Embracing industrial revolution 4.0 in universities

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Abstract. Embracing education 4.0 in universities in the Malaysian perspective has been limited to date and still considered at the early stages of implementation. This paper aims to analyze the literature highlighting the important elements of education 4.0 in universities as a means to position them strategically for the future. This is to provide new insight into the exploration of the idea in education through the perspective of how universities could embrace education 4.0 in the future. Since industrial revolution 4.0 (IR4.0) brings a huge impact on education, this paper helps universities policymakers to embrace their works on developing industrial revolution 4.0 education transformation and put more initiatives for the positive learning experience. This literature analysis reviews the following relevant areas: academic program 4.0, technological advancement 4.0 in teaching and learning, and 21st-century pedagogy. Hence, this study is significant in serving as a guideline to academics and policymakers in embracing the IR4.0 in higher education. This paper may have some direct implications towards the industrial 4.0 (IR4.0) movements in Malaysia which able to help the ministry to extend their works on developing IR 4.0 education transformation in line with Malaysia Education Blueprint 2013-2025.

1. Introduction

The industrial revolution 4.0 (IR4.0) considers the massive use of smart networked systems with the innovation of new products, procedures, and services. The presence of IR4.0 had brought a profound impact on the Malaysian educational landscape. New and emerging technology is beginning to have a profound impact on the delivery of higher education, bringing it an indicator of a new age of education [36]. With the introduction of technologies, it is clear that the education system is experiencing revolution and transformation. The wave of IR4.0 indirectly affected how education should be shaped to surpass the highly automated and digitized workforce in the future. Since the fourth revolutionary revolution will change the way humans live and work, many countries including Malaysia want to become an industrial community [16]. Malaysia is transitioning from a labor-driven economy to a knowledge-driven society. The Malaysian Higher Education Minister has designated a higher education system in line with the 2015-2025 Education Higher Education Plan and the global movements in industrial revolution 4.0 (IR4.0). Education has always been an agent for change as it transmits and exchange information among learners.

The purpose of this paper, therefore, was to shed light on how to embrace higher education in the IR4.0 contexts. The paper begins with discussing the literature of education 4.0 highlighting how universities should understand to face challenges and needs in IR4.0. It then proceeded to explain the limited studies to embrace education 4.0 in a Malaysian university. The paper then illustrates the data
collection which conducted a systematic qualitative literature review of relevant reports and documents. The paper concludes by explaining how Malaysian university extends its works on developing IR 4.0 education transformation in line with Malaysia Education Blueprint 2013-2025.

2. Literature Review
Universities in Malaysia need to change and provide something valuable to economic development. The university plays a major role in preparing students for industry 4.0 to stay relevant to current needs. In IR4.0, the creation of new jobs, and the introduction of new products and services are increasing [47]. Abersek [1] also stated that education 4.0 created many challenges in education such as the use of various advanced learning tools, opportunities for learning pedagogy and every individual need to acquire knowledge and essential skills to survive in this era. A workshop has been done to identify the important criteria in influencing the success of academic program 4.0 in a higher learning context. The output of the workshop has identified various programs related to academic 4.0 [10]. Universities need to ensure their academic programs able to fulfill the industry needs in the context of IR4.0. This will help their students to face challenges and understand the needs in IR4.0.

A new education system known as the Education 4.0 is a global movement to shift the traditional model of passive learning pedagogies to a new model that incorporates more advanced and modern digital technologies to enhance personalized learning [20]. Education 4.0 aims to produce lifelong learners who are equipped with skills in the twenty-first century classroom such as critical thinking, creativity, collaboration, and communication skills [11]. Thus, institutions need to move away from the traditional way of imparting knowledge and conducting research to a new way of doing which provides autonomy to educators and learners through technology. Malaysia, as an emerging economy, intends to be prepared and equipped for the I.R 4.0 through a quality Higher Education 4.0 (H.E 4.0). The drive towards this aim has been part of the country’s Education Blueprint 2015-2025 and the 2050 National Transformation (TN50) aspiration and the H.E 4.0 policies [21]. Malaysia Education Blueprint 2013-2025 demands new skills; thinking skills and digital literacy skills to be embedded in curriculum and pedagogy (Malaysian Education Blueprints [27].

IR4.0 that focuses on automation and digitalization such as Artificial Intelligence, Internet of Things (IoT), and Big Data has brought about the transformation of the education system. Education 4.0 is the technology or devices used by students to acquire knowledge. Students will be able to choose the tools and techniques which they want to acquire the knowledge they need. Education 4.0 is a life-long process rather than just focusing on the classroom-oriented process [45]. It is finding ways of making the learning and teaching process interesting to promote meaningful learning. It is all about using digital technologies to create an effective learning platform. This is mainly due to the increasing influence of digital technologies in all areas of life where it leads to the highest influence on e-learning. According to Fisk [17], education 4.0 refers to the future of learning that will be dramatically different in universities and throughout life as education 4.0 is all being practical where each module, subjects, courses and, etc. becomes individualized based on self-evaluation rather than being examined or assessed.

Several studies have highlighted the view of industry 4.0 [18][5][26][38][13][24][40][48]. However, these studies were not related to the application of industry 4.0 in the educational system. Only Barbara, Gabriela, Stefano, Domenico and Stefano [7] investigated how the changes in the educational needs of students in the context of education 4.0. Embracing education 4.0 in Malaysian university has been limited to date. To respond to the needs of IR4.0, universities must keep on playing their role in educating the future generation. In the Malaysian context, current research only focuses more on the use of technology in different courses, academic readiness, and challenges of implementing IR4.0 in education. Findings by Jamaludin, Mckay and Ledger [21] showed that the personal readiness of Education 4.0 respondents is very high; however, questions have been posted about the financial and managerial readiness of institutions throughout the country. Rosnah and Mahaliza [43] researched on the relationship between knowledge management and organizational learning with academic staff readiness for education 4.0. There are currently not many researches that can be referred to in education 4.0 as it is among the agendas that are still under discussion.
According to Anealka [6], the needs of IR4.0 are important to enable new opportunities in the education system. The innovative approach needs to be given in developing new programs, change certain skills, and improve learning content to meet changing demands in IR4.0. Since higher learning institutions are anchor institutions for economic development, the students’ involvement and forming partnerships with industries will be an essential part of success in higher education. In the future, the collaboration between industries and higher education institutions will be significant. Today’s students are going to be working within the industry 4.0 context and it is essential to prepare them into the industry [39]. Therefore, the responsibility for creating a high-quality education should collaboratively be shared among university students and the industries.

To remain relevant and competitive, the university needs to advance in science and technology and offer education 4.0 relevant programs. Sustainable development in universities is vital to be achieved because at this level, students are being prepared to emerge with skills and incorporate knowledge on what they had learned and brought in the real context [31]. To implement sustainable development, it became necessary to develop the ideas further in terms of defining what sustainability means and the relevance of educational development.

### 3. Method

#### 3.1 Data Collection and Analysis

The authors conducted a systematic qualitative literature review of relevant reports and documents. According to Alasuutari, Bickman, and Brannen [4] and Rory [42], a systematic review of the qualitative literature help to minimize bias, offer a reliable and reproducible evaluation of the research topic. Each report, article, and the paper were initially screened (title, abstract, introduction, and conclusion) to ensure that the review only included documents most relevant to the topic. The rationale for this step was to reduce all ineligible publications.

In Malaysia, studies are lacking in the integration of IR4.0 in the education system. Not much research had been reported which focuses on the integration of IR4.0 for higher learning institutions. Only few researches survey the use of technology in different courses and readiness of academicians to face the Education 4.0 challenge Airil, Rafidah, Mohd, Nurul, and Ahmad [3], Chiam and Joshua, [12], Dayang, Khalip and Zahari [14], Muhammad [32], Nurul Aini and Abdullah [35], Pauline and Norwaliza [37] and Shu, Lee, Shiuai, Alipal and Abdul [46]. Since there is a lack of studies embracing the IR4.0 in the Malaysian education system, not much information has been compiled. Two scholarly electronic databases between 2017 and 2019 were searched to identify the relevant aspects of IR4.0 in the Malaysian education system. These databases included: Researchgate and Google Scholar. Additionally, the authors reviewed news media stories published on websites such as the New Straits Times, Malay Mail, The Star, Berita Harian, Sains Magazine, and Leaderonomics.

The second stage involved analysis of the publications reports, articles, and papers that explicitly focus on the search terms such as “industry 4.0 Malaysia”, “context of industry 4.0”, “industry 4.0 education”, and “education 4.0”. The authors assessed the documents and classified them based on year, authors’ name, source/article title, and qualitative approaches used (e.g., reports, surveys) to reduce the potential for random errors and bias. It is conducted based on the method suggested by Alasuutari, Bickman, and Brannen [4]. The results were themed to contribute a better understanding of embracing IR4.0 in the education system. The themes are the overall discussions which are based on the systematic qualitative literature review findings. It has become easier for the researcher to put it into themes for discussion.

#### 3.2 Limitations

As indicated earlier, there are currently few studies in the published literature that investigate the IR4.0 within the Malaysian education context [43]. Merely in 2017, the Malaysian government focuses on the movements of IR4.0 in the education system. In the first quarter of the year 2018, the Malaysian Minister of Education encouraged all higher learning institutions to embrace education 4.0 in their academic curriculum. Since the scope of this study focuses on the Malaysian education system, most of the reports in this paper were media stories, surveys, reports, and academics published in the local newspapers and
websites. The authors considered these online sources as reliable and valid data as surveys, reports, and so forth, which are published in reputable newspapers and corresponding news websites, are screened under ethical journalistic procedures, and examined for journalistic integrity.

4. Results
A total of 15 reports and documents that identified the IR4.0 within the Malaysian education context were examined. There are no studies on a local perspective relevant to this topic that exists in any journal form. Due to the limited number of studies found through journal publications, most documents were found in the newspaper websites which provided essential data through surveys conducted on the topic of IR4.0 within the Malaysian education context.

Additional data was discovered through education reports, such as from the Ministry of Higher Education, Centre for Teaching Excellence & Academic Quality, Malaysian Higher Learning Perspectives, and Wawasan Open University is identified as the main source of data for these reports and news articles. This summary is illustrated in Table 1.

| No. | Themes                        | Author                                      |
|-----|-------------------------------|---------------------------------------------|
| 1.  | Academic program 4.0         | 1. Abdul Haseed                            |
|     |                               | 2. Rozana Sani                             |
|     |                               | 3. Jonathan Edward                         |
|     |                               | 4. Ministry of Higher Education            |
|     |                               | 5. Norain Mohamed Radhi                    |
|     |                               | 6. Ali Selamat                             |
|     |                               | 7. Centre for Teaching Excellence & Academic Quality |
|     |                               | 8. Hew Gill                                |
|     |                               | 9. Wawasan Open University                 |
|     |                               | 10. Anealka                                |
|     |                               | 11. Meylinda, Faaziah & Naim               |
|     |                               | 12. Morshidi & Wan                         |
| 2.  | Technological advancement 4.0 in teaching and learning | 1. Abdul Haseed |
|     |                               | 2. Ministry of Higher Education            |
|     |                               | 3. Veera Pandiyan                          |
|     |                               | 4. Mohd Azrone Sarabatin & Muhammad Faiz   |
|     |                               | 5. Dzulkifli Abdul Razak                   |
|     |                               | 6. Ali Selamat                             |
|     |                               | 7. Centre for Teaching Excellence & Academic Quality |
|     |                               | 8. Hew Gill                                |
|     |                               | 9. Wawasan Open University                 |
|     |                               | 10. Meylinda, Faaziah & Naim               |
|     |                               | 11. Anealka (2018)                         |
| 3.  | 21st century pedagogy        | 1. Abdul Haseed                            |
|     |                               | 2. Rozana Sani                             |
|     |                               | 3. Ministry of Higher Education            |
|     |                               | 4. Ali Selamat                             |
|     |                               | 5. Centre for Teaching Excellence & Academic Quality |
|     |                               | 6. Hew Gill                                |
|     |                               | 7. Wawasan Open University                 |
|     |                               | 8. Anealka                                |
|     |                               | 9. Meylinda, Faaziah & Naim               |
|     |                               | 10. Morshidi & Wan                         |

In conclusion, the findings of this paper showed three themes that emerged in terms of (1) academic program 4.0, (2) technological advancement 4.0 in teaching and learning, and (3) 21st-century pedagogy. The utilization of technology tools, contents, and devices among students for learning purposes will become more normal in the education sector. This highly digitized learning environment provides better space for teaching and learning. Technology integration welcomes wide potential in exploring knowledge besides building characters of the students. Demanding of updating curriculum in an academic program, new skills with advanced technology, and applying 21st-century pedagogy is
important to focus on in light of the IR4.0 in the Malaysian context. These results were relevant to the 2018 mandate from the Minister of Malaysian Higher Education. Based on the 2018 mandate with the theme of ‘Higher Education 4.0: Knowledge, Industry and Humanity’, there is a need to revamp the higher education to remain relevant and competitive in the IR4.0 [29]. Further initiatives can be taken by universities in preparing students for the challenge of IR4.0.

5. Conclusion
Today, in IR 4.0, innovation is a key competitive factor of digital transformation and, therefore, changes should be done on the way of teaching to cultivate an active teaching and learning environment. As reported in the Malaysian Education Blueprint, there is a detailed plan of action that maps out the educational landscape for the next 13 years (2013-2025). In conjunction with the Educational Blueprint transformation, it is hoped to transform education in the country by seeing more IR 4.0 research, especially in the higher education context. Schwab [45] believed that every individual should equip themselves with adequate knowledge and skills in the era of IR4.0.

The results of the systematic review will help the universities to develop the student’s ability to embrace new technologies, which enable them to adapt to changes in the learning environment. The universities could understand how to embrace education 4.0 more effectively to improve students’ academic performance and achievement. Educators able to identify suitable technology tools to assist students and students can learn with different devices based on their own choice of learning tools. This is because the findings can help universities to find appropriate teaching methods that need to be consistent with the changes focus on the IR4.0 and education 4.0 to produce knowledgeable human capital. Universities can design and update their curriculum to put more effort into supporting new learning and ideas in line with education 4.0. According to Xing and Marwala [50], improving the quality of service in universities can bring a significant change in society. Universities can refer to this finding to support and encourage more research in education 4.0.

All of these findings will be able to help the ministry to extend its works on developing IR 4.0 education transformation in line with Malaysia Education Blueprint 2013-2025. This is because education 4.0 will enable students to re-enter the world of learning at any time in their life through formal, non-formal, and informal pathways, to pursue their passions and ongoing professional development. The challenges of future learning and teaching must be turned into opportunities for change [15]. New teaching methods should be emphasized and developed where teaching concepts, infrastructures, and digital rights management should be practiced. As for the trends in learning, the changes should be on massive but personalized learning as the learning should be meaningful and thus, provide opportunities for effective learning. Universities can provide more opportunities for students to acquire essential skills to bring into their workplace.

Malaysian Ministry of Education also needs to provide adequate facilities to open learning institutions for them to utilize technology 4.0 effectively. In the era of education 4.0, students can search millions of information on the internet, interact and collaborate, and so forth. Thus, policymakers need to play their role by making the use of the latest technology 4.0 in the teaching and learning process by educators is compulsory. Educators need to attend training on how to utilize current technology to develop their skills and competency. This is one of the ways to assist educators to understand and explore in using these technologies 4.0 in the classroom.

This paper is expected to support Malaysia’s mission to promote the advancement of knowledge of research that will help transform the country into a competitive and high-income nation especially in the development of IR 4.0. According to Rajan and Vinod [41], education 4.0 is concerning on how to prepare students for future leadership positions in a globalized knowledge society. This paper may have some direct implications towards the industrial 4.0 movements in Malaysia which able to help the ministry to extend their works on developing IR 4.0 education transformation in line with Malaysia Education Blueprint 2013-2025. Education institutions have to embrace education 4.0 technologies and processes to remain relevant and competitive. Hence, this study is significant in serving as a guideline to academicians and policymakers in embracing the IR4.0 in higher education.
As to date, education 4.0 is still under-researched. Further studies are needed to explore more of students’ readiness and assessment to provide new insight into education 4.0 research. Further research should also consider using studies from other countries. The researchers feel that a greater number of studies from other countries may provide a wider perspective in embracing education 4.0 for universities.

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