

The Interconnectivity of Heutagogy and Education 4.0 in Higher Online Education

L'interconnectivité de l'héutagogie et de l'éducation 4.0 dans l'enseignement supérieur en ligne

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Résumé de l'article

Les progrès technologiques de l'industrie 4.0 créent un monde dynamique et en rapide évolution qui affecte notre façon de vivre et de travailler. Les éducateurs doivent repenser les approches pédagogiques existantes afin de mieux préparer les apprenants aux futures carrières que l'industrie 4.0 créera. Le Forum économique mondial a défini un nouveau modèle d'éducation, appelé Éducation 4.0, qui contient huit changements majeurs pour redéfinir l'apprentissage dans la nouvelle économie. L'heutagogie, ou apprentissage autodéterminé, est une approche qui favorise la pensée critique, les compétences socioémotionnelles et l'apprentissage tout au long de la vie. Ces compétences sont nécessaires à l'éducation 4.0. L'objectif de cet article est de recommander des principes de l'heutagogie comme une approche d'enseignement et d'apprentissage efficace pour répondre aux besoins de l'éducation 4.0. L'approche de l'étude consiste à examiner la littérature existante sur l'éducation 4.0 et l'heutagogie. Un modèle conceptuel qui relie l'heutagogie aux quatre principes d'apprentissage de l'éducation 4.0 sera proposé comme résultat principal pour répondre à la question de recherche : comment l'heutagogie dans l'enseignement supérieur en ligne répond-elle aux besoins de l'éducation 4.0 ? Ce document fournit une base pour des recherches et des discussions plus approfondies sur la façon dont l'heutagogie et d'autres approches peuvent répondre aux besoins de l'éducation 4.0 afin de préparer les apprenants à un monde en évolution.

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The Interconnectivity of Heutagogy and Education 4.0 in Higher Online Education

L'interconnectivité de l'héutagogie et de l'éducation 4.0 dans l'enseignement supérieur en ligne

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Abstract

Industry 4.0 advancements in technology are creating a dynamic and fast changing world that affects how we live and work. Educators need to rethink existing teaching approaches to better prepare learners for future careers that Industry 4.0 will create. The World Economic Forum defined a new education model, called Education 4.0, which contains eight major changes to redefine learning in the new economy. Heutagogy, or self-determined learning, is an approach that promotes critical thinking, social-emotional skills, and life-long learning. These skills are necessary for Education 4.0. The purpose of this paper is to recommend the principles of heutagogy as an effective teaching and learning approach to meet the needs of Education 4.0. The approach of the study examines existing literature on Education 4.0 and heutagogy. A conceptual model that interconnects heutagogy to the four learning principles of Education 4.0 will be offered as a key finding to answer the research question: How does heutagogy in higher online education meet the needs of Education 4.0? The paper provides a base for further research and discussion into how heutagogy and other approaches can support the needs of Education 4.0 to prepare learners for a changing world.

Keywords: Education 4.0; Heutagogy; Higher online education; Industry 4.0; Lifelong learning

Résumé

Les progrès technologiques de l'industrie 4.0 créent un monde dynamique et en rapide évolution qui affecte notre façon de vivre et de travailler. Les éducateurs doivent repenser les approches pédagogiques existantes afin de mieux préparer les apprenants aux futures carrières que l'industrie 4.0 créera. Le Forum économique mondial a défini un nouveau modèle d'éducation, appelé Éducation 4.0, qui contient huit changements majeurs pour redéfinir l'apprentissage dans la nouvelle économie. L'heutagogie, ou apprentissage autodéterminé, est une approche qui favorise la pensée critique, les

compétences socioémotionnelles et l'apprentissage tout au long de la vie. Ces compétences sont nécessaires à l'éducation 4.0. L'objectif de cet article est de recommander des principes de l'heutagogie comme une approche d'enseignement et d'apprentissage efficace pour répondre aux besoins de l'éducation 4.0. L'approche de l'étude consiste à examiner la littérature existante sur l'éducation 4.0 et l'heutagogie. Un modèle conceptuel qui relie l'heutagogie aux quatre principes d'apprentissage de l'éducation 4.0 sera proposé comme résultat principal pour répondre à la question de recherche : comment l'heutagogie dans l'enseignement supérieur en ligne répond-elle aux besoins de l'éducation 4.0 ? Ce document fournit une base pour des recherches et des discussions plus approfondies sur la façon dont l'heutagogie et d'autres approches peuvent répondre aux besoins de l'éducation 4.0 afin de préparer les apprenants à un monde en évolution.

Mots-clés : éducation 4.0 ; heutagogie ; enseignement supérieur en ligne ; industrie 4.0 ; apprentissage tout au long de la vie

Introduction

Technological and global change in our social, economic, and work environments affects how we teach and how we learn. One of the drivers of change is technological disruption. The fourth industrial revolution, or Industry 4.0, is a technological revolution that will disrupt and transform how we live, work, and relate to each other (Schwab, 2016). Klaus Schwab, Founder and Executive Chairman for the World Economic Forum (WEF) professed that technology has made it possible for people to access the digital world through new products and services, such as “ordering a cab, booking a flight, buying a product, making a payment, listening to music, watching a film, or playing a game” (Schwab, 2016). These advancements in technology and globalization changed whole industries (ride sharing such as Uber changed the taxi industry) which triggered the increasing need for new skills in current jobs and, at the same time, displaced certain jobs and created new ones (Zahidi, 2019). The World Economic Forum (2020) estimated that 65% of students currently in school will work in jobs that do not exist today, 47% of today’s jobs will be automated in the next 10 years, and beginning in 2020, more than 50% of the content in graduate degrees will no longer be relevant in 5 years. By the time we learn something, it quickly becomes outdated. Agonacs and Matos (2019) described the twenty-first century learning context:

where the constantly changing workplace requires fast learners; where knowledge and skill acquisition has become increasingly the responsibility of the individual; where learning happens ubiquitously and non-linearly; where the Internet is a primary source of information; where an excess of information is at one’s disposal in a second; where most of the learning occurs through knowledge sharing; and where the role of the teacher or trainer has radically changed (p. 223).

Educators need to rethink existing teaching approaches to prepare students for future careers that Industry 4.0 will change and create. How we teach and how we learn needs to be “re-imagined for the emerging futures of work” (Hussin, 2018; Salmon, 2019) including both the alignment of

technology and human teaching and learning. Education 4.0 is a revolution in education that responds to the changes born from Industry 4.0 (Abdullah et al., 2020; Hussin, 2018; JISC, 2019; Koul & Nayar, 2021, p. 99). Skills that are most valuable in an Industry 4.0 world are those that are human-centric such as leadership, social influence, emotional intelligence, collaboration, creativity, critical thinking, flexibility, and adaptation to change (Salmon, 2019; World Economic Forum, 2020).

Heutagogy, or self-determined learning, can provide a model of online learning and teaching in higher education that develops autonomous capabilities for learners to design and create their own learning paths based on their needs, while promoting a new era of life-long learning that is critical for a changing digital world (Agonacs & Matos, 2019; Blaschke, 2021; Hussin, 2018; Ishak & Mansor, 2020; Salmon, 2019). Learning is becoming more aligned with what we do rather than what we know, making traditional methods of disciplined-based knowledge inadequate to prepare learners to live and work in communities and workplaces (Davis & Hase, 2001). Adult learners and workers will expect flexible and agile learning experiences that will match the needs of the future (Blaschke, 2021; Salmon, 2019).

A gap in the literature on Education 4.0 was found regarding a lack of pedagogical approaches. Most of the literature that discussed Education 4.0 focused on the competencies, skills, and capabilities required to meet the disruptions caused by Industry 4.0 as well as emphasizing a need for changes in how we educate and how we learn. The WEF (2020) suggested that education systems must become innovative and offered five key innovation approaches: playful; experiential; computational; embodied; and multiliteracy. Fisk (2017) offered an approach developed by the Institute for the Future (2013) whereby they suggested traditional education needs to transform into learning flows where education becomes “embedded in everyday settings and interactions, distributed across a wide set of platforms and tools” (Institute for the Future, 2013). The purpose of this paper is an attempt to address the transformation of education by suggesting heutagogy as an effective teaching and learning approach to meet the needs of Education 4.0. Ashton and Newman (2006) assessed that heutagogy “reflects the changed world in which learning takes place and recognizes the complex array of skills required for today’s different kind of workplace” (p. 829). Thus, this review of the literature on Education 4.0 and heutagogy in higher online education is guided by the following research question: How does heutagogy in higher online education meet the needs of Education 4.0? A conceptual model that interconnects heutagogy to the learning principles of Education 4.0 will be offered as a key finding. This paper provides a base for further research and discussion into how heutagogy and other approaches can support the needs of Education 4.0 to prepare learners for a changing and constantly evolving world.

Literature Review

The Evolution of Education

Academic literature in the field of Education 4.0 is limited. Much of the research and information about Education 4.0 is found in reports, blogs, videos, and websites. Themes found in these

resources vary in discussions about the evolution of education from Education 1.0 to Education 4.0 (Koul & Nayar, 2021; Salmon, 2017; Salmon, 2019), comparisons on the relationship between Industry 4.0 and education (Abdullah et al., 2020; Ally & Wark, 2020; Elayyan, 2021; Shahroom & Hussin, 2018; Xing & Marwala, 2017), and Education 4.0 frameworks that describe the future of education (Abdullah et al., 2020; Fisk, 2017; Koul & Nayar, 2021; World Economic Forum, 2020). A common theme of Education 4.0 found in the literature is that it is a response to global change that will impact jobs, businesses, governments, economies, culture, and education due to Industry 4.0 (Fisk, 2017; JISC, 2019; Koul & Nayar, 2021; Salmon, 2019; World Economic Forum, 2020).

Education 4.0 evolved from the models of Education 1.0 to Education 3.0 and has been described using Web 1.0 to Web 4.0 as a metaphor (Gernstein, 2014; Salmon, 2017; Salmon, 2019). Education 1.0 “is a type of essentialist, behaviourist education based on the three Rs”, which stands for receiving, responding, and regurgitating (Gernstein, 2014, p. 84). According to Salmon (2019), Education 1.0 and Web 1.0 represented “transmissive” ways of learning and teaching. Education 2.0 evolved with Web 2.0 (also called the ‘read-write’ Web), which provided interaction, collaboration, and content creation (Salmon, 2019). Web 3.0, or the Semantic Web, provided education with “relevant, interactive and networked content that is freely and readily available and personalized, based on individual interests” (Gernstein, 2014, p. 89). Education 3.0 is, therefore, considered the digital and mobility era of education, transforming the role of the educator to include digital tools and applications (Harkins, 2008; Salmon, 2019). Enter Education 4.0 and Web 4.0 (the ‘symbiotic Web’), a model of education where “students will expect, perhaps demand, learning experiences that reflect and enhance the way [to] live in the world” (Salmon, 2019, p. 102). In other words, the goal of Education 4.0 is to create a global education ecosystem, where the learner is at the core and empowered to create their own learning journey and their own knowledge (Koul & Nayar, 2021).

Education 4.0 Frameworks

There are two notable Education 4.0 frameworks found in the research conducted. The first is Peter Fisk’s (2017) Nine Trends in Education 4.0. Fisk’s (2017) vision of Education 4.0 “establishes a blueprint for the future of learning – lifelong learning – from childhood schooling to continuous learning in the workplace, to learning to play a better role in society” (para. 4). According to Fisk (2017), the process of learning will need to change and transform to something that is more personalized and collaborative. He identified nine trends that define Education 4.0 as shown in Table 1.

A second framework is offered by the WEF which defined the new education model Education 4.0, which aims to increase the quality and accessibility of learning through innovation, social mobility, and inclusion (World Economic Forum 2020). In their report, “Schools of the Future: Defining New Models of Education for the Fourth Industrial Revolution”, they provide a framework outlining four foundational skills and four approaches to learning “that more closely mirror[s] the future of work, and that takes full advantage of the opportunities offered by new learning technologies” (p.6) as shown in Table 2.

Table 1*Nine Trends in Education 4.0*

Trend	Brief description
Diverse time and place	Students need opportunities to learn anytime, anywhere
Personalized learning	Students learn at their own pace, taking on harder tasks after a certain mastery is achieved
Free choice	Students have a choice in how they want to learn
Project based	Students will adapt to applying skills in shorter terms to a variety of situations
Field experience	Students will be exposed to more hands-on, real-world opportunities i.e., internships
Data interpretation	Manual calculations will become irrelevant due to machines. Students will need to apply analysis and critical thinking skills to predict future trends
Exams will change completely	Students' knowledge will be assessed as they learn and demonstrate learnings through projects in the field
Student ownership	Students will become more dependent on their own learning
Peers and mentorship	Due to students' increased independence, mentoring will become fundamental to their success

Note. Adapted from *Nine Trends in Education 4.0*, by P. Fisk, 2017.

Table 2*The World Economic Forum Education 4.0 Framework*

Foundational skills (content)	Approaches to learning (experiences)
Global citizenship skills	Personalized and self-paced learning
Innovation and creativity skills	Accessible and inclusive learning
Technology skills	Problem-based and collaborative learning
Interpersonal skills	Lifelong and student-driven learning

Note. Adapted from *Schools of the Future: Defining New Models of Education for the Fourth Industrial Revolution*, World Economic Forum, 2020, p. 7.

The focus of the WEF's framework is to prepare children for skills and knowledge that will be needed in an Industry 4.0 work world; however, the framework can be applied to adults entering higher education as well as workers who either need or want to upgrade their skills and knowledge as their

work environments change. It is interesting to note that of the four skills identified by the WEF, only one referenced technology skills. Salmon (2019) identified this paradox where, although digital literacy and technological skills will be warranted to work and live in the new Industrial 4.0 era, the most valuable skills for the future will depend on the inherent human characteristics, such as “creativity, critical thinking, responsive communication, and out-and-out human collaboration” (p. 109). Another skill emphasized in the literature was the importance of lifelong learning (Ally & Wark, 2020; Koul & Nayar, 2021; World Economic Forum, 2020; Xing & Marwala, 2017). Lock et al. (2021) commented that “dynamic, complex societies now expect learning across one’s lifetime” (p. 1648), which will require learner agency and interactive methods of teaching and learning.

Both frameworks share a few common principles: a focus on learner-centred ownership to create their own learning path that is lifelong; learning will shift from traditional and siloed competencies to experiential and project-based capabilities that focus on adaptability and agility; assessment will become more “authentic, meaningful, and reflective” (Salmon, 2019); and the role of the educator transitions to a mentor, where the curriculum is collaboratively designed with the student. This paper will focus on WEF’s Education 4.0 model, which proposes a framework specifically designed to prepare learners for the Industry 4.0 work world.

Heutagogy

The Principles of Heutagogy

Heutagogy, also referred to as self-determined learning, was developed by Stewart Hase and Chris Kenyon in 2000 (Agonacs & Matos, 2019; Blaschke, 2012; Hase, 2014). It is a learning approach that places the “learner at the centre of the learning process” (Hase & Blaschke, 2021a, p. 13). In other words, the learner determines what and how to learn (Hase, 2014; Hase & Kenyon, 2000). Hase and Blaschke (2021a) provided a simplified list of principles fundamental to heutagogy. The first principle is *learner agency*, where the learner is at the centre deciding what and how to learn and how their learning should be assessed. *Self-efficacy and capability* refers to a learner’s ability to know how to learn, which is dependent on “the learner’s belief in his or her own abilities, and capability, which is the ability of the learner to demonstrate an acquired competency or skill in new and unique environments” (p. 14). *Metacognition and reflection* are concepts that go hand-in-hand. Metacognition is the process of learning by applying a double-loop method, which requires reflection, a critical learning skill that allows learners to synthesize what they have learned. *Non-linear learning* is the process whereby learners define and choose a variety of paths to learning and where the learner is responsible to choose what to learn and how to learn it. The last principle, *Learning how to learn*, is inherent within all four principles; nonetheless, it was deemed an essential principle by McAuliffe et al. (2009).

The Correlation of Learner Agency, Capability, and Lifelong Learning Skills

What is fundamental to self-determined learning hinges on learner agency, which is “the capacity of learners to take responsibility for and to direct and determine their own learning paths” (Hase & Blaschke, 2021b, p. 7). For learner agency to work, learners need to have a certain level of motivation and self-efficacy to define their learning path (Hase, 2014, p. 18). Hase (2014) recognized that a learner’s agency “is something that is intrinsic to each individual person” (pp. 18-19) and is a culmination of a person’s experiences, both past and present, providing learners with skills in both competence and capability.

It is important to highlight that heutagogy makes a distinction between competence and capability. While heutagogy recognizes competence as essential to being capable, it raises the importance of the capability to learn (Blaschke & Hase, 2015; Davis & Hase, 2001; Hase & Davis, 1999). Nagarajan and Prabhu (2015) defined competence as having skills, knowledge, and capacity to fulfill current needs, while capability focuses on the ability to develop and adapt to meet future needs. Capable people are more inclined to be creative, competent learners, prefer to work in teams, collaborate well, and have strong self-efficacy (Hase & Davis, 1999). Hase and Davis (1999) concluded that capable people experience richer learning experiences from those who only use competencies to learn (para 8).

Blaschke (2021) gathered capability skills that aligned with the principles of heutagogy found from three sources: “Future Skills: The Future of Learning and Higher Education” (Ehlers & Kellermann, 2019); “European Framework for the Digital Competence of Educators: DigCompEdu” (Redecker & Punie, 2017); and “LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence” (Sala et al., 2020), as shown in Table 3.

Table 3

Heutagogy Principles Aligned with Lifelong Learning Skills

Heutagogy principle	Lifelong learning skills
Learner agency	Active learning and learning strategies; autonomy; creativity; flexibility; leadership; personal agility; self-direction; self-initiative (intrinsic motivation); self-management; self-regulation
Self-efficacy and capability	Self-efficacy; tolerance for ambiguity
Reflection and meta-cognition	Ability to reflect; analytical thinking and innovation; complex problem-solving; critical thinking and analysis; ideation; reasoning; self-regulation; sense-making
Non-linear learning	Active learning and learning strategies; collaboration; cooperation and communication competence; digital literacy; technology use

Note. Adapted from Table 1. Heutagogy principles aligned with lifelong learning skills accessed from *The Dynamic Mix of Heutagogy and Technology: Preparing Learners for Lifelong Learning* by L.M. Blaschke, 2021, p. 1634.

The purview of each of the reports used by Blaschke (2021) are varied; however, all have one common theme: to identify key skills and competencies to work and live in a dynamic and changing world. The “European Framework for the Digital Competence of Educators: DigCompEdu” (Redecker & Punie, 2017) focused on identifying digital competencies for educators “to be able to effectively use digital technologies for teaching” (p. 15), while the “Future Skills: The Future of Learning and Higher Education” report takes a broader focus, which identified future skills that include individual development, instrumental, and social world/organization-related skills (Ehlers & Kellermann, 2019). Lastly, “LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence” focused on key competencies needed for lifelong learning and learning how to learn (Sala, et al., 2020). Blaschke (2021) concluded that heutagogy is an approach that can prepare students with lifelong learning skills to adapt to a changing workforce.

Heutagogy in Higher Online Education

Heutagogy has a natural place in higher online education because it shares “certain key attributes, such as learner autonomy and self-directedness, and has pedagogical roots in adult teaching and learning” (Blaschke, 2012, p. 57). Blaschke (2012) identified three specific common characteristics that both distance education and heutagogy share:

- Technology: Distance education considers implications of emerging technology on distance education theory and practice. The relationship with heutagogy is that it is considered a potential theory as a way to integrate emerging technologies in distance education.
- Profile of the distance education learner: Distance education has, traditionally, been designed for the experienced adult working learner. Historically, distance education practices have been strongly influenced by Knowles’ (1975) andragogy theory, which heutagogy is an extension of.
- Learner autonomy: Distance education supports a level of autonomy, a skill that is pivotal in heutagogical teaching and learning approaches.

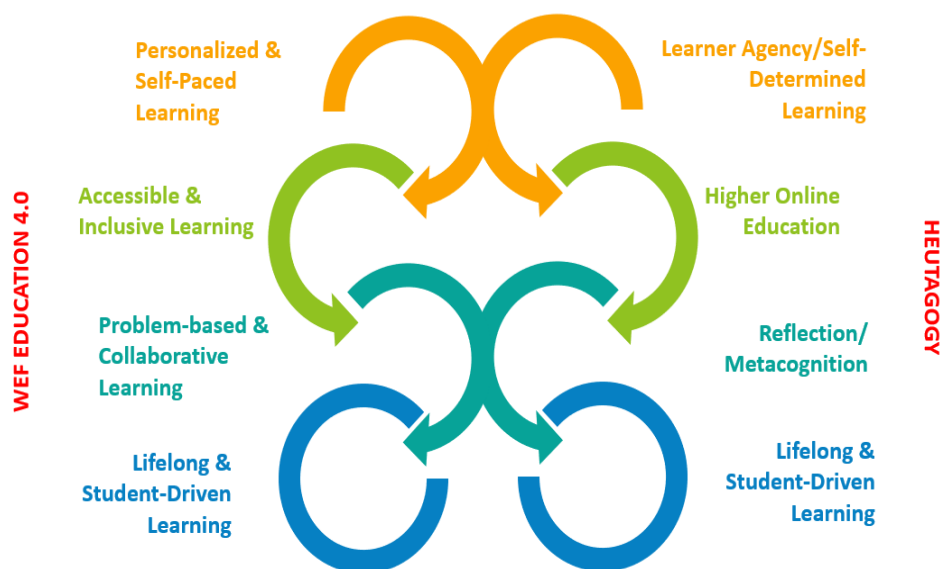
Online learning technologies, such as the use of e-portfolios, mobile learning, and social media, provide increased opportunities in learner agency, self-efficacy and capability, metacognition, non-linear learning, and learning how to learn (Blaschke, 2021). Further to this, Lock, et al.’s (2021) Delphi study on technology-enabled lifelong learning revealed a correlation between technology, online and blended higher education, and heutagogy. One of their conclusions indicated that heutagogy’s principles can occur in blended and online learning environments (Lock, et al., 2021).

Key Findings

This article aimed to address a gap in the literature on pedagogical approaches to applying the Education 4.0 framework by recommending heutagogy to address changes in how we live, learn, and work. The review of the literature on Education 4.0 and the principles of heutagogy revealed similarities in their approach to learning. Although the review was not exhaustive, it highlighted an interconnection between the two learning approaches as shown in Figure 1. As discussed in the literature review, Education 4.0 and heutagogy places the learner at the centre of the learning journey. This, unto itself, connects Education 4.0 to heutagogy. This concept led the author to investigate how heutagogy in higher online education can meet the needs of Education 4.0. Examples from qualitative studies are offered that demonstrate the application of the principles of heutagogy that align with Education 4.0's framework. Figure 1 illustrates how heutagogy's main principles correlate to WEF's Education 4.0 learning approaches.

Figure 1

The Interconnectivity of Heutagogy and WEF's Education 4.0



Personalized/Self-Paced Learning and Learner Agency/Self-Determined Learning

The World Economic Forum (2020) described personalized and self-paced learning as students designing their individual learning paths, gauging their own progression based on skill proficiency, and having flexible learning environments. Similarly, learner agency and self-determined learning are based on students' owning and choosing their learning path and the process to learn, which "can also equip learners with the skills and capabilities that will help them better transition to the workforce" (Blaschke & Hase, 2015, p. 29). A shift toward personalization in education allows students to tailor to their individual needs in work and life.

Canning (2010) explored the process of implementing learning and teaching strategies that empowered learners to develop as heutagogic learners, which was observed in a foundational degree program in early childhood. The program aimed “to facilitate heutagogy [by] providing opportunities for self-directed learning and professional development, with students encouraged to take control over their own knowledge acquisition and the reflective process” (p. 60). Blended learning and teaching approaches were adopted, which included face-to-face seminars, online learning, work-based reflection, and tutor visits in both face-to-face and online settings. This created a flexible learning environment of both social and academic experiences in which learners personalized their approach to learning through reflective portfolios and utilized social networking forums to share personal and professional information.

At the outset of the program, the learners preferred a more traditional pedagogical structure in which teachers were depended upon as knowledge experts to inform what is to be learned, when, and how. The program created a learning environment that eased the learners towards heutagogy by “developing a community of open discussion, sharing experiences and supportive networks to facilitate the beginnings of self-directed study and motivated learners” (Canning, 2010, p. 62). This approach supported and increased the learners’ confidence and allowed a sense of empowerment and self-efficacy to emerge. The work of Hase and Blaschke (2021b) recognized that learners need to have a certain level of motivation and self-efficacy to define their learning path. As one of the key principles, learner agency provides individuals with the competence and capability to bring together their past and present experiences to discover their own approaches to learning (Hase, 2014).

Accessible and Inclusive Learning and Heutagogy in Higher Online Education

Ensuring access to educational opportunities for everyone requires a transformation toward more accessible and inclusive learning approaches (World Economic Forum, 2020). In an Education 3.0 world (Harkins, 2008), technological advances such as social media, mobile devices, and software applications have increased access to information where learners can be more autonomous in their individual learning. The WEF (2020) suggested that accessibility to learn is increased through technology that include integrating multiple techniques such as “visual, audial, tactile, and kinesthetic methods” (p. 12) to create learning opportunities that suit the needs of all students. Heutagogy aligns with the WEF’s accessible and inclusive learning practice based on the premise that it is considered a “net-centric theory”, which is the connectivity of learners to technologies used in online learning (Anderson, 2010). Cochrane (2020) identified several advantages to applying heutagogy in online higher education that increases accessibility and inclusivity, such as empowering teachers to facilitate openness, develop assessment strategies that meet the needs of the individual, encourage active learning inside and outside of the classroom by establishing communities of practice, and provide accessibility and equitable access to technologies for both teacher and learner.

Agonács and Matos (2019) conducted a study to understand what empirical evidence existed to heutagogy in practice and found that “heutagogy and self-determined learning are predominantly linked in the studies to the online environment and digital technologies” (p. 234). Further to this, a qualitative study conducted by Tümen Akyıldız (2019) sought to discover the learner’s perception on heutagogical

implementation and its practicality. One of the research questions was based on “Technology integrated teaching” in which 55% of respondents recommended utilizing technology to be heutagogical learners” (p. 164). Blended learning environments also seemed to be a fit for heutagogical learning. Several studies proved that blended learning was one of the main success drivers for heutagogical learners because it provides multiple ways of knowing through different types of interactions that encourage the production of knowledge within formal and informal learning communities (Ashton & Newman, 2006; Canning, 2010; Singh, 2003).

Problem-based, Collaborative Learning and Reflection and Metacognition

The WEF (2020) recommended that learning needs to shift from processed-based learning, where teachers provide direct knowledge to students by demonstrating processes and formulas, to a problem-based approach, where students are assigned collaborative projects allowing opportunities to try multiple solutions to solve problems. Research conducted on problem-based approaches concluded that this approach to learning increased a student’s ability to solve problems, provided a sense of ownership to what and how they learn, and developed strong learning communities (WEF, 2020). Heutagogy adheres to the practice of reflection and metacognition, which is a similar approach to problem-based learning. Reflection allows students to think about what they have learned and how they learned it (metacognition) by revisiting their potential solution and finding ways to improve or adjust outcomes (Blaschke, 2021; Hase & Blaschke, 2021a).

Reflection and metacognition are learning processes in which learners assess past and current experiences, knowledge, or behaviours which they use to inform future knowledge and actions (Barnett & O’Mahony, 2006). In other words, reflection and metacognition combine hindsight, insight, and foresight to work through problems. Blaschke (2021) accounts that “the reflection process also allows [learners] to practice more analytical and critical thinking and to engage in complex reasoning and problem-solving” (p. 1633). Essentially, reflection and metacognition can lead to higher levels of cognitive activity, strengthening a learner’s ability to analyze and synthesize problems.

Lifelong and Student-Driven Learning

The WEF (2018) estimated that by 2022, an extra 101 days of learning will be needed to keep up with the changing work world. Ashton and Newman (2006) studied a group of academics in a university program preparing new teachers and found that “heutagogy provides an enriched teaching methodology for lifelong learning in universities in the 21st century” (p. 826) and Lock et al. (2021) recognized that the complexities of a changing world require people to be lifelong learners. This corroborates with the claims from heutagogy and Education 4.0, in which both emphasize the importance of developing lifelong learners to prepare them for an ever-changing work world (Hase & Blaschke, 2021; World Economic Forum, 2020).

Lifelong and student-driven learning in Education 4.0 and heutagogy depends on learner agency (Hase & Blaschke, 2021; World Economic Forum, 2020). Students have a voice and a choice on how they want to learn and assess when they need to learn. In a Delphi study on technology-enabled lifelong

learning conducted by Lock, et al. (2021), they recognized that heutagogy's principles support and build lifelong learning skills (Table 3). The authors claimed: "By using a heutagogical approach to instructional design, students learn to make decisions with regard to their learning, become more autonomous learners, and develop the knowledge and skills to engage heutagogically beyond higher education as lifelong learners" (p. 1649). Examples of lifelong skills include creativity, flexibility, self-direction, and self-regulation to name a few, all of which are also skills and competencies needed to work and live in a dynamic and changing world (Blaschke, 2021).

Conclusion

Several of the articles explored in this paper raised the concern that all levels of education face many demands to address changes in employability and society in general. WEF's Education 4.0 framework was premised on the expectation that jobs will change and become more complex. Workers will need to quickly adapt to new and disruptive innovations that will affect how we live and work. According to Blaschke and Hase (2015), heutagogy provides a framework that develops self-determined lifelong learners with capabilities that will prepare them for the workforce of today and in the future. Its principles reflect the changing learning environment and recognizes the complex array of skills, competences, and capacities needed for today's workplace. Heutagogy addresses the call to action from the WEF (2020) who are urging educators, governments, and organizations to "connect, scale and mainstream these promising new models, standards and approaches, and ensure access to Education 4.0 for all" (p.6). This paper analyzed the literature and discovered findings to answer the research question: How does heutagogy in higher online education meet the needs of Education 4.0? A conceptual model was presented to illustrate that heutagogy's principles can address Education 4.0's learning approaches; however, heutagogy is only one practice that supports the needs of today's and future learners. Further studies are recommended about how heutagogy and other existing pedagogies, models, theories, and approaches can assist in transforming teaching and learning for the new era in theoretically sound practice.

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