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Paper

The W-shaped model of professional competencies for the Fourth Industrial Revolution and its relevance to honors programs

Beata Jones[1*], Albert Pilot[2], Pierre van Eijl[2] & Josephine Lappia[3]

1 Texas Christian University, USA, b.jones@tcu.edu
2 Utrecht University, the Netherlands, A.Pilot@uu.nl, eijl0000@wxs.nl
3 Breda University of Applied Sciences, the Netherlands, Lappia.J@buas.nl

*Correspondence: b.jones@tcu.edu

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Abstract
As the world is undergoing the Fourth Industrial Revolution (4IR), the fusing of physical, digital, and biological worlds with new technologies, we experience the profound impact of this revolution on the labor markets and the subsequent career planning of students. The new economic reality created by 4IR calls for immediate action in the world of higher education. The purpose of this paper is to advocate for new key competencies that university students will need to thrive in the new economy. These competencies include human literacy, digital fluency, hyper-learning, and systems and design thinking. Together, they are presented as the "W- shaped 4IR Competency Model." This model combines previously published opinions about the topic from various educational futurists who have tackled the issue. This paper includes a call to action for universities to address the skills gap challenge of college graduates and rethink their value propositions. As honors programs are the breeding ground for innovation, universities might consider starting to test the robot-proof, twenty-first-century curricula with the smaller honors cohorts and then consider the curricular transfer to the mainstream educational programs. We urge honors educators and administrators around the world to adopt curricula that will make their graduates "robot-proof" and able to thrive in the new economy for decades to come.

Keywords: honors competencies; honors skills; fourth industrial revolution; digital age; 4IR

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1. Introduction

Higher education must prepare students for a working environment in an economy that has just undergone the Fourth Industrial Revolution (4IR, see Section 3), where artificial intelligence is now increasingly playing an important role. Schwab (2016) explains that the Fourth Industrial Revolution is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. Robots, artificial intelligence, and various other information technologies, applied at an ever-increasing pace within professions, will have a profound impact on the white-collar employment of college graduates (Went, Kremer & Knottnerus, 2015; World Economic Forum, 2018). How should our university training change as a result? Many programs in higher education are ill-prepared for the new reality, and we believe the problem is urgent. Since this is not a widely shared concern, this article is a call to action to convince educators—especially the honors program directors—of why action is needed.

Social and scientific developments require higher education renewal to meet the demands of the twenty-first century on the knowledge, skills, and mindsets of university graduates. The students who are now starting their higher education will enter the labor market in 2024 and will need to work for at least forty years. The half-life (that is the amount of time that has to elapse before half of the knowledge or facts is superseded or shown to be untrue) of the knowledge they acquire in college is under five years (Arbesman, 2013). Therefore, current students must develop not only their basic capabilities while in college, but also continue to develop themselves throughout their professional careers. We need, therefore, transformational learning (Mezirov, 1994) where students change their frame of reference about their world and leave the university as a different person than when they arrived. Honors education, often considered a laboratory for innovation in mainstream higher education (Wolfensberger, van Eijl & Pilot, 2012), can play a key role in experimenting with various paths forward, addressing the challenge of transformational learning. We as honors educators can help find the educational paths, where we currently have no roadmap. The remainder of the paper starts with the role of honors programs as laboratories of innovation for new developments. Then, the paper builds on the ideas of the changing nature of people, labor markets, and learning as a function of 4IR and proposes a new framework, the W-model, for honors education competencies and higher education at large. Four groups of competencies are identified as key in this model and then explained: human literacy, digital fluency, hyper-learning, and systems and design thinking. The paper concludes with a discussion of the proposed model limitations and the possible role of honors programs in the process of innovation towards 4IR-curricula.

2. Purpose of honors programs in higher education and their innovative function

The current purpose of higher education is to sustain the development of societies by enabling citizens to 1) play a productive role in society, 2) provide for a culture transfer, and 3) develop innate human potential (Seldon & Abidoye, 2018). Universities achieve their missions by various means (Xing & Marwala, 2017), focusing on knowledge acquisition and, more recently, skills development. An important purpose of honors programs worldwide is their role as laboratories of educational innovation within broader university programs, ultimately transforming the regular curricula (Wolfensberger et al., 2012). Honors programs typically provide motivated and able students an opportunity to realize their potential; to build a culture of excellence as a part of an agenda of an institution or a country; and to

provide an authentic learning environment with wicked problems that invite students within their learning communities to "learn how to innovate" (Lappia, 2015, 226; Wolfensberger, 2015, 16).

Honors programs across the globe differ in their guiding principles (Jones, 2016). The goal of honors in the United States is to offer "opportunities for measurably broader, deeper, and more complex learning-centered and learner-directed experiences" (NCHC, 2017). The modes of learning include research and creative scholarship, multi- or interdisciplinary learning, service-learning and leadership, experiential learning, and learning communities. Many honors programs in Dutch colleges and universities, on the other hand, focus on acquiring the following skills and competencies (Lappia, Weerheijm, van Eijl, & Pilot, 2014; van Eijl & Pilot, 2016) :

1. Personal development: Who am I? What do I want? What can I do well? How do I get there?
2. Multidisciplinary collaboration: Teamwork in projects where multidisciplinary perspectives were important.
3. Communication: Oral, written, and digital with fellow students and outside partners in authentic assignments requiring empathic listening.
4. Creativity: Thinking outside the box in projects and assignments

As honors programs are the breeding ground for innovation, universities might consider testing the twenty-first-century curricula with the smaller honors cohorts (van Eijl & Pilot, 2016) eager to focus on self-improvement and willing to tackle the development of relevant competencies needed for the Fourth Industrial Revolution (see Section 4).

3. Fourth Industrial Revolution

Fourth Industrial Revolution (4IR) (Schwab, 2017) refers to the fusing of physical, digital, and biological worlds (e.g. autonomous weapons, 3D Printing, synthetic biology) and is characterized by the growing use of technologies such as artificial intelligence, Internet of Things, robots, drones, virtual reality, cloud computing, and other advanced wireless technologies that are expected to change all disciplines, economies, and industries at an unprecedented rate. These new technologies are changing us and altering what it means to be human, resulting in changes to the way we think, live, work, and interact with each other (Kaplan, 2015; Levy & Murnane, 2012).

The 4IR is not just about technology and the unprecedented speed with which it changes the world we live in. 4IR creates an opportunity to take advantage of our global communities, build sustainable economies, become more equitable and inclusive, and shape a human-centered world by leveraging the new technologies. 4IR therefore gives us a chance to build a world of greater creativity, higher purpose, and deeper fulfillment (Neumeier, 2013, 21) by automating most mundane processes and allowing us to focus our energy on creative endeavors. Because of these opportunities, the following sections focus on some implications of the 4IR for people, labor markets, and learning, setting the foundation for the future of higher education and honors programs.

4IR implications for people

4IR holds great promise for improving the quality of life for the world's population, allowing our cities, governments, workplaces, and organizations to become "smarter" and requiring

us to plan for and adapt to these new technological capabilities. The changes require governments and businesses not only to keep up with the investment in infrastructure but also to develop future leaders who can take advantage of the new capabilities provided by the technology. Because of these societal changes, the tools and processes of the pre-digital era will no longer be effective in the next decades (Stevens & Strauss, 2018). People will be required to learn, unlearn, and relearn technologies, as demonstrated recently with the COVID-19 pandemic and the need to adapt to remote work within a week's notice.

Additionally, the use of social media for communication appears to have resulted in a lower level of social skills and empathy among young adults and children, as evidenced by the work of Campbell (2018), Grainger & Bandura (2019), and Sabatini & Sarracino (2014). The decrease in direct communication may have eroded our capacities to cooperate, to communicate in-depth, and to understand others (Colvin, 2015). "Retooled by the tools we use, our brain adjusts and adapts" (Davidson, 2011, 16). The new technological tools are not a "bad thing," though. We just must prepare the next generation of college graduates to harness them appropriately.

4IR implications for the labor markets

The developments in information technology also have a profound impact on the labor markets (Went et al., 2015) and career planning for the students of today (Frey & Osborne, 2013; Eliot, 2017; Beaudry, Green & Sand, 2013; IBA Global Employment Institute, 2017; Campbell, 2018; van Heugten et al., 2016). Tse, Esposito & Goh (2018) report a popular estimate that 65% of children starting elementary school this year will work in jobs that do not exist yet. Artificial intelligence could eliminate between 7 and 47% of the current jobs by the year 2030 (McDonald, 2019). The Dutch Scientific Council for Government Policy and the World Economic Forum expect that both routine activities and complex skills will become vulnerable to automation (Went et al., 2015; World Economic Forum, 2018). Artificial intelligence is effective when large data sets are available for training and testing and will, therefore, heavily influence the labor market of highly educated people. The 4IR is not about replacing human labor and energy by machines but about replacing human thinking, including recognizing and interpreting human facial expressions, voices, and emotions, and analyzing patterns and relationships that people do not see or understand.

The future workforce is expected to be a blend of humans and robots working together to enhance the employee experience in the gig economy (Meister, 2019). To become *robot-proof*, i.e., to become irreplaceable by even the most sophisticated artificial intelligence (Aoun, 2017; Pilot, 2020), we will have to embrace the new systems and robots and re-skill, if needed, to work along with them. We will need to become excellent at everything that makes us uniquely human and embrace the economy with its new challenges (Seldon & Abidoye, 2018; McKinsey Global Institute, 2019).

4IR implications for learning

Institutions of higher education also benefit from the new technologies available today. Professors take advantage of vast online resources and tools, enriching their teaching, and providing more stimulating courses. Video and collaboration technologies (Zubizarreta, 2020) allow remote participants to take live, online classes, as seen with the COVID-19 lockdowns. Distance learning with asynchronous courses allows working individuals to

complete online degrees or needed training without leaving their jobs or home at a lower cost. It is easier than ever to acquire knowledge and learn, whether through formal or informal education. Therefore, simple knowledge and rudimentary skills acquisition can no longer be the value proposition for universities or honors colleges.

Universities have already been under pressure worldwide to rethink their educational offers (Seldon & Abidoye, 2018), facing problems of affordability, maintaining quality, and, most notably, lack of adequate preparation for careers. Though the return on investment in college degrees is still positive, their value is deflating as the costs of higher education continue to increase (Aoun, 2017). A new focus on preparing college graduates for life in 4IR, using the newly available resources and tools, might help alleviate some of the current criticisms of higher education mentioned earlier.

4. Implications of 4IR for change in the competencies developed during college

What expertise, skills, and attitudes should we help develop in our students to prepare them to flourish in the new economy? To answer this question, the authors carried out an investigation by the method of theoretical generalization (Payne & Williams, 2005) and analysis of recommended practices, using descriptive approaches of comparative education via a document review of reports, books, websites, articles in scientific journals, and conference proceedings. Databases were searched using combinations of keywords such as "21st century," "Fourth Industrial Revolution," "future," "skills," and "competencies." The selection of sources was made based on the subjective judgement of the authors' importance in the domain of discourse. Identified competencies, repeatedly advocated by researchers, were generalized by the first author into four groupings of related items.

Based on the above analysis, the following four competencies for success in the twenty-first century have been identified: *human literacy, digital fluency, hyper-learning, systems and design thinking* (Toffler, 1970; De Waal, 2009; Thomas & Brown, 2011; Davidson, 2011, 2017; Neumeier, 2013; Colvin, 2015; Aoun, 2017; van Eijl et al., 2017; Kosslyn, 2019; Seldon & Abidoye, 2018; Tse et al., 2019; Meister, 2019). These competencies include capabilities or "observable human attributes that are demonstrated independent of context" (Hagel, Brown & Wooll, 2019, "The good news"), such as human literacy, and the remaining metacognitive skills that are transferrable from situation to situation and from domain to domain. When these four competencies are combined with deep functional expertise in at least one field, the competencies promise to deliver excellence in future jobs, including the ones that might not exist yet. Table 1 below presents an explanation of the four sets of competencies and a brief discussion of each competency follows.

Table 1. 4IR Competencies

Human literacy 1. Empathy 2. Communication 3. Collaboration 4. Emotional intelligence 5. Networking & influencing 6. Cultural agility 7. Ethics 8. Confidence	**Digital fluency** 1. Data fluency 2. Technology fluency 3. Coding 4. Digital storytelling 5. Critical consumption of information
Hyper-learning 1. Fast, continuous learning 2. Learning, unlearning, and re-learning 3. Reflecting on learning 4. Deliberate practice	**Systems & design thinking** 1. Critical thinking and problem-solving 2. Creativity/ innovation/imagination 3. Thinking holistically 4. Agile frameworks 5. Change management 6. Entrepreneurship

Human literacy

As artificial intelligence advances, rendering many human skills unnecessary, higher education might want to shift its focus to developing skillsets and mindsets that computers cannot easily mimic. While technical skills meet the entry-level requirements for jobs, our social skills will lift us to the status of stars in the future (Neumeier, 2013, 82). In the age of robots and artificial intelligence, theorists have consistently highlighted human literacy as our key differentiator from machines (Aoun, 2017; Seldon & Abidoye, 2018; Tse et al. 2019). Human literacy takes us beyond the ability to communicate and collaborate, focusing on developing the knowledge and skillset to not only understand oneself and others but to meaningfully connect with them. The components of human literacy include *empathy, communication and collaboration, emotional intelligence, networking and influencing, cultural agility, ethics,* and *confidence.*

The key component of human literacy is *empathy*. Empathy, the ability to discover what another person thinks and feels to give an appropriate response, is the foundational skill that increasingly makes people valuable as technology advances (De Waal, 2009; Neumeier, 2013; Colvin, 2015; Aoun, 2017). People have traditionally developed the ability to empathize outside the realm of formal education; however, as empathy scores among American college students between 1979 and 2009, and especially after 2000, have strongly decreased (Colvin, 2015; Konrath, Chopik & Hsing, 2014), universities might consider including empathy training in students' professional development programs. Indeed, people can develop empathic abilities (Colvin, 2015, 85; Gotto, 2013).

Researchers still consider *communication* (Tse et al., 2019) and *collaboration* skills (Davidson, 2011; van Eijl et al., 2017) as pertinent components of human literacy since most of "the great advances of the future will not come from a single man or woman, but from a concentrated effort of a group" (Neumeier, 2013, 30). One cannot express empathy or collaborate without communication. Through collaboration and fusing of different

perspectives from individuals with various disciplinary backgrounds, we are seeing different contexts and typically come up with better solutions than if we worked individually.

Effective collaboration requires *emotional intelligence* (EQ), the ability to identify and manage one's own emotions and the emotions of others (Davidson, 2017). Teamwork invariably involves resolving conflicting viewpoints, which is challenging without EQ. According to a University of California Berkeley study, EQ abilities are four time more important in a workplace than IQ (Neumeier, 2013, 82).

In addition to emotional intelligence, another key ability is understanding how to thrive within a *network* of others (Davidson, 2011) and *influencing others*, as innovation often requires the implementation of unpopular ideas without alienating others or demotivating a team (Neumeier, 2013, 152). Given our global economy, the prevalence of working across borders, and different corporate cultures, *cultural agility,* or the ability to perform successfully in cross-cultural situations, is also required of the twenty-first-century worker (Aoun, 2017). The essence of being human is to make moral choices, thus all students should get a grounding in *ethics*, especially as related to the dilemmas created by the 4IR (Davidson, 2011; Aoun, 2017; Seldon & Abidoye, 2018). Finally, future generations will need *confidence* to boldly take on the challenges of the complex world we live in as well as the needed risks (Tse et al., 2019).

Digital fluency

Technology is the driving force of human society. "McKinsey suggests that by 2030, the workforce will spend 55% more time using technical skills than in 2016" (McDonald, 2019). Therefore, digital fluency is yet another key competency to develop for the future, as suggested by, e.g., Davidson (2011), Aoun (2017),van Eijl et al. (2017), Zimmerman (2019), and Tse et al. (2019). Digital fluency requires *data literacy, understanding of various technologies* and their affordances*,* some *coding* skills*, digital storytelling,* and the ability to *consume information critically.*

Data literacy will enable us to analyze the big data generated by billions of smart objects and systems to make better decisions, capturing new markets or market shares (Davidson, 2011; Aoun, 2017). *Understanding technology* will help us deploy better systems to solve the problems at hand or capturing opportunities (Davidson, 2011, Aoun, 2017). While not everyone needs to be a programmer, understanding the conceptual elements of *coding* will enable us to communicate our needs better to those who code and to sharpen critical thinking skills. Coding will allow us to begin interacting with technology in a more constructive way (Aoun, 2017; Tse et al., 2019). *Digital storytelling* skills will enable us to more effectively share the narrative and information we want to get across, which often needs to be presented digitally (Davidson, 2011; Aoun, 2017). Finally, the ability to *consume information critically* is key to finding credible sources in the sea of information and misinformation. Critical thinking has a long history of being recognized as a key skill to develop in honors education as well.

Hyper-learning

Lewis Perelman (1992) originally coined the term *hyper-learning* to mean self-directed, non-linear, *fast, and continuous learning* using technology to extract new insights from a maze of

information and experiences, enhancing our intelligence. Hyper-learning benefits from a "growth mindset" (Dweck, 2007), the belief that one can learn and increase the capacity to learn by *reflecting on the learning* methods and corresponding accomplishments. Hess and Gozdz (2018) re-examined the hyper-learning idea, suggesting that becoming a hyper-learning community is the future of business during the 4IR and beyond.

As we currently live in a world of constant change, with the COVID-19 pandemic underscoring this point, learning how to learn is a key literacy. This ability gives a person the power to apply the principles of learning to new disciplines, giving one the confidence that anything is possible to learn. This skill requires individuals to develop a new concept of knowledge—one that sees it as a process rather than a thing, *constantly learning, unlearning, and re-learning* (Davidson, 2011).

When learning occurs in the domain of one's passion with focus and competent guidance, the mastery of the field often follows. "The path to mastery is the journey to yourself" (Neumeier, 2013, 231), and thus it is highly relevant in honors education that aims to build self-awareness.

Systems and design thinking

Systems and design thinking competencies take the students beyond the development of critical thinking skills and creativity, all widely advocated in the recent literature on future-proofing one's career (Neumeier, 2013; Aoun, 2017; Seldon & Abidoye, 2018; Tse et al. 2019). As Arnold and Wade (2015) state, "*systems thinking* is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors, and devising modifications to them to produce desired effects" (p. 675). Similarly, according to IDEOU (n.d.), "*design thinking* is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." As the problems facing the world are complex and consumers become accustomed to personalized offerings exceeding their expectations, both systems thinking (Senge, 2006) and design thinking are necessary competencies to develop among university students. Systems thinking requires *critical thinking and problem-solving skills, thinking holistically, embracing ambiguity,* and *implementing the agile and change management frameworks* (Alexander, 2018; Meister, 2019). Design thinking builds upon our empathy and *creativity* skills, fostering curiosity, *imagination*, divergent thinking, playfulness, and wonder (Staley, 2019, 128), key right-brain skills that are harder to automate. Creativity, imagination, and design thinking are the keystones of *entrepreneurship*, which generates original solutions to challenges or opportunities. Systems and design thinking take critical thinking and creativity skills development, common honors curricular goals, and elevate them to 4IR relevance by allowing individuals to tackle harder problems with better human insights.

5. The W-shaped 4IR competency model

Literature is full of a letter- or symbol-based metaphors that describe the type of person one might find in a workplace, based on his or her expertise and skills. The most commonly discussed skillset letters in the literature include a hyphen/dash (Sharma, 2018), an "I" (Groll, n.d.), a "T" (Fay, 2017; Hansen, 2010), a "π" (Sharma, 2018), and most recently, a "Z" (Meister, 2019). Given the prevailing focus on letters or symbols to describe a model, we

were also compelled to select a letter for our competency model. We chose the letter "W," as it conveniently could stand for "win" in the age of 4IR. The "W"-shaped competency model aims to develop people with imagination and vision, who can collaborate to design innovative outcomes, filter non-essential information, and focus on the key problems at hand, while just-in-time filling-in important expertise gaps.

The W-shaped model combines competencies, which typically no single program offers, and therefore could be well-suited to honors interdisciplinary curricula. The model calls for multi-disciplinary insights, skillsets, and mindsets typically developed across a variety of fields, such as humanities, sciences, educational sciences, business, and art. The W-shaped-skilled individuals will have, besides deep functional expertise in at least one field of study, the needed attributes to develop into superstar employees of the future—individuals not defined by their title, who can see the big picture and details, who show real grit (Duckworth et al., 2007), are kind, and move the needle in the organization (Holmes, 2016).

Figure 1. The W-shaped 4IR Competency Model

Source: Jones, 2019

6. Conclusion

The recent changes in technology adoption, accelerated by the COVID-19 pandemic, have created a new economic reality that calls for immediate action in the world of higher education and particularly in honors programs, which aim to offer innovative curricula. While popular media made us believe that AI is going to take over our jobs, the truth is that AI will simply change the nature of our work, eliminating some jobs, and creating new ones. The new jobs will require different competencies than what many institutions of higher learning have been developing thus far. In the future, humans and technology should work cooperatively, which has the potential to make a better world for all of us. It is time for universities to realize the urgency of the impact of new technologies on the labor markets, rethinking value propositions. The W-shaped professional competency model may offer an avenue for consideration to some higher education institutions.

An important limitation of this paper to note is that it presents a prediction for the future, based on common beliefs among educational futurists from the developed countries. In

developing countries, the future may not reflect the Fourth Industrial Revolution reality and therefore, the objectives for higher education and honors programs in those countries might be more traditional. Additionally, the future is uncertain, as we have seen with the sudden outbreak of the COVID-19 virus and the resulting changes in the world around us. The current W-model key competency predictions are based on the recent, observable trends before COVID-19. As new trends become identified, the W-model will need to be refined and updated, as needed. Additionally, the model should not be perceived as a dictate in restructuring curricula in higher education where different choices must be made for each study program depending on situational factors.

Honors programs can and should, however, play a key role in the curriculum innovation process. These are the places within universities where there is room to experiment with new content, new assignments, and new teaching methods. In a recent study (van Eijl et al. 2017), students from three honors programs from different institutions were asked if their honors programs stimulated them to acquire the twenty-first-century skills as formulated by Binkley et al. (2010), which overlap the competencies of the W-model. Nearly all students replied that their honors programs encouraged them more to acquire some of these skills and more so than their regular program. In an ongoing study, van Eijl and Pilot (in preparation) found that 4IR competencies were an important part of the efforts of teachers and institutions to transfer the expertise and goals of the honors programs into the regular programs in experiments with honors as a laboratory of innovation.

Our paper is a call to action for universities to address the skills gap challenge of their graduates. Let us begin with honors programs to explore, design, and institutionalize the educational paths for the future explored in this paper. Revolutionary changes typically start with the grass-roots movement (Perelman, 1992), so we urge honors educators and administrators around the world to adopt curricula that will make their graduates robot-proof, able to “win” in the new economy for decades to come.

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