person's aspirations are and when or where those can be accomplished. Some popular wearable devices are bracelets such as Huawei Talk Band 2 (see <http://consumer.huawei.com/en/wearables/talkband-b2/>), and Xiaomi Mi Band (see <http://www.wearable.com/xiaomi/xiaomi-mi-band-review/>), which track movement, exercise, and other health-related activities. There are tremendous implications for physical education, nutrition, and health classes in K-12 education.

13.2.4 Adaptive Learning

Adaptive learning technologies refer to software and online devices and environments that adjust to individual needs (Di et al., 2016). The start of the work on adaptive and intelligent learning systems is usually traced back to the SCHOLAR intelligent tutoring system (see <http://scholar.hw.ac.uk/>) that offered adaptive learning for the topic of the geography of South America (Carbonell, 1970). Adaptive learning is a sophisticated, data-driven, and in some cases, nonlinear approach to instruction and remediation, adjusting to a learner's interactions and demonstrated performance level, and subsequently anticipating what types of content and resources learners need at a specific point in time to make progress. In this sense, contemporary educational tools are now capable of learning the way people learn. Adaptive devices are enabled by machine learning technologies that develop a rich profile of the learner including prior knowledge and interests. Adaptive devices can adapt to each student's progress and interests and adjust content in real time as well as customize exercises appropriate for a specific learner. Many educators envision these adaptive platforms as tutors that can provide personalized instruction on a large scale. Currently, several systems and platforms providing adaptation to users' learning styles, cognitive abilities, affective states, and the context of the learning have been created (Wang & Wu, 2011; Yang, Hwang, & Yang, 2013). In addition, many of the adaptive learning systems that incorporate learning styles are based on the notion that matching the learning strategies with the learning styles can improve learner performance; examples include MANIC (Stern & Woolf, 2000). MANIC is a Web-based instructional system which provides lecture-based material. In MANIC, the adaptation is achieved by providing different media representations for each learner.

Diffusion of Innovations (Rogers, 2003)

Diffusion of innovations is a theory that aims to clarify how, why, and at what rate new ideas and technology spread. In Everett Rogers's book *Diffusion of Innovations*, which was first published in 1962 and is now in its fifth edition, Rogers claims that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The beginning of the Diffusion of Innovations theory is diverse and spanning many disciplines.

Diffusion occurs through a five-step decision-making process. It occurs through a series of communication channels over a period of time among the members of a similar social system. Rogers' five stages (steps): awareness, interest, evaluation, trial, and adoption are integral to this theory. Diffusion of Innovations has been applied to numerous contexts, such as technology promotion with a particularly large impact on the use of technology.

13.3 Issues Involving in Emerging Technologies

Over the past decade, there has been an emphasis on equal access to information and communications technologies. Lack of equal access is often referred to regarding a divide between those in developed countries and regions and those in less developed countries or between the well-to-do and the poor. To benefit from new technologies, one must have access and the means to gain access to the Internet and other resources, which is an essential and persistent concern. Other issues related to new technologies concern privacy, ethics, and security. In addition to these human-oriented issues, there are a number of implementation issues that need to be addressed, including accreditation, scalability, sustainability as well as issues that are specific to specific regions and cultures (e.g., humor, color, and examples do not always work well in different cultural contexts).

13.3.1 Ethical, Security and Privacy Issues

Ethical, security, and privacy issues cover a family of things that have importance in everyday life. Ethics in technology is a sub-field of ethics addressing the ethical questions specific to the use of technology to support learning and instruction. The ethics involved in the development of new technology—whether it is always, never, or contextually right or wrong to invent and implement a technological innovation. Ethics relates to the question of what is right or wrong regarding technology use in learning. Spector (2005) proposed an educratic oath for educators, and the first part of that oath is to do no harm to learners. Disadvantaging some learners when using technology can widen the digital divide and is a violation of that principle.

Security is a key to technology use in education. The use of student data is crucial for personalized learning and continuous improvement, but using student data to create security issues. Security, acting as the stewards of student data, presents educators with several responsibilities. School officials, families, and software developers have to be mindful of how data privacy, confidentiality, and security practices affect students. Schools and districts have an obligation to tell students and families what kind of student data the school or third parties (e.g., online educational service providers) are collecting and how the data can be used.

Privacy is a particularly hot-button issue in technology, considering the pervasive nature of the Internet in people's daily lives. Many Web sites collect user data, from usernames and passwords to personal information such as addresses and phone numbers, without the explicit permission of users. Selling this information is widely considered unethical, but is often in a legal gray area because the user provides the data in the first place.

Example 1: So You Think You Can Secure Your Mobile Phone with a Fingerprint?

No two people are believed to have identical fingerprints, but researchers at the New York University Tandon School of Engineering and Michigan State University College of Engineering have found that partial similarities between prints are common enough that the fingerprint-based security systems used in mobile phones and other electronic devices can be more vulnerable than previously thought.

(See <https://www.sciencedaily.com/releases/2017/04/170411104603.htm>)

13.3.2 Quality Control, Accreditation and Sustainability Issues**Example 2: Does Apple Have an Obligation to Make the iPhone Safer for Kids?**

The average teen spends at least six hours a day looking at a screen, with most of it from using a smart phone. Many parents, naturally, have wondered if so much time spent in front of a screen is safe.

Research suggests that digital media stimulates the same brain chemicals and regions as other addictive products. Indeed, there is an increasing consensus that the technology companies who have led us into the digital age have a responsibility to build some safeguards.

(See <https://www.scientificamerican.com/article/does-apple-have-an-obligation-to-make-the-iphone-safer-for-kids/>)

Accreditation and Quality Assurance has established itself as the leading information and discussion forum for all aspects relevant to quality, transparency, and reliability of measurement. Since the 1990s, with the rapid development and popularization of the Internet, a wide range of resources cooperation and sharing has become the general trend, and the technical standards of learning resources in this process have played a crucial role.

These issues involve resources sharing and relevant standards making in different countries which will affect the diffusion of technology. For example, SCORM (see <https://scorm.com/scorm-explained/>), which defines communications between client-side content and a host system are closely related to sustainability.

Example 3: Standards Development Organizations (SDOs)

SDOs are standards development organizations which work to formulate health and safety standards. The term “standard” includes a wide variety of technical works that prescribe rules, guidelines, best practices, specifications, test methods, design or installation procedures and the like. The size, scope, and subject matter of standards vary widely, ranging from lengthy model building or electrical codes to narrowly scoped test methods or product specifications.

(See <https://www.nfpa.org/codes-and-standards/standards-development-process/the-value-of-standards-development-organizations>)

For sustainability, once the resources cooperation and sharing process have been fully implemented, efforts must turn to greater efficiency in programme delivery and to maintaining stakeholder engagement, and also political support for widescale realignment of budgets and resources. Even initially effective, resources cooperation, and sharing interventions may change in their effects over time. Therefore, interventions must adapt to changing circumstances and contexts over time to continue to be effective and relevant to stakeholders and intended target groups.

13.3.3 Culture and Regional Issues

The utilization of technology has a close relationship to specific regions and cultures. Culture and region may affect the transfer of technology. New groups of students from different backgrounds should be considered. Some are digital natives (persons who understand the value of digital technology and seek out every opportunity to use it), whereas some may be digital immigrants (late, recent, and perhaps even reluctant adopters of the new technology; Prensky, 2001). The different generations with different cultural and regional backgrounds may have a different understanding of technology and its use in a lesson.

Culture and regional differences affect human behavior patterns (O’Neil, 2006), and these differences are always reflected in the way people study, share knowledge and skills with others, and so on. Some researchers hold the view that cultural differences can have a negative effect on students’ participation in online courses (Shattuck, 2005).

Example 4: What Effect Does Culture Have on Learning? BBC News

How important are schools? That is the question posed by John Jerrim, a researcher at the Institute of Education. To answer it, he looks at Australian families of Chinese heritage. They go to Australian schools, and yet they do not seem to absorb teaching like other Australians.

On one of the PISA tests, an international test, they scored “two years ahead of the average child living in either England or Australia”. Home culture really matters.

(See <http://www.bbc.com/news/education-29559814>)

Example 5: Beyond the Classroom: The Impact of Culture on the Classroom

When humans grow up without culture, do they ultimately invent it? What role does culture play in defining the individual? How does culture impact learning?

Culture includes what people actually do and what they believe. Culture influences greatly how we see the world, how we try to understand it, and how we communicate with each other. Culture determines, to a great extent, learning and teaching styles with the help of technology.

(See <http://www.miamiherald.com/news/local/community/miami-dade/community-voices/article36727782.html>)

13.4 Challenges for Educational Technology

In addition to the issues previously discussed, there are a number of recurring problem areas that have been called challenges in Woolf’s (2010) *Roadmap for Education Technology* (see <https://cra.org/ccc/wp-content/uploads/sites/2/2015/08/GROE-Roadmap-for-Education-Technology-Final-Report.pdf>). That report focused on the role and impact of computing and technology in education, including recommendations for the future. Seven grand challenges were identified followed by seven technology recommendations, which will be discussed in the following texts. In addition, the New Media Consortium’s *Horizon Reports* emphasize similar challenges and considerations.

13.4.1 Personalizing Education

The one-method-fits-all approach does not match up with a diverse population and the potential of new technologies; moreover, finding in cognitive psychology and new technologies makes it possible to create effective learning activities to meet individual student needs and interests.

13.4.2 Assessing Student Learning

There is a need for effective assessments of students and teachers, not only for accountability and promotion (summative) but also to improve learning and instruction (formative). The focus of assessment should be on improving learning, and assessments should be seamless and ubiquitous (woven into learning activities unobtrusively), especially from the perspective of life-long learning.

13.4.3 Supporting Social Learning

Supporting meaningful and collaborative learning activities is more important than ever before, partly due to requirements in the workplace to work collaboratively and partly due to the affordances of new Web 2.0 technologies.

13.4.4 Diminishing Boundaries

Traditional boundaries between students and teachers, between and among personal abilities and types of learning, between formal and informal learning, and between learning and working are changing and becoming blurred in the twenty-first century; this creates a need to recognize the significance of informal learning and different learner abilities and interests.

13.4.5 Developing Alternative Teaching Strategies

The teacher is no longer the sole source of expertise in classroom settings due to the widespread availability of networked resources; this creates a need to change instructional approaches and train teachers accordingly.

13.4.6 Enhancing the Role of Stakeholders

Stakeholders in educational systems need to develop trust that those systems are adequately preparing students for productive lives in twenty-first-century society; as a consequence, there is a need to regularly consult with employers, parents, administrators, teachers, and students to ensure that all stakeholders have confidence that the educational system is working well.

13.4.7 Addressing Policy Changes

The knowledge society requires flexibility on the part of an informed population; educational inequities and the digital divide can challenge the stability of a society and need to be addressed, as with the other challenges.

13.4.8 Challenges in Horizon Reports

The Horizon Project defines solvable challenges, difficult challenges, and wicked challenges. Solvable challenges that we understand and know how to solve including improving digital literacy and integrating formal and informal learning. Difficult challenges are ones that we understand but for which solutions are elusive, such as achievement gap and advancing digital equity. Wicked challenges are categorized as complex to even define, much less address, such as managing knowledge obsolescence and rethinking the roles of educators.

Key Points in This Chapter

- (1) Four kinds of emerging technologies will have potentials to improve learning and instruction: learning analytics, artificial intelligence, wearable devices, and adaptive learning.
- (2) Issues involving in emerging technologies: ethical, security and privacy issues, quality control, accreditation and sustainability issues, culture and regional issues.
- (3) Challenges for educational technology: personalizing education, assessing student learning, supporting social learning, diminishing boundaries, developing alternative teaching strategies, enhancing the role of stakeholders, addressing policy changes, challenges in Horizon Reports.

Learning Resources

How to Integrate Technology. <https://www.edutopia.org/technology-integration-guide-implementation>

Center for Teaching and Learning. <http://www.washington.edu/teaching/teaching-resources/engaging-students-in-learning/teaching-with-technology-2/>.

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