Philippine Higher Education Vis-À-Vis Education 4.0: A Scoping Review

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Abstract: Education 4.0. is paralleled with the birth of industry 4.0. The latter demands more to former to sustain its revolution. Breakthroughs in technology that are variably absorbed in the Philippines in becoming an industry 4.0 posed great challenge in the current education system to produce a different Filipino in modern world. This study is a scoping review centers on yielding insights about the status of Philippine higher education in transforming to education 4.0 in the context of research, advancement in technology, and the facilities. It also addresses the education 4.0 of ASEAN countries. The searched literature from ten academic databases were critically assessed based on inclusion and exclusion criteria. Research capacity and development made other countries to advance and in bridging the gap between industry 4.0 and education 4.0. Variance of technological advancements as well as the preparedness and availability of modern educational facilities determine the status of Philippine higher education in relation to education 4.0. In position to this, Philippine education system must plan yesterday in preparation for the modern world and ensures that the demands of industry 4.0 are well taken not only locally but globally

Keywords: Philippines, Higher Education, Education 4.0.

1. Introduction

Industry is mutually partnered with education, as history proves that revolution in the industry from 1.0 to 4.0 has paralleled relationship with education from 1.0 to 4.0 [1]. This came into the existence of the term "education 4.0" [7]. The former is always a response to the latter. To catch up with the industry 4.0 where human and technology are united to unlock promising possibilities, education 4.0 has become the trend of discourse by scholars as the direction of the future of education [1], [5-7]. Certainly, Industry 4.0 will be demanding more in the present education system with its current technology and methodology in teaching [2]. It requires that the system of education provides a learning experience with a globalized environment that are automatized, networked, virtualized, and flexible [3]. With the goal also of producing future workers that are competent in the use of emerging technologies as well as the values associated with it [6]. There is also a vision that the learners should learn to learn the sources of learning and how to build knowledge and skills within the process of learning [7]. So far, ASEAN countries such Malaysia, Vietnam, and Thailand to name few has already developed a blueprint in their higher education system for alignment with global trends bound with enduring necessary changes and adaptations [2] – [3]. Based on the report of Technical Education and Skills Development Authority (TESDA) 2016, Philippines education system realized the surged of alignment with global trends through the recent relevant reforms in the system of education which includes K-to-12 and the development of Philippine Qualifications Framework (PQF)

[4]. It is a realization that in modern world it requires a different Filipino [3] – [4]. But an issue would be there enough preparation and readiness in consideration to the present research development capacity, facilities, and technology which are requirements to claim that the country is ready for education 4.0 or perhaps, it is still in the education 3.0 and in a long way for revolution because of gap in the technology. Based on literature [5], breakthroughs in technology in the Fourth Industrial Revolution (FIRe) including artificial intelligence (AI), advanced robotics, neurotech, nanotechnology, blockchain, data analytics, biotechnology, cloud technology, 3D printing, and Internet of Things (IOT) are variably being diffused in the Philippine industry. These are evidences of workforce demands needed to address by the country's system of education. In an article of Martin et al. [6] purported that education system must be with lifelong affair with industry 4.0 because of its very fast revolution. But is this mutual affair factual in the Philippines? This paper has the goal to describe and analyze the status of Philippine higher education in transforming to education 4.0 in terms of capability in research and development, technological advancement, and educational facilities. This study also provides brief insights about ASEAN countries strategies in preparing and transforming their education system to education 4.0.

2. Methodology

2.1 Literature search

Ethical approval was not taken because it is not required for a literature review. In the search of literature, six academic databases were considered: Google Scholar, JSTOR, Academic Search Premiere, arXiv, Directory of Open Access Journals (DOAJ), Microsoft Academic, Embase (Elsevier), Jurn, BioOne, CiteSeerX, EconBiz, HubMed, and OAlster. The search Boolean or combination of terms were: "education* 4.0" OR "4.0 education" OR "Philippines* Higher Education" OR "Philippines* Education 4.0" OR "Education 4.0* Philippines." Other specific search term used was "education 4.0 filetype:pdf." Considerations for limiting searches were articles in open-access journals, peer-reviewed, with abstracts, and written in English language. Literature written in other language than English were omitted. Date restrictions were articles published from 2010 to 2019. The literature search was conducted in the end month of 2018 and first month of 2019. The references of each article were also examined to look for further relevant studies.

2.2 Review Procedure

Figure 1 summarizes the process of appraising articles with the corresponding number after every stage. Primarily, the author laid the objectives or main concern of the study and the criteria for inclusion and exclusion of article. All the searched articles along with the citations and abstracts were downloaded and saved categorically in a folder corresponding to the name of database. Any duplicated articles identified were removed and only one remained for screening. The initial process of screening has been conducted primarily by assessing the relevance of the abstract of each article. Those that deemed irrelevant and hard to assess were excluded. Articles that have perplexing relevance were consulted to colleague professors of the author for final decision as to include or exclude. All articles that met inclusion criteria were tracked for available full-text which then downloaded, saved, and reviewed for the second round based on criteria (see Table 1). Eligible articles were examined and relevant information yielded upon appraisal were encoded using a tabular format.
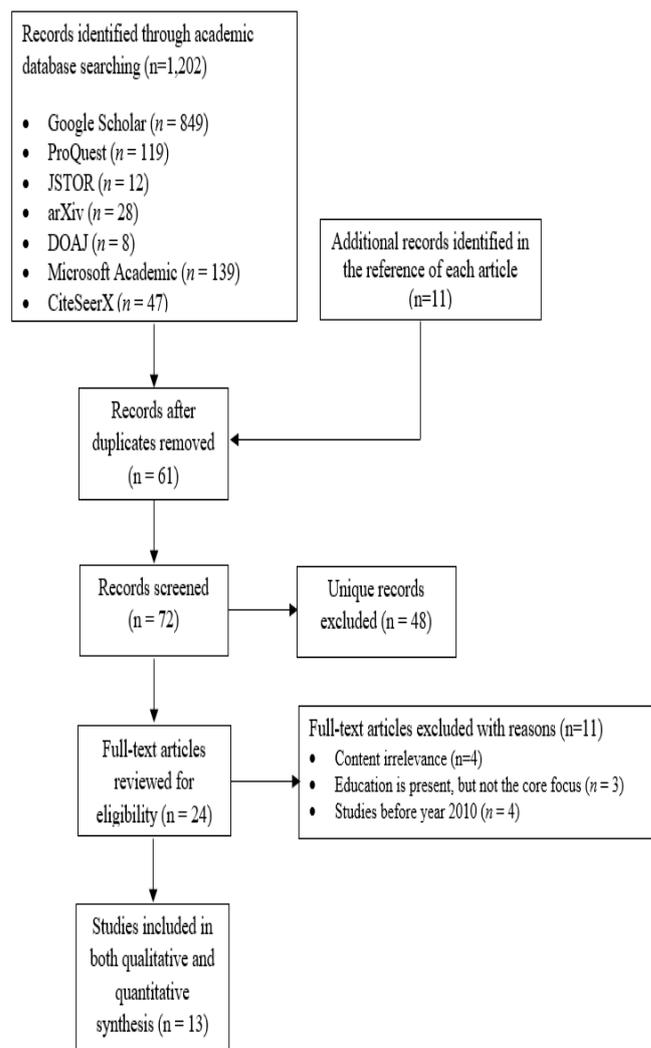

Figure 1 A summary of the appraisal of literature

Table 1. *Inclusion and exclusion criteria*

Criterion	Inclusion	Exclusion
Language	English	Not English
Type of article	Peer Reviewed, Conference paper	Research posters
Type of study	Quantitative & Qualitative	
Study focus	Philippine higher education, Education 4.0	Education 4.0 or higher education was mentioned but not the focus of the discussion (e.g. industry 4.0 as the main topic being discussed).
Year of publication	January 2010 to January 2019	Studies on or before December 2009

3. Findings and Discussion

3.1 Countries of study

Education 4.0 is a trending concern worldwide as an address to industry 4.0 and the 21st century learners. The revolution in education 4.0 based on review of literature has been a discussion of different countries including Austria, Brazil, Czech Republic (n=1), Germany, Malaysia (n=1), Minnesota, Philippines (n=2), Slovakia, Thailand (n=2), Turkey, and Vietnam. Type of studies from these different

countries were research paper (n=8), conference proceedings (n=3), and literature review (n=2).

3.2 Research and Models of Education 4.0

In a research study in Austria, the role of research in education 4.0 is critical driver in looking at the complexity of academic institutions. Producing new knowledge though research aids understanding on how technology and human being be mutually partnered in solving problems. It is tagged as the key for meeting needs of industrial revolution [3]. In Brazil, the focus of their research is employing robotics in classroom activities anchored from KSAVE Model which addresses the 21st century skills [9]-[10]. Similarly, Germany focus of research is also robotics and the potentials of new technologies including Internet of Things (IoT), digital mapping, virtualization of the world, technical business process, and smart factory and products [11]. They have designed a hypercube model of learning as a result of their research supported by European research project INTUITEL [12]. On the other hand, Malaysia as a developing country had established Blueprint 2015-2015 for Malaysia's education system with the purpose of alignment with global trends with consideration of balance between ethics and morality together with knowledge and skills [13]. In Minnesota, U.S.A., the direction of their research is on Leapfrogging. The meaning of Leapfrogging means "get ahead of the competition or the present state of the art through innovative, time-and-cost-saving means." They employed leapfrogging principles and practices as a model of learning in their education system [14]. In Slovakia, there is a research called augmented reality in education 4.0 in which the concept of learning experience is similarly related to that of computer mediated reality or virtual reality [6]. Thailand study has pointed out that the challenge in education system for education 4.0 is on developing model for new strategies, approaches, and ways of learning advanced technologies [15]. In the analysis of curriculum by a Turkish researcher in Turkey claimed that the biggest key to bridge between industry 4.0 & education 4.0 is research and development activities [16]. In Vietnam, the challenge in the operation of higher education system towards education 4.0 is confined in the triad of human resource quality, macro environment change, and technology capabilities. Furthermore, in the Philippines, Education 4.0 will become part of its research agenda by year 2020. The first conference discussion regarding this trend was on the year 2017 [18]. Based on the Labor Market Intelligence Report of TESDA (2016), Philippines has variably absorbed some of the technologies that are identified components of Industry 4.0 which expects to demand a different Filipino worker to compete in this modern world. The demands are directly addressed to Philippine higher education [18]. As partial address, the Department of Science & Technology (DOST) introduces research and training on data science for improving knowledge discovery [5]. However, the speed of internet is a great challenge. It has been compared that Philippines is one of the slowest in internet compared to other ASEAN countries. Based on a scoping review study, the application of internet covers all fields [19]. This would mean to have negative implications in concretizing IoT, digitalization, automatization, smart technologies, and in navigating the world web for empowering research.

3.3 Technological Advancement

Technological advancement is an indicator of how progressive and developed the country. Having advance technology in the academic setting may seem to be complex among digital migrants and other non-technologically oriented academic workforce. Added with this is the on-going revolution in the industry in becoming 4.0 which brings more complexity in the academe as it demanded more to produce workforce that fits in the need of the industry 4.0. Based on literature, we can only effectively respond to complexity (industry 4.0) with complexity [3]. In technological advancement, the concept of E-Learning has gone, but instead, it becomes WE-learning. In other countries like Malaysia, Indonesia, Singapore, Austria, Brazil, Germany, and Japan has already cross-bridged in integrating technological advances in their education system [3], [9]-[13]. They are on the course of pushing limits of the usefulness of technologies to aid human being. In Brazil, robotics is already in use in the classroom working, interacting, and learning with the students [9]. It has found to be as useful learning tool for students providing a variety of features for learners. Even at early level of education, favorable outcomes have been cited including development in the cognitive, language, conceptual, and social skills [20]. Based on overseas research report, Philippines position in relation to science and technology is almost at par with Vietnam and Cambodia in terms of patented technology and innovations that variably ranked between 6th to 7th place. In comparison with Japan, Malaysia, and Singapore that placed in the 1st, 2nd, and 3rd spot respectively, [21] indirectly implies that Philippines is a way behind in integrating technologies in the education system. It is evident with the speed of internet connection based on the news report that Philippines has the lowest speed of 3.7 megabytes pe-second (mbps) which is sixth times lower than the average global internet speed of 24.2 mbps [22]. With these challenges, the full potential of the features of available technology in the industry as well as in the education system could not be achieved. This means that IoT, automatization, digitalization, teleconferencing, and even robotics, though available, may not be fully integrated.

3.4 Educational Facilities

Facilities of a higher education institution in education 4.0 must be modeled with the type of learners it produces based on the demands needed by the industry 4.0. Edge in educational facility empower learners, facilitators, and the system of education. An Education 4.0 facility is a facility that allows the use of advance technologies including robotics, IoT, digitalization, automatization, and teleconferencing to name few. It is a facility that produces workers who can be competent to work in the modern world. Teachers in higher education is no longer the prime source of learning, it is the environment, the educational facility that primely nurtures learner in which the teacher is a mere facilitator. Some countries made their set-up of education highly digitalized which provides opportunity for students to explore and practice via computer assisted means [3]. Robotics has been already in place as facilitator of learning of learners in collaboration with or replacement of teacher [9]. Learning experience of learners in a facility of education 4.0 is "connected to the learner, focused on the learner, demonstrated by the learner and led by the learner." For an instance, there is on-line learning and flipped classroom to

employ [23]. The learner is proactive and independent as it exposes to different platforms that are available and accessible across dimensions, that is, high-end technologies [14]. Based on literature, most of the countries that have educational facilities ready and aligned with education 4.0 are variably those developed countries. So simply Philippines as developing country must make its facility aligned and ready to produce a different Filipino learner.

3.5 Strategies in becoming Education 4.0

Different countries have different strategies when it comes to addressing issues and challenges with education 4.0. The recommendation for higher education and global universities to be remain relevant in education 4.0 is to recalibrate their strategies in offering programs grounded at the lower hierarchy level of education [14]. Bottom-up approach of recalibration across curricula and pedagogy, partnerships, research, faculty, infrastructure, funding, governance and leadership are crucial [13]-[14]. Interestingly, almost all of the countries trademark strategy for alignment geared towards education 4.0 is cascaded to research, technology innovation and development [3]-[5], [8]-[10], [13]-[18].

4. Conclusion

Based on the scoping review of literature from ten academic databases that were systematically appraised, education 4.0 is a challenging state to attain in different countries to address the needs and demand of industry 4.0. Developed countries within revolution of industry 4.0 has made strategies recalibrating the program offerings grounded from lower to higher level of education to be always relevant in education 4.0. Educational facilities, technological advancements, and most importantly research were attributes and crucial determinants of a higher education institution to be a ready and capable in becoming an education 4.0. Thus, Philippine higher education in relation to or in becoming education 4.0. must plan yesterday in preparation for the modern world and ensures that the demands of industry 4.0 are well taken not only locally but globally.

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