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The 4th Industrial Revolution: Contemplations on Curriculum Review and Its Implementation in the Malaysian Higher Education Institutes

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Abstract

The higher education landscape is once again undergoing massive transformation. Not more than two decades ago, it was the advancement of digital technology and globalization that drove the need for transformation in higher education. At present, the transformation is driven by the need to face the challenges of the 4th Industrial Revolution (4IR). Much discourse has been centered on debating the roles of higher education in meeting the demands of 4IR. This paper aims to address similar issue by discussing the curriculum reviews done by higher education institutes in embracing 4IR. As curriculum is central to any academic programs, it is vital that the curriculum review done by the higher education institutes in catering to the growing needs of 4IR be examined. The close look at the curriculum review initiatives will focus on the changes done in terms of subject contents, methods of delivery and methods of assessment. Further, the academics' perceptions of the curriculum review and how the curriculum is to be implemented are investigated. The findings shed some lights on the contemplations of the academics amidst the initiative to provide higher education curriculum that meet the requirements of the Ministry of Education and the needs of 4IR. It is expected that curriculum departments in the higher education institutes could find the findings useful in bridging the gap between the academics' concerns and the need to meet the challenges of 4IR through the revised curriculum implementation.

Keywords: Industrial Revolution 4.0 (4IR), Higher Education, Curriculum Review

Introduction

Malaysian higher education has seen a quantum leap in becoming at the forefront of higher education industry. Malaysia Higher Education Blueprint (Higher Education) 2015-2025 has been instrumental in the ascending growth of higher education development. The blueprint has indeed been proven as the Ministry of Education has recorded phenomenal series of internationally recognized success in the last few years. The then Ministry of Higher Education was awarded the most innovative Ministry in 2017 by the then Prime Minister. This award is an accolade to the ministry's impactful innovative initiatives in bringing Malaysian higher education to be at par with the internationally renowned higher education institutes. The latest innovative initiative by the Ministry includes the embracing of the 4IR elements in the higher education curriculum. All higher education institutes have been required to review their existing curriculum and make necessary changes in order to cater to the needs of the 4IR. Champions to curriculum review initiatives in any higher education institutes are the Curriculum Affairs Department (CAD). Needless to say, reference to the Malaysian

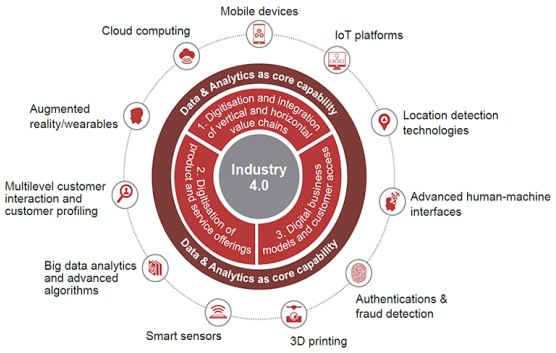
Quality Framework (MQF) in developing or reviewing the curriculum is obligatory and obtaining Malaysian Quality Agency's (MQA) approval for the curriculum is mandatory prior to the implementation of the academic program.

This paper is organized as follows. In section 2, the discussions on the 4IR and its influence on the Malaysian higher education are given. In section 3, the curriculum review initiatives which include changes done in terms of subject contents, methods of delivery and methods of assessments are presented. The findings from the survey on the academics' perceptions of the implementation of the revised curriculum are elaborated in section 4. Finally, the work of this paper is summarized in the last section.

The 4th Industrial Revolution (4IR) and Malaysian Higher Education

The booming of the world's economy is dependent on the industrial revolution of the respective era. It is a well-known fact that the first industrial revolution took place when factories began to maximize the power of their productivity through the transformation of engineering at that time. The first industrial revolution is famous for the mechanization, water power and steam power. The following era saw the further advancement of technology in mass production through the use of a new energy source; electricity. Hence, the second industrial revolution focused on mass production, assembly line and electricity. Upon the discovery of electricity, the wonders of computers and automation took over the capability of production in the subsequent era. Currently, the fourth industrial revolution or also known as 'Industry 4.0' captures the importance of cyber-physical systems. The 4th Industrial Revolution capitalizes on digital technology, automation, and artificial intelligence. Of late, the term 'Industry 4.0' has been coined to reflect the kind of industry which is making its way in various disciplines across the globe. 'Industry 4.0' revolves around the concept of automation and data exchange which includes cyber-physical systems, the internet of things (IoT) and cloud computing. It could be concluded that 'Industry 4.0' is the way forward upon various past industrial revolutions (Lasi et al, 2014).

According to PwC's 2016 Global Industry Survey (retrieved from www.pwc.com/industry40), there are several characteristics of 4IR. The characteristics are interconnection, data, integration, innovation and transition. Besides the characteristics, 4IR is also resembled by their components such as artificial intelligence, industrial internet, industrial cloud computing, industrial big data, industrial robot, 3D printing, knowledge work automation, industrial network security and virtual reality. Gray (2016) and World Economic Forum (2018) summarized that the advancement of digital economy, robotics and autonomous transport, artificial intelligence and machine learning, cutting-edge materials, biotechnology and genomics are the identities of 4IR. The following is 4IR framework as proposed by PwC 2016.



Source: PwC, 2016, retrieved from: https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf

One of the main roles of higher education institutes is to prepare graduates who would fill up the nation's workforce. As the nation workforce is synonymous with the development of the industry and economic trends, there is a need for higher education institutes to be alert with the needs of the industry. Some of the technological components of 4IR need to be the common features of any academic programs offered at the higher education institutes would

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include cloud computing, big data, data analytics, IoT, robotics, and virtual or augmented reality. In this instance, higher education institutes need to provide a curriculum which embraces these technological components of IR to stay relevant. Hence, 4IR has a great influence on how the graduates' preparation is planned and delivered. The planning and delivery of the said preparation are represented by the term 'curriculum'.

The Department of Higher Education at the Ministry of Education monitors every higher education institution in Malaysia. The monitoring begins with the relevant policies and regulations. To ensure objectivity, the department has specified certain Key Performance Indicators (KPIs) to all higher education institutions. Interestingly, it has become a tradition each year for the Minister to deliver his mandate publicly. In his mandate, the theme, which directs the KPIs, is announced and the specific agenda and projects for the year are made known. Top management of the higher education institutes will be directed to what needs to be done in achieving the KPIs based on the theme. The year 2018 is the year in which the Ministry of Education emphasizes on embracing 4IR in higher education. The term 'Higher Education 4.0' is an obvious statement which leads all initiatives geared towards enculturation 4IR in the higher education institutes.

Several initiatives to assimilate 4IR in the higher education system includes integrated assessment, CEO@faculty program, 2u2i (work-based learning concept), Massive Open Online Courses (MOOCs) and Accreditation of Prior Experiential Learning (APEL) to name a few. Aside from all these initiatives, curriculum review is an academic activity that is mandatory to ascertain the relevant quality of academic programs. Hence, with the emerging needs of catering to the needs of 4IR, the purpose of any current and upcoming curriculum review is to ensure the adaptation of 4IR in the curriculum. As curriculum review takes place between three and five years, it is almost definite that many faculties will have to review their curriculum now. Hence, as the way forward is to embrace 4IR in the curriculum, there is an urgent need to reconsider how 4IR is translated into the existing curriculum. This idea brings forth the need for relevant guidelines for the curriculum review. Curriculum Affairs Department (CAD) in each higher education institute now faces the challenge to provide the respective guidelines and regulate curriculum review

Curriculum Review and 4IR

There have been many definitions given to the term curriculum. Tyler (1957), Taba (1962), McNeill (1985) and Tanner and Tanner (1995) are some main classic references when researching curriculum. Tyler stated that curriculum is "…all of the experiences that individual learners have in a program of education whose purpose is to achieve broad goals and related specific objectives, which is planned in terms of a framework of theory and research or past or present professional practices" (p. 79). Taba (1962) claimed that "… the curriculum is all of the learning of students which is planned by and directed by the school to attain its educational goals" (p. 11). McNeill (1985) further commented that curriculum is "… usually thought of as a course of study or plan for what is to be taught in an educational institution" (p. 12). Finally, Tanner and Tanner (1995) postulated that "…curriculum is the planned and guided learning experiences and intended outcomes, formulated through systematic reconstruction of knowledge and experience, under the auspices of the school, for the learners' continuous and willful growth in personal-social competence" (preface). Interestingly, despite the various definitions given on 'curriculum', one aspect remains the same as stated by Wiles and Bondi (2011). According to them, "…Although the definition of curriculum has changed in response to social factors and expectations for the school, the process of curriculum development has remained fairly constant over time. Through analysis, design, implementation and evaluation, curriculum developers set goals,

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plan experiences, select content, and assess outcomes of school programmes" (pp. 5-6). Wiles and Bondi's view has set the path in this paper.

For the purpose of this study, three aspects governing any curriculum; planned experiences, selected contents and assessment, would be central to the investigation. As there is a need to embrace 4IR in the curriculum, there is a growing need to confirm the changes done after a curriculum review are relevant to the idea of 4IR in higher education. A close look into the changes done to the planned experiences, selected contents and assessments could give a glimpse of how the higher education institutions are embracing 4IR in their curriculum. Additionally, equally important is to seek further understanding of the academics' perceptions of the curriculum review and its implementation. As this area is fairly new, any findings are worthy to note and could serve as the baseline to what is yet to be further explored.

Higher education institutes produce graduates who will fill up the relevant job vacancies in the industry. Noting the importance of this view, it is pertinent for the higher education institutes to ensure their curriculum meets the needs of 4IR. Therefore, it is important to understand what 4IR is and what it entails. As discussed earlier, there are technological components that need to be common features of the curriculum. Such features include cloud computing, big data, data analytics, IoT, and virtual or augmented reality. Besides the components, curriculum that supports 4IR needs to also include the characteristics of 4IR such as interconnection, data, integration, innovation and transition. In short, the current and upcoming curriculum reviews need to address such characteristics and components of 4IR. The Minister in his 2018 mandate had called for immediate action in redesigning higher education in which he stipulated that the curriculum needs to be fluid and organic in meeting the needs of 4IR. He further mentioned three other aspects which each higher education institutes need to be concerned with in order to be affluent with 4IR namely; 21st century pedagogy, latest learning and teaching technology, and redesigning learning space.

Academics' Perceptions of 4IR Awareness, Curriculum Review and Its Implementation

A survey was carried out on a group of academics in four selected faculties in one of the Malaysian public universities. The faculties were identified based on the fact that they had undergone curriculum review. A total of 120 academics took part in the survey. Their perceptions of 4IR, changes done to their respective syllabus during the curriculum review in integrating 4IR and how they implemented the changes were studied. All the items were on a Lickert scale from 1 (strongly disagree) - 5 (strongly agree). A simple descriptive analysis was done and mean scores were identified in analyzing the data. It is important to note that the faculty offers academic programs under the Social Sciences cluster. In terms of demographic profile, 80% of the respondents were female. In terms of academic experience, 50% of them had been an academic in less than 5 years, 25% in less than 10 years and the other 25% had been an academic the past 15 years. The respondents' responses are summarized in the following tables. Table 1 depicts their perceptions of their 4IR awareness.

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Table 1: Perceptions of 4IR awareness

No.	I am aware of/that	mean
1	4IR characteristics	3.10
2	4IR components	2.95
3	4IR influence on my students' graduate employability	4.25
4	I need to revise my syllabus to cater to 4IR needs	4.25

It is quite obvious from Table 1 that majority of the academics had quite a low level of awareness of 4IR. The mean scores on the four items seem to indicate that the respondents were not highly aware of 4IR.

Next, the respondents were asked about their perceptions of the changes they did to their respective syllabus during the recent curriculum review. Table 2 signifies their responses.

Table 2: Changes done to the existing syllabus

No.	Planned experiences: In my revised syllabus, I have included	Mean
1a	IoT	3.50
1b	gamification	3.20
1c	3D printing	2.00
1d	big data	2.50
1e	data analytics	2.75
1f	MOOCs	3.85
1g	collaboration with other program/faculty	3.50
	Contents: In my revised syllabus, I have included topics/sub-topics on:	
2a	big data	2.50
2b	data analytics	2.85
2c	game development	3.75
2d	online research	4.25
	Assessments: In my revised syllabus, I have included assessment methods such as:	
3a	e-portfolio	3.75
3b	online quizzes	3.75
3c	online projects	3.00
3d	student e-conferences	3.25
3e	peer assessments	4.25

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It is interesting to note that most of the respondents seem to be up-to-date with the changes they made to their syllabus. The high mean scores for most of the items suggest they revised the syllabus to meet the changing landscape of higher education through the inclusion of internet, digital technology and online resources. However, the low mean scores on items 1c, 1d and 1e may suggest further exposure and training to such items in their disciplines or subject matter. Additionally, there may also be a lack of relevant infrastructure and infostructure to support the development of such initiatives. However, further research could confirm this interpretation.

Finally, the respondents were also asked about their perceptions of their program's outcomes and the relevance to 4IR. Table 3 summarizes their responses.

The mean scores for all the items seem to suggest that the respondents think elements of 4IR are present in their program's outcomes. However, their low mean scores in Table 1 (awareness of 4IR) may suggest more information is needed to further confirm the high mean scores as listed in Table 3.

Conclusion

In summary, the findings of the survey seem to suggest that the awareness level of the respondents on 4IR was quite low. This suggests a need for exposure and training on 4IR to the academics. It is worth to note that that the demographic profile of the respondents comprises of majority young academics (50%), while an equal percentage (that is 25%) comprise academics who had served the university the last 10 and 15 years respectively. Hence, it could be concluded that they still have a long way to go as academics. Series of training could facilitate their understanding of 4IR and how it could impact their subject matters. The responses given in the changes done in their respective syllabus suggest that the respondents were aware of the latest technology in learning and teaching. It is safe to deduce they are practicing the 21st century learning and teaching through the use of the internet, digital technology and online resources. However, there are indications that they lack the connection to 4IR's relevant technological components and how to train them to the students. Finally, the respondents seem to show their high regards to the program's outcomes in meeting the needs of 4IR. Since the findings from their level of 4IR awareness are showing lower mean scores, it could be deduced that a further investigation on the academics understanding of 4IR is needed. Similarly, a study on the development of program outcomes in meeting the needs of 4IR could be carried out.

Table 3 : Perceptions of program's outcomes and 4IR

No.	I think the program's outcomes	Mean
1	reflect the 4IR characteristics	3.75
2	include the 4IR components	3.00
3	state the 4IR skills/competencies	3.75

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www.gjat.my

References

Gray, A. (2016). The 10 skills you need to thrive in the Fourth Industrial Revolution. https:// www. weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution

Lasi, H., Fettke, P., Kemper, H.G., Feld, T. & Hoffmann, M. (2014). Industry 4.0. Business & Information Systems Engineering, 6, 239-242. https://doi.org/10.1007/s12599-014- 0334-4

Malaysia Education Blueprint (Higher Education). 2015-2025. (2015). Putrajaya: Ministry of Higher Education.

McNeill, J. (1985). Curriculum: A Comprehensive Introduction. New York: Macmillan.

Minister of Higher Education 2018 Mandate. (2018). Presented on 11 Jan 2018. Putrajaya International Convention Centre.

PwC's 2016 Global Industry Survey. (2016). retrieved from www.pwc.com/industry40 on 29 January, 2018.

Taba, H. (1962). Curriculum Development: Theory and Practice. New York: Harcourt Brace Jovanocich.

Tanner, D. & Tanner, L. (1995). Curriculum Development: Theory into Practice. New York:Macmillan

Tyler, R.W. (1957). Basic Principles of Curriculum and Instruction. Chicago: University of Chicago Press.

Wiles, J. W & Bondi, J.C. (2011). Curriculum Development: A Guide to Practice. Boston: Pearson.

WEF. (2018). New Vision for Education: Fostering Social and Emotional Learning Through Technology. Report 20 April 2018. https://www.weforum.org/reports/new-vision-for-education-fostering-social-and-emotional-learning-through-technology