Emerging Technologies: It's Not What *You* Say – It's What *They* Do

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Abstract
This paper is provided for the *Online Learning* journal 2018 Special Conference Edition. It was initially presented at the 2018 OLC Innovate Conference in Nashville Tennessee. In this article, we will explore various emerging technologies. It is important to note that the authors believe that learning is not a complete circle when evaluated by what educators do, the technologies we use, or how we communicate our knowledge to our students. Learning is only successful when we fully assess the impact of our preparations and presentations on student outcomes. Students need the opportunity to actively participate in the *doing* of learning. Modeling the literacies needed to enable us to skillfully meet the needs of our future world through strong use of technologies in a heutagogical setting enables learning success.

Keywords: emerging technologies, heutagogy, high-impact learning

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Emerging Technologies: It's Not What *You* Say – It's What *They* Do

Can a student learn while commuting in an autonomous car? Can a robot teach my class? Is what I tell my students making an impact in my class? How can I create learning experiences that will move students toward the future? In this paper, we explore these and other questions related to the intersection of the latest technology trends in higher education. We consider how they will impact both the online and traditional classroom modalities while focusing on student-centered learning and heutagogical practices. We provide a brief overview of a few of the emerging technologies that will encourage us to explore new ways to lecture to a class and provide students with high-quality, impactful learning engagement. We consider how we might utilize emerging technologies to provide students with learning experiences through *doing*.

Emerging technologies support the theory of heutagogy by making learning more pervasive and ubiquitous, giving learners more opportunities to determine what, where, when, and with whom learning takes place. The concept of heutagogy expands our current thinking of pedagogy and andragogy to look at self-determined learning (Gerstein, 2014). Connecting information from a variety of fields and individuals is necessary to add depth and breadth to the self-determined learner's knowledge base. As educators, we can create the curiosity to find and explore connections between many sources while using emerging technologies that can lead learners to new knowledge and enhanced learning. The transition from pedagogy to heutagogy is depicted in Figure 1 (Blaschke, 2012).

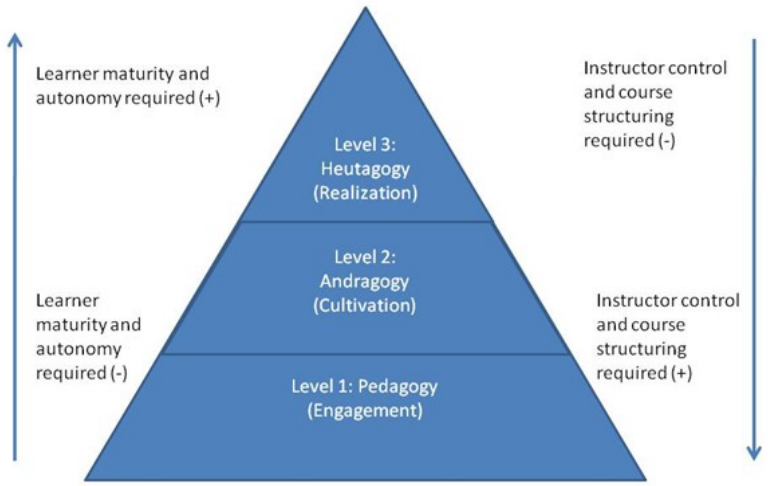

Figure 1. Progression from pedagogy—andragogy—to heutagogy. Adapted from "Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning," by L. M. Blaschke, 2012, *The International Review of Research in Open and Distance Learning, 13*(13), p. 60. CC-BY.

This article considers some of the most recent trends and new learning technologies, including artificial intelligence, virtual reality, augmented reality, and experiential reality, with exemplars of how the technologies being discussed can benefit the self-determined learner. It explores the definitions, continuum, and characteristics of pedagogy, andragogy, and heutagogy and their impact on student-centered teaching strategies. The focus centers on the strategies connected to a student-centered teaching approach. What students *do* is far more important than what we, as educators, say. These technologies allow students to become active participants in the acquisition of knowledge.

Artificial Intelligence

Artificial intelligence (AI) may be one of the most significant game changers for higher education. Professor Ashok Goel created Jill Watson, an AI robot who learned to act as an exemplary TA for Goel's large enrollment classes at Georgia Tech (Maderer, 2016). Watson, as the teaching robot is most commonly referred to, was a high-performing TA that indicated that certain responses could be learned and programmed for reuse as students asked questions. In 2017, Hubert, another AI robot, was launched. Now, Hubert can organize and synthesize materials for instructors. Hubert is able to help faculty members determine how to improve their courses by

assisting with student evaluation and feedback (Lieberman, 2018). This tool remains in beta version and has some known need for future development but may be able to assist faculty members by quickly disseminating information from evaluations to assist with building a better learning experience.

In many ways, elements of AI have become ubiquitous in our everyday lives. Hannay (2014) asserted that computer image recognition, text-to-speech processors, cloud-linked applications, and even self-driving cars are examples of AI developments that augment human intelligence. Opportunities for application of AI technologies abound within higher education. AI technology supports adaptive learning, which in turn affords greater differentiation of instruction to learners. Yet, such technologies are not widely adopted across academia. This may be partly due to a relatively high cost of implementation as well as a fear of losing the human connection in education. The full impact of AI on society and education has not yet been explored, but it continues to be an emerging technological trend with potentially far-reaching impacts (Basken, 2016). AI can assist students with moving through the continuum of learning as foundational materials are learned and specific learning needs are met.

Blockchain

Transforming education through an alternate credentialing system is not a new concept but continues to be discussed as a way to decrease credentialing costs while allowing students high-impact experiences in building skills and critical thinking in their field of study (Horn, 2017). Since the 1970s, institutions that provide pathways to adult degree attainment have utilized forms of prior learning evaluation (Buban, 2017). In a report from the Online Learning Consortium Research Center for Digital Learning (Buban, 2017), six institutional case studies were examined and reviewed related to understanding the definition of alternative credentials and how alternative credentials are used to assist the adult learner in meeting their educational goals.

Blockchain provides a new approach to issuing, displaying, and verifying digital credentials. MIT took this concept and created open source code for others to begin exploring this emerging technology (MIT Media Lab, 2016). Most recently, Southern New Hampshire University began issuing blockchain credentials to College of America graduates (Kelly, 2018). Some unaccredited institutions are using this approach as well, such as Holberton School located in San Francisco, CA, which specializes in software engineering programs through a peer review and project-based learning approach to learning, and Teachur, located in Utah and currently working with a consultant to seek regional accreditation, which offers two undergraduate degrees founded on mastery learning to deliver credentials that are alternate routes to a degree. There are other early adopters of blockchain technology to document and verify records (Ruff, 2016). Building a socioeconomic structure utilizing this technology may impact not only the fundamental structure of credentials and transcripts in higher education but may also significantly impact how those who teach may become credentialed. This is a highly complicated structure that needs much more testing and development before it can ever be utilized to improve our current method of credentialing; however, it is a structure that has its roots in the substance of Bitcoin and thus has some underpinning of stability. Basic blockchain technology offers several advantages for end users, such as improved transparency, faster transactions, greater flexibility, and lower costs. Challenges include security issues, validation concerns, utilization, and implementation costs to institutions offering blockchain credentials (Akram, 2017; Ruff, 2016). Further, student privacy is also a concern (Ruff, 2016). Another major challenge in higher education is to ensure accessibility and the adoption of Universal Design in Learning (UDL) principles in course design and delivery.

Accessibility and UDL

Rapid technological advancements have influenced how higher education is delivered over the past two decades, which is evident in the growth of distance education (Allen, Seaman, Poulin, & Straut, 2016; Linder, 2017). Institutions are offering more online, hybrid, and web-based courses today than ever before. Instructors and students have more web-based technological tools at their disposal. With enrollment growth and technology comes a myriad of issues affecting teaching and learning, such as accessibility and UDL (e.g., see the EDUCAUSE Infographic [EDUCAUSE, 2018]).

Accessibility refers to how environments are designed so that learners with disabilities, such as vision, hearing, or mobile impairments, can use and benefit from that environment (U.S. Department of Health and Human Services, 2018). Although state and federal laws like the Americans With Disabilities Act (ADA) require nondiscrimination toward individuals with disabilities in postsecondary education, many institutions have historically complied with their legal requirements by providing individual student accommodations. For example, a disabilities services office might have provided a typed video transcript to a deaf student after a film was shown in class. Accessibility, however, offers a different approach than traditional accommodations because it benefits not only students with disabilities but all learners from a design perspective. According to the Tennessee Board of Regents "'accessible' means that individuals with disabilities are able to independently acquire the same information, engage in the same interactions, and enjoy the same services within the same time frame as individuals without disabilities, with substantially equivalent ease of use" (*Accessibility or Accommodation Training Course*, 2015). Given this definition, the previous example of emailing a student a video transcript after showing the film in class would not qualify as being accessible. Rather, all video content would need to have closed captions as a text-based alternative at the time the video is provided to the entire class. By providing captions, the content is more broadly accessible to all learners. Not only could hearing-impaired students access the video content through captions or transcripts, but students who are English language learners and those working in noisy or quiet environments could also take advantage of the alternative format for improved learning.

When considering examples such as video captioning, accessibility and UDL are often discussed together. That is expected, because a UDL approach to course design anticipates "the presence of students with diverse abilities, disabilities, and other characteristics" (Burgstahler, 2015, p. 32). UDL reflects a paradigm shift in how educators design learning environments. A UDL approach is intentionally more inclusive of diversity among individuals, rather than focusing on the average student (Burgstahler, 2015). Consequentially, the UDL approach tends to reduce the need for student accommodations based on disability.

Researchers at the Center for Applied Special Technology (CAST) developed UDL as a framework for optimizing the teaching and learning process. The UDL guidelines are grouped into three categories, with the goal of developing expert learners who are

- purposeful and motivated (through multiple means of engagement),
- resourceful and knowledgeable (through multiple means of representation), and
- strategic and goal-directed (through multiple means of action and expression) (CAST, 2018).

Guidelines encourage provision of options in each area to make learning materials accessible and applicable to diverse learners; thus, flexibility is a central premise of UDL. Emerging technologies support the practice of universal design as well as the theory of heutagogy by providing learners with more options for consumption of information, engagement, and assessment. Additionally, technologies support improved accessibility in the design and use of common instructional materials.

Augmented, Virtual, and Mixed Reality

Perhaps the emerging technologies that have the most potential to impact higher education are in the areas of augmented, virtual, and mixed reality. Institutions are now experimenting with these tools to build strong pedagogical uses to assist the experiential learning techniques in a variety of disciplines. Bitter and Corral (2014) asserted that this type of technology was pedagogically sound and would become pervasive in education. Additionally, they noted that this type of technology lends itself well to adaption to mobile and wearable technologies. Expanding this immersive technology into the mobile environment supports the movement into a self-determined mode of learning by adhering to the tenet of heutagogy (Blaschke, 2012). Use of mobile devices to engage in anywhere, anytime learning is enhanced through the use of augmented and virtual reality apps. Already, many medical schools are expanding the experience of medical students with combinations of augmented, virtual, and mixed reality, such as the Mixed Reality Lab at Oklahoma State University (http://trcf52.okstate.edu/x/index.html).

There are major differences between augmented, virtual, and mixed realities, and the technologies used to design and deliver these experiences also vary. In augmented reality, the technology projects virtual objects into a user's real-world environment. One popular example is the game Pokémon Go, which can be played on any smartphone. This type of game can be extremely costly to produce but has a relatively low cost to consumers. In contrast, virtual reality artificially creates the user environment. It is a more immersive experience, shutting out the real world visually and often audibly. Institutions are investing in the creation of virtual experiences through business partnerships and student-led teams. For instance, at Tennessee Tech, teams have created virtual experiences for students to drive a buggy on the moon and to visit WWII historical sites (http://ttuicube.com/). The costs of creating and experiencing virtual reality tend to be much higher than augmented reality, but technology companies are generally eager to support educational initiatives using their devices (Evans, 2018). There are also several inexpensive alternatives that educators can employ to engage learners in virtual reality using smartphone apps and a pair of cardboard or plastic goggles (Evans, 2018). Mixed reality environments are the most complex and least studied of these technologies. In mixed reality, digital objects appear real and allow the user to interact with them.

Cost and a high level of technical expertise pose major challenges to using augmented and virtual reality widely in education. A recent product purchased by Amazon may change the landscape of adoption of augmented and virtual reality in an all-in-one development platform that will allow for a drag-and-drop approach for augmented and virtual reality (Marvin, 2018). This new platform, Sumerian, may be a game changer in allowing augmented and virtual reality apps to truly integrate the physical and digital worlds using a heutagogical approach to support a model of self-determined learning.

Future of Jobs

Aoun (2017) discusses the need for a new discipline that he terms *humanics*. As president of Northeastern University, he calls for new literacies to be introduced as part of our work which allow students to experience new concepts in dealing with the changing landscape of higher education and work integration. Aoun posits that students will need data literacy, technological literacy, and human literacy, as well as significant experiential learning approaches within each literacy, to develop the depth of skills needed to be prepared for their futures. He also asserts that students must develop lifelong learning skills. This heutagogical approach to continuation of learning will prepare students for the needs of the societies in which they live today and in the future.

Michio Kaku, a theoretical physicist, believes the future jobs that will thrive are those that are nonrepetitive and those that require intellectual creativity and tasks that require thinking. Kaku's precepts (Crieghton, 2018) are shared by Aoun (2017) and are further defined in the literacies discussed above.

As Aoun (2017) and others have argued, the future jobs not easily adapted to the machine learned environment will be those that focus on communication and interpretation of human interactions. These types of jobs will underscore the need for a highly skilled workforce whose members are technologically and digitally literate and who excel in the abilities related to innovation.

Dyer, Gregersen, and Christensen (2011) advocate for considering the skills needed to innovate. The identified five skills needed to achieve innovation are the following:

1. *associational thinking*—identifying connections;
2. *questioning*—the passion for building learning through inquiry;
3. *observing*—learning through the experience of observing people, processes, and interactivity;
4. *networking*—building a group of "testers" to try new ideas and concepts; and
5. *experimenting*—the ability to try new things and enjoy the process of learning about a new approach.

Soft skills are needed today in the workforce and will continue to be needed in the future. It is assumed that soft skills are intuitive. However, the opposite seems to be true. In a Burning Glass Technologies report (2015), it was noted that one in three skills are considered baseline skills, even in the most technical career fields. These baseline skills include customer service, organizational skills, writing, communication, and basic technology skills.

Rainie and Anderson (2017) authored a Pew Research Report that states that the training ecosystem is evolving with a mix of innovation in all education formats. Learners will be required to cultivate these 21st-century skills in order to meet the needs of future employers. New credentialing systems will evolve to meet the changes in industry and employee needs. Today, we see this new approach to credentialing in micromaster's degrees and other innovative approaches to credential completion. As mentioned, blockchain technology may be used as a new way to document workforce and learner credentials. Work and jobs of the coming years will be launched by the entrepreneurial efforts of the workers. The workforce will continue to have both increases

in the need for highly skilled workers and decreases in employment opportunities that change based on the evolution of nontechnical job functions.

Building a Personalized (Professional) Learning Network

One key component of the future of jobs is that all students will find the need to develop a personalized learning network (PLN). The participants in these networks are both personal and professional learners. Individuals create PLNs using tools such as social media, communication events, collaboratories, and other technologies to connect with colleagues around the world.

Four characteristics of those using PLNs successfully include the following:

1. Adapting to the overall sense of being part of one's chosen field.
2. Demonstrating mindfulness by reaching out to find new and innovative ways to think about a problem or issue in their field.
3. Cultivating a sense of curiosity and an ability to think, learn, and share.
4. Building digital literacy skills that will provide the basis for collaboration across platforms and through a variety of tools.

By building on the theory of connectivism, the learner can adopt ways to creatively search out and participate in strong PLNs (Clifford, 2013). Becoming a participant in a PLN can be a powerful career booster. Use of the PLN can make a true difference in opportunities for professional growth and impact on the student's chosen field. It is the responsibility of the instructor to assist students with the ability and skills to begin to build and develop a PLN.

Conclusion

More people, including those with disabilities, are taking advantage of the flexibility online education affords. Technological advances allow many individuals to leverage the Internet to expand their knowledge and skills through higher education. Instructors and instructional designers are beginning to approach course development through UDL, thus intentionally building more inclusive learning environments that leverage technologies and student choice. A universally designed course affords students freedom and flexibility to engage in the teaching and learning process in a way that they determine is best for them.

Assessment of student learning, particularly in online environments, is being strengthened through the use of AI. In addition, AI tools support an instructor's ability to design and adapt learning paths to meet the uniqueness of each individual student's needs. This technology, with further development, could be used to increase student engagement and active, self-directed learning. Augmented, virtual, and mixed reality tools are also emerging as technologies useful for improved learner engagement. In augmented reality, virtual reality, and mixed realities, the lines between reality and computer-enhanced learning are blurred, creating unique learning experiences that could not be replicated in real life or are too costly or dangerous to do so. As technology continues to advance, the social and economic culture of our world is affected as well. Jobs, and the skills people need to be successful in their work, will likewise also be subject to rapid changes in the future. As educators, it is our job to prepare today's students for tomorrow's workplace. The best way to prepare them is to foster an ability to become lifelong, self-directed learners who can

successfully leverage technology and information resources and by building personal, professional learning networks.

At the end of the day, it isn't about what educators do, nor how we communicate our knowledge to our students: It is about what the students see us doing, what they have the opportunity to participate in, how they have actively participated in the *doing* of learning, and how they have seen us model the literacies needed to skillfully enable them to meet the needs of our future world. Learning is only successful when we fully assess the impact of our preparations and presentations on student outcomes. More applied and empirical research is needed in order for these emerging technologies to advance and become grounded within higher education. Further, students need the opportunity to actively participate in the *doing* of learning. Modeling the literacies needed to skillfully enable us to meet the needs of our future world through strong use of technologies in a heutagogical setting enables learning success.

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