New approaches on education technologies: A global perspective for digital transformation

Brad Hokanson [a] *

[a] University of Minnesota, USA.

Highlights	Abstract
- Can higher order skills be developed in the context of learning other basic topics? - how do we get students to be more effective learners and to be able to learn independently? - how do we ensure learning? - Can skills be developed in the context of learning other content? **Article Info:** Review Article **Keywords:** *Change, Innovation, Technology Adoption, Global impact*	For education worldwide, the global pandemic was a major shock. The Internet did not stop, but for a while, going to school did. It caused a worldwide leap to online education. For educational technology, it might have been a step forward, with some hesitancy: some will soon be forgotten, but much will be retained. This writing outlines a number of ideas and directions, posed in the form of questions, seeking to continue to move educational efforts forward, for in a post-pandemic world, education is still challenged by technology.

[1] Introduction

Meeting the pandemic, many in the field of education encountered the opportunities of technology more than any other time. We were limited in our mobility and in our skills with technology, but one could be overcome to ameliorate the other. We used technology to advance our efforts in the face of a global pandemic. Using computers for education and learning became, for a great period of time, the way to move forward. Many recognize the shortfall of online learning, and have rushed back to in person teaching, but some changes remain in place, and some things were learned with the advent of the pandemic, with the advent of forced technology use.

The pandemic has affected the way we work and how education occurs. We now do things by norm which would have been unthought of three years ago. One of the simplest changes to our work environment has been the shift of our meetings to an online venue. For example, at major universities with multiple campuses all in the same metropolitan area, meetings are online and now easily open to everybody online. This simple experience has helped many better understand and use the digital environment. Educators too have learned to work and meet remotely as part of a regular work environment, and this skill has been transferred to our teaching. Similarly, we collaborate with others through educational technology for research or outreach

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purposes. And, of course, the ICETOL conference itself, is more impactful, global, and accessible via the Internet.

Inherent in the title of the ICETOL conference, Digital Transformation, Online Learning, and Global Change are questions which inspire further discussion. This writing began by posing the question "How is education global?" and the subsequent question "How is learning global?" Today, education may be global; that is, there is a capability for learners to engage in education around the world, in person or online, or by other means such as radio, television, print, or correspondence. The location, the place is less important, but it still provides a context for the learner.

How education is conducted continues to be a question as well. Is the use of 'educational technology' an extension of education, or is it a normal part of education, using tools…i.e. technology…in advancing learning? Can we improve all education through our understanding of technology? Technology, used in education is much more broad than computer-assisted learning:

> "…In modern terms, technology is any systematized practical knowledge, based on experimentation and/or scientific theory, which changes the capacity of society to produce goods and services, and which is embodied in productive skills, organization, or machinery" (Saettler, 1991, p. 4).

How can we improve all education through our understanding of educational technology? The field of educational technology is one of seeking innovation and better methods, and inherent is a push to improve methods and theory. Educational technology is a broad field, and one which has an impact both on in-person teaching and online or remote education. Efforts often have a foot in both domains, with live activities for online classes and digital material for in-person efforts. One can foresee a future with a hybrid understanding of education, selecting methods and materials to address both modalities.

Does all education lead to learning? Understanding the difference between 'education' and 'learning' is of value; they are related but not equivalent. "Education is the process of *facilitating* learning, or the acquisition of knowledge, skills, values, morals, beliefs, habits, and personal development."] [Wikipedia, 7.11.22] Education is about making learning possible, through encouragement and practices.

Does all learning result from education? Specifically, that is, the formal process of education, as learning may happen without education, and education may happen without learning. "**Learning** is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences." [Wikipedia, 7.11.22] In reality, no "teacher" is required. To some extent, this self-directed learning has been embraced by many in the field of educational technology.

How do we get students to be effective learners and to learn independently? Whether that is in a formal educational setting or beyond; our time is limited, as with a child. Clearly, an important aspect of learning, in any field, is the need to develop self-learning and intellectual development.

How can we, as educators, incite the drive for further learning? How do we, as educators, react to answers or solutions that are not specifically what we are seeking? Our goal must be to get learners to be 'self-propelled', finding their own challenges as well as new answers. We need to move past the repetition of easy answers. By experience, delivery and evaluation based on informational content is considerably simpler than a complex form of learning or skill; memorizing the poem is simpler than writing or analyzing; identifying a historical artist is simpler than creating a drawing.

Can we direct learners to address complex or "wicked" problems? Causing learners to address more challenging problems will result in deeper learning. These are not the simple solutions of "remembering" but to address such areas as synthesis, analysis, and creating…building in the capability for critical thinking comes through asking hard questions.

Can higher order skills be developed in the context of learning other basic topics? The specific does drive out the general; and the basic subjects and content are often more stressed than higher order thinking skills, with the assumption those skills will develop without attention. The revised Blooms Taxonomy, a categorization of activities helps prescribe a hierarchy of methods for teaching. embodied

For leaders in education these are valuable questions which extend *past* the idea of just teaching via the Internet using the same methodology, *beyond* delivering content via computer technology. We have to go further.

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Of course, computer technology is necessary for communication and teaching. On our computers we carry the resources we have collected; books, images, sounds, writings, and more. It also provides access to challenges; the Internet delivers more content and more "informal learning" as well as our intentional efforts at education.

Once you have the capability for global reach to and from any location, one's perspective changes. Learning anywhere becomes more feasible. The learners themselves have a choice in how best to learn and to be educated. Teaching in these circumstances is more of a challenge, and it also reveals our capability, both due to technology and due to our ability to flexibly teach even complex subjects and overcome locational challenges.

Music education can provide a good example. No longer are music lessons constrained to a physical location. Japanese violin learners can take music lessons from an instructor in Finland; American bandoneon players can learn from instructors in Argentina; and a local piano teacher can continue teaching lessons from home in spite of a pandemic lock down. It's now commonplace to take lessons remotely using a good Internet connection.

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Through our own experience, we know the formal process of education may happen without learning. We also all know *learning* may happen without formal education. And the best result of any formal education is the ability to learn *itself*.

As education is less teacher-centered and more student centered, more will be expected by the learner, guided by instruction. Education will more often be through remote means, and this will change the nature of teaching and learning. A different set of skills will be needed by instructors, and, given the shifting between instructional formats, educators will need go have a broader understanding of teaching methods. Future teachers will teach in diverse learning environments, using diverse media and methods. Teachers must teach both online and in-person, with choices for simultaneous or recorded sessions.

One substantial question, regardless of instructional media, is **how do we get students to be more effective learners and to be able to learn independently?** That may be the end goal for education, to give learners enough skill in learning as well as content and background to learn beyond formal education. The internet may be an open book, but part of our responsibility is to provide guidance to help students to learn from the digital encyclopedia.

We can provide direction for learning but ask the question in educational practice, **how do we ensure learning?** where learning may occur but which is not well recognized in the current educational context? For example, when we are looking for a simpler or different answer, how do we react to correct answers or solutions which are not specifically what is sought? Can we encourage the development of divergent answers?

Learners own ideas can provide sparks for learning; however, they need a structure, encouragement, and direction. They do not need the repetition of facts as a educational method, but direction, engagement, and

encouragement in learning. As educators, we need to build on learners' ideas, whether from wrong or divergent answers and to guide them in the right direction.

Examples of a technological shift are seen in a number of areas, and it has encouraged changes in pedagogical methods and processes. It's not just about access or location, but *how* we teach and *how* people learn.

Some of the changes forced by the pandemic have affected and enhanced the shift to online education and learning.

This is something hardly imagined a few short years ago, yet now it's much more acceptable and much more commonplace. We can reach out to expertise as well as reaching out to our students whether they're in South Africa or Turkey or Finland.

In the author's experience, students have participated in live, campus based online classes from Puerto Rico, Shenzhen, Hong Kong, Hanoi, Shanghai, and Shenzhen, China. It's a substantial challenge for a student in China to participate in a class in Minnesota. They are University of Minnesota students, yet they have gone home due to the pandemic and are logging in remotely. They perform as well or better than local students who have signed in the same way, so whether it's from 10 kilometers or 10,000, the synchronous online class works exceptionally well. Synchronous learning is much more engaging than asynchronous learning, needed at least for undergraduates. As an instructional format, the engaged but online instruction is more effective as it utilizes the full capability of the teacher.

Of course, this may be a problem, with students choosing what they perceive to be the easiest route to educational credit or passing, not recognizing which route as the most effective or which are the best methods of education, whether it is in-person, synchronous, or asynchronous…or even self-learning. We know learners often pick methods they perceive as easiest, not necessarily the best or most effective in their learning. Motivation and applied effort need to be key for the learner, not ease of completion.

Our teaching, our work, and our learning have shifted online, 'encouraged' and accelerated by the pandemic. So have our research methods. Many of us endeavor to conduct research on various topics including human behavior.

Perhaps the simplest use of the Internet for researchers is to conduct surveys and polls on a broad range of people. Computerized data services such as Qualtrics allow researchers to gather data from a broad, anonymous public.

Analysis of data no longer needs to be conducted by single individuals with a small data set, as very large datasets are analyzed and shared across the globe whether it is the locations of dark stars or the complexity of the human genome. Shared research on large data sets is becoming the norm, opening up globally analyzed research.

One of the more commercialized examples of this phenomenon, is the use of the Mechanical Turk, available through Amazon. It offers a connection to anonymous and live human participants for experimental purposes over the Internet. They are paid a nominal sum, ranging from one cent to $5 or more to complete surveys or complete digital exercises. Data gathered supports a number of research projects at various university and commercial interests.

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How do we go beyond principally teaching content or information to address the more advanced skills and capabilities that are needed in the 21st century? We need to intentionally address these skills, focusing on them within the classroom and online. To improve problem solving for example, requires a redesign of our regular structures, offering *challenges* solve with appropriate evaluation and testing measure learning.

What is needed is education beyond content, beyond information delivery, in reaching to skills and traits that enhance everyone's lives. Previously, education has been limited to conveying information, often enhanced by computer use and capability. We have still not advanced the critical aspects of a learner which have great value. There exists a common set of interests among multiple sources with common positive attributes occurring as valuable for all. But all can be developed through education, whether in-person or on the Internet, but there are limitations due to context.

One of the guiding efforts to better education is broadly described as 21st Century Skills. 21st Century Skills is a concentration of educational goals, going beyond reading, numeracy, facts; information/content as focus.

There are a large number of authors and groups that have developed standards addressing 21st Century Skills. Many of the directions are consistent. Most educators recognize the need to go beyond traditional educational goals of literacy, numeracy, scientific literacy. computer capability, financial cultural, and civic literacy.

One such group is the educational technology oriented group ISTE, the International Society for Technology and Education, lists a number of standards as well and they include creativity and innovation, communication and collaboration, research and information fluency, critical thinking problem solving and decision making, digital citizenship, and technology operations and concepts.

One of the more broadly reaching groups is the World Economic Forum which lists a set of three levels of 21st Century Skills; Foundational Literacies, Competencies and Character Qualities. Foundational literacies are a generally focused on basic educational tasks, such as literacy and numeracy but also include computer skills and civic literacy, among others. Competencies are more social and interactional; they include communication, creativity, critical thinking, and collaboration.

Character Qualities are those that enhance all of the work of education, such as leadership or grit.

One substantial question is whether or not such 21st century skills can be developed concurrently while learning other topics. Many times the argument for resolving the need for 21st century skills is by addressing them through existing classes. This can be true, but in many cases direct attention is necessary, whether by changing pedagogy or by specifically developing educational programs for those topics. In my own experience, I have found success in specifically addressing a few of the 21st century skills, creativity and critical thinking.

Each 21st Century skill can be developed in the classroom or on the Internet, but there are the limitations of context, as well as some opportunities. Content is often offered as a *medium* to develop these skills, but in my experience, the specific drives out the general. General education instructors focus more on the subject at hand than improving critical thinking or creativity. This may be due to self-selecting an easier model for educational processes, or a submission to a more standardized curriculum.

Development of more complex thinking skills is possible, utilizing moderate levels of computer/technical skill.

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Can skills be developed in the context of learning other content? Specific domain-focused creativity, however must be addressed within each area of study. It remains important to use content to develop more advanced creative capability.

All 21st Century skills can be developed in the classroom…or via the internet, but there are limitations. Singular classes such on a specific trait can develop these skills when presented as a general capability, applicable in any field. Subsequent development can occur as part of disciplinary education; e.g. the development of creative skills in the specific domain of chemistry.

Learning has been extended by the internet and by computer technology [not the same] It has meant more universal access; capability, location, physical disability, time, and a much greater breadth in what is accessible.

We have been presented with an open door, an openness, to utilize a vast variety of worldwide resources and to have access to a worldwide audience of learners. We need to go past the limitations of simpler metrics of education such as memorization and rote learning, lower-level skills of Blooms Taxonomy. We must focus of the higher levels of learning: Analyze, Evaluate, and Create,

We, in the field of educational technology must take the lead in moving education forward to new and better ways of teaching. There's a value to the broad use of computer and internet-based technologies, but lessons learned from those capabilities can and should be applied in person.

Education, in these times, like everything else, is more accessible: no longer limited to local environments and resources. Education now has a global reach in both directions to outside information and to local accomplishments.

References

Florida, R., Mellander, C., and King, K. (2015). The 2015 Global Creativity Index (2015). Martin Prosperity Institute, Rotman School of Management, University of Toronto. Retrieved from: http://www-2.rotman.utoronto.ca/mpi/wp-content/uploads/2015/07/GCI-2015-Insight_The-2015-Global-Creativity-Index.pdf

World Economic Forum and The Boston Consulting Group (2015). New Vision for Education: Unlocking the Potential of Technology. Geneva.

https://en.wikipedia.org/wiki/21st_century_skills#Common_Core