

# Fourth Industrial Revolution and Curriculum Development

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## ABSTRACT

The Fourth Industrial Revolution (4IR) was built on the ICT and electronic transformations of the Third Industrial Revolution. This paper focuses on the 4IR's impact on the educational sector, particularly on the academe's role in the supply side of the future workforce. The educationist aims to design the learning program that would best equip the student for the workplace of the 21st century, and the success indicators of the learning program are responsiveness to job demands and curriculum contents relevance. How well the education strategist understands the workforce market and its required proficiencies would spell attainment of the key indicators. This researcher is tasked with the continued equipping of the university faculty and aims to share this critical need for educators to integrate into their learning objectives the acquisition of the required 21st-century skills by the students.

**Keywords:** 4IR, ICT, 21st Century Workplace, curriculum content relevance, Philippines, Asia

## INTRODUCTION

Technology has immensely transformed our society in the last decade, and many writers have ascribed different terms for this phenomenon. The phrases New Economic, Digital Economy, Internet Economy, Web Economy, Digitization, Digitalization, Digital Transformation, and 4IR, can

portray this transformation. The latter term is the more telling designation because it provides the context of transition. It subsumes the economic, social, technological, educational, and governance aspects of this change. This contextualization follows the industrialization framework identifying the key change agent and traces its impact on selected societal dimensions. The change agent for the First Industrial Revolution (IR) was water and steam power to mechanize production. The 2nd IR used electricity for mass production. The 3rd IR used ICT and electronics for automated production. The 4IR is the digital revolution that began in the 1980s and is characterized by technological convergence blurring the physical, digital, and biological spheres. 4IR further builds on computerization from 3IR with more IT-hungry applications like cognitive computing or AI, the internet of things, big data analytics, and cybersecurity, among others.

4IR changed how people learn and how to apply technology to learn. Graham Brown-Martin (2019) restated Toffler's (1970) quotation, "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn." The phrase emphasizes that in times of rapid change in an uncertain future, the most valuable skill would be learning rather than simply reciting a set of facts and procedures. Technological convergence has shifted learning paradigms, and educators need to review the learning process to equip learners with 21st-century skills adequately. They need to de-silo the curriculum and design learning experiences that encourage learners to make things by collaboratively solving interesting real-world challenges, which will be the key to prospering in the 21st century. The future workers will succeed by working alongside machines rather than competing with them, by programming them rather than being programmed by them. Education is the primary tool for connecting people to the workplace. It is a building block that is used to aid employment. Employment, in turn, is the channel that allows people to be economically autonomous and play an active role in the economy (Gwata, 2019).

This researcher aims to track how the paradigm shift wrought by technology will impact the educational institution and thus develop strategies in this sphere. Publications from the OECD, Philippine Institute for Development Studies (PIDS), MIT Sloan Management Review, Deloitte Digital, World Economic Forum, McKinsey & Company, and other articles on 4IR will provide sources for this study to propose educational policies, particularly in the curriculum development.

**Literature Review.** The following sources discuss 4IR, the needs and qualifications for the 21st-century worker, and the vital role of the academe in equipping the future workforce. The PIDS publication “Assessing the Alignment of Data Science and Analytics (DSA)-Undergraduate Related Programs with the Emerging Demands for DSA Workforce” by Quismorio et al. (2020) studied the impact of increasing demand for DSA professionals and its supply-side status in terms of the curriculum design by the educational institution, which will be extensively discussed in the next section, primarily guides the direction of this paper. Harris & Mehrota (2014) observed that the increased demand for DSA is due to the emergence of the digital enterprise with a huge appetite to amass and analyze data which coincides with the decreasing cost of data storage and increasing computing power to support sophisticated data extraction techniques. Another PIDS article titled “Preparing the Philippines for the Fourth Industrial Revolution: A Scoping Study” by Dadios et al. (2018) comprehensively describes the 4IR, its impact and implications, and the Philippine governments’ policy response to this technological revolution. The PIDS 4th Annual Public Policy Conference of 2018 emphasized 4IR and gathered perspectives from stakeholders to guide the formulation of responsive public policy to 4IR (PIDS, 2019). The Proposed PIDS Research Agenda for 2020-2025 is anchored on the AmBisyon Natin 2040 framework based on three pillar objectives of 1) to enhance productivity, 2) to sustain growth potential, and 3) to enhance the social fabric and reduce inequality. The established research objectives were a consensus among experts and set 4IR as the first critical area among the first objective/pillars with trading arrangements and agricultural productivity (PIDS, 2019)

Renjen (2020) observed in the 2019 Deloitte Global annual survey on C-executives that business leaders have seen the need to nurture a culture of lifelong learning and equipping their workforce with skills for the future. Another Deloitte survey in 2017, the Industry 4.0, also assessed C-level readiness for 4IR and found that only 25% of the executives were confident that they have the right workforce composition with a low 17% HR/ talent prioritization on the determination and hiring of the right workforce (Forbes Insight & Deloitte, 2018). The PricewaterhouseCoopers Future Workforce survey of 2017 found that about three-quarters of the workforce see the need to attain new skills to remain employable in the future and the same rate of workers see that technology cannot replace people (PricewaterhouseCoopers, 2017). Butler (2018) observed that

academe is best positioned to address the soft skills gap of the 21st-century workforce.

**Discussion.** The 4IR changed working conditions and workforce qualifications, causing an imbalance in the workforce demand-supply situation. This disparity can be attributed to a country's policies. The mantra "The future is already here – it's just not very evenly distributed" by William Gibson from his 1984 novel "Neuromancer" rings true regarding the impacts of the industrial revolutions as some countries have yet to experience the effects of the Second and Third IR while leading countries have already leapfrogged to the 4IR. Country development is largely determined by its degree of saturation on industrialization. But 4IR also allows people to leapfrog the requisites of the prior IRs because the physical-digital-biological convergence is largely based on people's soft skills. A 2020 CNA feature article on TikTok highlighted the empowerment endowed by the viral video app on a backwater Indian artist, which would not have been possible if not for the low-cost high-availability internet in remote Indian villages. High technology made possible the exposure and dissemination of a unique raw talent otherwise not possible without the viral app. Highly technical skills may not be necessary for the artists but much so for the video app developer and the DSA who created the app recommender algorithm. The skills of the artist, the app developer, and the DSA, although divergent, were equally leveraged by 4IR technology. The millions of video viewers were drawn to the artist's opus by the recommender algorithm, the AI in the video app pooled the subscriber preferences, and the low-latency network allowed concurrent viewing by the millions. The digitalized artist skills and the developers' digitalization skills combined to redefine the 4IR workers' success formula. This success definition was unheard of and unattainable before the advent of 4IR. Today's workforce must develop skills mainly through social and emotional learning (SEL), which may include the ability to collaborate, communicate, and solve problems. These SEL proficiencies combined with traditional skills will equip the worker to succeed in the digital economy. The basic commonalities in the success formula were identified in 16 skills to be developed in the 21st-century students (Soffel, 2016). Digital empowerment has caused disintermediation or the reduction of intermediaries between producers and consumers and requires wider skillsets and flexibility from the producers. Jobs created tend to require higher levels of education and specialized study, while jobs destroyed

involve physical or routine tasks (Davis, 2016). The educational institution is best positioned to contribute to the preparation and training of future workers. The educator must strategize on how curricula and learning will need to change (Butler, 2018).

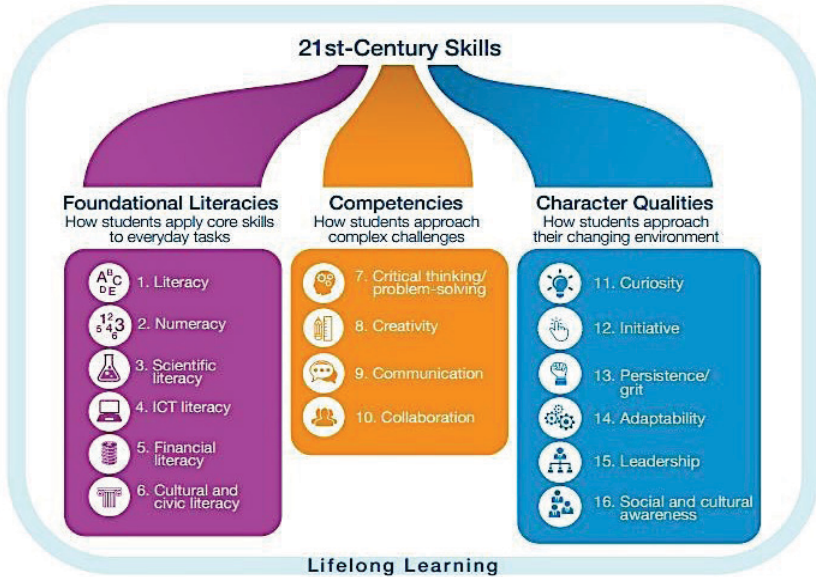


Figure 1. Skills for the 21<sup>st</sup> century

“Lifelong learning for all” as a policy goal was identified by OECD Education Ministers in 1996 (Lifelong Learning for All, OECD, 1996) and echoed in UNESCO publications and the European Commission as a response to the challenge of rapidly changing economic landscape and the premium need to innovate, improve productivity and painless adaptability to structural changes. It was in the context of rapid technological progress and international economic integration that the 1994 International Adult Literacy Survey (IALS) of 12 OECD countries was done and had the sobering finding that less than 25% of the adult population failed to reach three of the five minimum literacy competence level needed to adequately cope with the complex demands of everyday life and work. These results were confirmed by follow-up surveys in 22 countries/regions.

Most educational policymakers assume that credentials systems and lifelong learning are linked; however, this has never been verified. This

is because, while there is a lot of information regarding lifelong learning and credentials systems, the middle ground has been mostly untapped. The focus is on this middle ground, according to Matter (2007), and the question is: how can national credentials systems support lifelong learning in terms of quantity, quality, efficiency, and equitable distribution of learning opportunities?

Mechanisms are the theoretical connections between national credentials systems and lifelong learning, and each one should be able to adjust the qualifications system to make it more favorable to lifelong learning. Policymakers will have a reason for altering credentials systems with lifelong learning advantages in mind if such mechanisms can be found, understood, and then translated into concrete solid links.

The ASEAN Qualifications Reference Framework (AQRF) adopted the learning outcomes approach from the OECD qualifications model to allow transferability of learners and workers qualifications among member states. The AQRF has two components, the Learning Outcomes, and Level Descriptors. Learning Outcomes are statements that describe significant and essential learning that learners have achieved and can reliably demonstrate at the end of a course or program. In other words, the learning outcomes approach identifies the scope and depth the learner will know and be able to apply by the end of a course or program (AQRF, 2018). It should be noted that the AQRF distinguishes between a supply-push and demand-driven qualifications framework (QF). This distinction will bear much on the relevancy of learning programs and the flexibilities required for the program graduate. The supply-push QF tends to be more rigid and formal as the qualification level of professions such as a medical doctor, architect, accountant, and engineer was already fixed. And the demand-driven QF focus on the qualifications of work skills or may require a separate framework or as an integrated framework. The 21st-century workplace and the 4IR have provided a close approximation of the market-driven workers' qualifications. QFs are mostly dependent on the established educational policies of a member state. The state educationists should understand the workforce market and its required proficiencies to design the learning programs that would best prepare the workers for the 21st century. Key indicators of the learning program are responsiveness to job demands and curriculum content relevance.

**4IR and Curriculum Development.** The 4IR and its attendant new technologies drive the rapid changes in the workplace and for worker

qualifications and competencies. The 21st-century workers' qualifications are marked with lifelong learning and flexible soft skills which can be integrated into curriculums. The educationist is required to have a clear understanding of the workplace demands and capable of flexible and modular learning programs that would closely approximate the graduate outcomes sought by employers.

**History of the Argument.** The 4IR is characterized by dynamic production and labor markets requiring an educational system that enables flexibility and modularity to cater to the changing needs, diverse talents, passions, and interests of students (Dadios et al 2018). Learning is expected to be generated from various environments including formal, non-formal, and informal education systems. Given the expected diverse ways of generating competencies and skills, the quality assurance and certification systems should not be limited within systems but should facilitate movement across formal, non-formal, and informal education systems. The assessment and certification of knowledge learned outside the classroom will be an important source of building qualifications. Also, it should facilitate movements of learners across different levels (Worldbank, 2003; Brown-Martin, 2019).

**The extent of the Problem.** The Philippines is among the legacy countries, the lowest archetype of countries on 4IR readiness, in the World Economic Forum report on Readiness for the Future Production (2018) scoring 6.1 out of 10 unfavorable drivers and complex structures of production. The Philippines are Thailand, Mexico, and India. The next higher archetype of countries are those with a simple structure of production and unfavorable drivers of production called nascent countries which include Indonesia and Brazil. Domingo (2019) opined that our country could be among the 4IR nascent countries by taking 3 actions: first, to upskill and reskill workers for the 4IR; next is to innovate organizations to adopt available technology platforms; and finally, to set in place the fundamental building block of good governance.

**Effects of the Problem.** Competencies lacking in the graduated workforce would risk the employers hiring workers without the right skills for the required tasks. Productivity would be sacrificed for additional training and longer job adjustments. Hesitant employers who are cautious about hiring less competent job applicants would exacerbate youth unemployment.

**Potential solutions.** The methodology adopted by Quismorio et al (2020) where a professional maturity model, online job scraping, and juxtaposition of scraped competencies with Commission on Higher Education (CHED) curricula were taken for the data science and analytics (DSA) professionals can be applied to other professional programs. The maturity model was based on competencies recommended by the Asia-Pacific Economic Cooperation. The online job scraping established the competencies for DSA job roles sought by employers. The CHED curricula for programs that could be sources for DSA prepared graduates.

## CONCLUSION

The 4IR has changed working conditions and workplace qualifications and the academe is best positioned to prepare the future worker through relevant and responsive learning programs. Educators need to de-silo the curriculum and design learning experiences that would encourage innovation and collaborative problem-solving for real-world challenges. The future workers will succeed by working alongside machines rather than competing with them, by programming them rather than being programmed by them.

“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn”. Lifelong learning is a sine qua non for the 21st-century worker as structured education from school or college cannot fully prepare the worker in the continually evolving workplace. Soft skills can be integrated into the learning outcomes of school curricula. The future workers’ essential attributes of creativity, curiosity, and critical thinking can be taught in a learning program that closely approximated the learning outcomes with the graduate sought by the employers. It is an impetus for the government to work on the appropriate mechanisms to define the middle ground between lifelong learning and qualifications framework.

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