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Perceived challenges towards Education 4.0 implementation among academicians: A preliminary analysis

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ABSTRACT

The Industrial Revolution caused major changes in the economy and advancement in technology. Specifically, IR4.0 stimulates the development of Education 4.0, in which the use of information, internet and technology become part of the teaching and learning process allowing students to learn at any time through digital platforms. Promoting for Education 4.0 involved challenges particularly constant changes in the teaching and learning techniques, and the facilities to cater to the technology demands. This study attempts to assess perceived challenges towards Education 4.0 implementation among the academicians at a comprehensive university and to explore the relationship between gender and perceived challenges among them. Based on purposive sampling, online questionnaires were distributed via google form to a population of 352 academicians in the selected comprehensive university. Data gathered from 127 responses were analysed using SPSS. The findings indicate the majority of the respondents perceived IT infrastructure as the main challenge, while the skills of individuals are the least challenges towards Education 4.0 implementation. However, there is no evidence of a significant association between gender and any of the perceived challenges items. Thus, regardless of male or female academicians, they have a similar perception of the challenges towards Education 4.0 implementation. The findings assist the Education 4.0 stakeholders to look into those perceived challenges and take necessary actions such as increasing budget allocation for IT facilities, as a support towards the success of Education 4.0 implementation. Future research may be undertaken to examine more specific infrastructure challenges in implementing education 4.0 at other comprehensive universities as well as at research universities and focused universities.

Keywords: IR4.0, Education 4.0, Academicians, Challenges, Gender

1.0 INTRODUCTION

The Industrial Revolution caused major changes in the economy and advancement in technology. Four different phases of the Industrial Revolution consist of IR1.0 to IR 4.0, which demonstrate the revolution of technology from water and steam production into mass production based on labor and electricity, later into computer and automation and the most recent to cyber-physical systems (Sharma, 2019). These phases are summarised in Table 1 below.

Table 1: Phases of the Industrial Revolution

| Phases of IR | Year | Description |
|--------------|-------|---|
| Industry 1.0 | 1784 | Built on machinery for water and steam production |
| Industry 2.0 | 1870 | Built on mass production possible by dividing labor and using electricity |
| Industry 3.0 | 1969 | Built on electronic usage and information technology to make more automated |
| Industry 4.0 | Today | Using a cyber-physical system |

(Source: Sharma, 2019: 3558)

The fourth industrial revolution (IR4.0) marked a new wave of technology in business and industry. IR4.0 stimulates the development of Education 4.0, in which the educational system is closely associated with the development of the digital era. The use of information, the internet and technology becomes part of the teaching and learning process in Education 4.0. Students can learn everything at any time through digital platforms. Consistent with IR4.0, the expectation from the education system is to manage and produce graduates who are ready to fulfil the industry requirement (Kassim & Teng, 2018). Hence, Education 4.0 needs to capture the teaching and learning process of the 21st-century students' generation. Students should be in the capacity to learn and develop their skills to meet future job demands.

In accommodating for the students' needs and ensuring the success of the Education 4.0 process, various stakeholders are involved namely education authority, management team and academicians, or educators. The role of academicians in the teaching and learning process is significant in the implementation of Education 4.0. Undeniably, Education 4.0 is recent and may demand to learn- and-relearn of technology among the academicians. Some academicians may have already promoted Education 4.0 via the use of digital platforms such as WhatsApp and Facebook to support their teaching and learning process. Thus, this study aims to identify the challenges perceived by the academicians towards the implementation of Education 4.0; and to assess for gender differences towards such challenges.

2.0 LITERATURE REVIEW

2.1 Education 4.0

Education 4.0 is inspired by the rapid development of Industry 4.0. Different phases of movement in educational technology comprise Education 1.0 that promotes memorization practice; Education 2.0 that encourages learning through the Internet; Education 3.0, which allows for consumption of knowledge and labor; and, Education 4.0 that enables education to create changes (Sharma, 2019).

Education 4.0 marks a new paradigm in the education sector as it focuses on innovation and maximizes the use of information, internet, and technology. Through technology, human-machine interfaces become universal that enable a quick revolution in innovation (Lawrence, Fung Ching, & Haslinda, 2019). Education 4.0 refers to the use of technology in the contexts of teaching and learning (Dunwill, 2016) and it relies heavily on the internet usage and virtual environment, which combine the use of technology in most aspects of education pedagogy (Meylinda, Faaizah, & Naim, 2018). In other words, technology advancement provides support to the teaching and learning process in this era (Anggraeni, 2018).

The understanding of the Education 4.0 concept is important to promote its implementation in the classroom. According to Sadiyoko (2017 as cited by Anggraeni, 2018), there are nine characteristics of Education 4.0. These include:

1. It can be done anywhere and anytime.
2. It is based on students' needs.
3. It is a flexible delivery.
4. It reflects peers and mentors.
5. It is about sharing information to answer "why" and "where" questions.
6. It is about practical application.
7. It is about modular and project.
8. It reveals student ownership in which the students participate a lot.
9. It contends the evaluation process.

As such, Education 4.0 requires changes in teaching and learning techniques to meet the demand for education technology.

2.2 Strength and weaknesses of Education 4.0

As Education 4.0 greatly involves innovation and maximizes the use of information, internet, and technology, it may be favorable to some and unfavorable to some others. For the learners of the 21st century, Education 4.0 becomes an enjoyable learning process as they could access the information anywhere at any time with the availability of the internet access. The flexibility of digital learning improves the learning experience of the students since it provides a wide range of technology-enhanced educational strategies (Siti Dianah, 2020). For the educators or academicians, Education 4.0 has transformed the teaching methods into a more technology-based.

Technology in education has its strengths and weaknesses. It creates a new way of teaching and learning. It opens rooms for new experiences and self-discoveries. Students can collaborate to get information through online access to data. Education technology in Education 4.0 has stimulated the shape of students for self-learning, critical thinking, digital capabilities, and problem-solving ability (Siti Dianah et al., 2020). With the technology options, students are able to learn at their table or desk without having to physically present in the classroom, hence may encourage learning engagement among students. Education 4.0 offers dynamic learning styles that are truly revolutionary and provides an improvement in learning outcomes (Sharma, 2019). However, technology may not be affordable by students from lower-income family groups.

The advancement of technology has also transformed teaching methods from the traditional classroom approach to technology-based techniques. This requires some academicians to learn and relearn to cope with technology-based teaching. The rethinking and reassessing of traditional teaching approaches are necessary to meet the learners' needs in the era of technology (Salimah, Alshboul, & Shahin, 2019). Education 4.0 is a digital revolution that gives benefits to many educators. Through the digitalization of teaching, educators can reach their students via various virtual platforms. Education 4.0 allows educators to select the best methods and techniques to facilitate teaching tasks; and to communicate better with 21st generation learners (Sharma, 2019).

In coping with Education 4.0 demands, educators are to be future-oriented and adaptable to the changes in the digital teaching environment. Their role is to innovate teaching using emerging technologies to engage the 21st generation of learners. As such, *"teaching should be interactive, creative, engaging, effective with greater emphasis on digital age skills development, and less on memorizing content"* (Salimah, Alshboul et al., 2019:1339).

Other strengths of Education 4.0 as listed by Lawrence (2019) include creating an opportunity for educators to engage in new technology tools; enhancing the knowledge and usage of technology; and,

developing the technology classroom into 21st-century skills. In contrast, the weaknesses of Education 4.0 consist of resistance to change; and, its situational outcome as digitally connected but socially disconnected (Lawrence, 2019).

Therefore, Education 4.0 has significantly affected the education sector. The teaching and learning process emphasized the needs for both educators and learners to improve their digital competencies. This is crucial to promote the effective use of technology in teaching and active learning in the digitalized teaching and learning era.

2.3 Challenges in Education 4.0 implementation

The IR4.0 that focuses on smart technology, artificial intelligence, and robotics has transformed the desired teaching and learning approach through Education 4.0. Universities are shouldering the tasks to equip their graduates for a world in which cyber-physical systems are predominant across all industries. This urge for changing in learning approach with technology incorporation as part of the universities' curriculum (Frances, 2019). The changes are needed to show an alignment between curriculum and contemporary industrial job positions (Tandon & Tandon, 2020).

Moreover, Education 4.0 needs to prepare students for the future state of employment. As Education 4.0 implementation involves the advancement of technology, changes to traditional teaching and learning processes to become mobile are inevitable. In the era of learning-anytime-anywhere, it is necessary to offer wider opportunities for self-paced learning among students (Tandon & Tandon, 2020).

On the universities' side, the implementation of Education 4.0 requires effective financial planning, skilled staff, increased industrial partnerships, advanced infrastructure, revised curricula, and insightful workshops. These are important to empower beginners with requisite skills and a competitive advantage for Industry 4.0 (Mian, Salah, Ameen, Moiduddin, & Alkhalefah, 2020). If the needed resources for adoption are not made available, implementation will become a problem since all the elements are important for the improvement of teaching and learning (Muzira and Bondai, 2020).

Those are among the inevitable challenges in the implementation of Education 4.0. Also, other prescribed challenges include many sources of distractions to practices of individual life, work or business, and disruptions to industry structures and society. Furthermore, the challenges are due to constantly changing in the generation of students, and accelerating learning progress causing present knowledge to obsolete before one's entire career ends (Selamat, Alias, Hikmi, Puteh, & Tapsi, 2017).

Apart from that, it is a challenge to precisely forecast what lies ahead to sustain a competitive advantage in the long run in coping with the changing demand of future education (Lawrence, 2019). Challenges also arise due to the need to change among educators particularly with teaching techniques, as they may be unfamiliar with IT and need more training (Gerstein, 2014). Various components of pedagogical skills with excellent knowledge of profession are necessary to create a solid foundation for the continuous improvement of the level and knowledge of future educators (Ikromova, 2020).

Similarly, lecturers' teaching techniques, students' speaking skills and facilities are other identified challenges in promoting Education 4.0 in English for Survival classes (Anggraeni, 2018). Transformation in the higher education system including various techniques of flipped classroom teaching, e-learning, virtual labs, and project and problem-based learning, etc is the major requirement of the current education system globally (Gupta, 2020).

In short, challenges in Education 4.0 implementation as an *Education of Tomorrow* lies due to the necessity to re-design teaching pedagogies and education contents to align with the needs of IR4.0 generation (Ghozali, 2018). The role of both educators and learners is crucial to ensure the accelerating progress of Education 4.0 implementation.

2.4 Gender differences in Information Technology

Gender socialization approach and structural approach provide two broad explanations on gender differences in values and work interest (Betz, O'Connell & Shepard, 1989). According to the gender socialization approach, early socialization processed influenced gender differences in values and traits to

an individual's work role. Gender differences affect work-related decisions and different responses between men and women may be derived from the same occupational rewards and costs (Lupetow, 1981 in Betz et al., 1989; Veroff, 1977). In contrast, the structural approach contends that gender differences that exist due to early socialization will be dominated by occupational roles. Both men and women are making similar work-related decisions in a given occupation (Feldberg & Glenn, 1979; Lacy, Bokemeier & Shepard, 1983).

The issue of gender is one of the most frequently researched individual-level variables within the business ethics literature (Craft, 2013; Ford & Richardson, 1994; Loe, Ferrell & Mansfield, 2000; O'Fallon & Butterfield, 2005). Apart from that, studies on the issue of the gender gap in Information Technology (IT) were also conducted (Margolis & Fisher, 2002 as cited in Wong & Hanafi, 2007). Specifically, gender differences found to exist in some prior research concerning IT, such as different patterns in the increase of IT confidence found between females and males due to their computer experience (Wong & Hanafi, 2007); and, gender differences is one of the factors that influence the intensive use of IT (Jackson et al., 2008).

In addition, gender is also among the factors that predict the adoption and integration of Interactive Digital Technologies in education by faculty members (Agbatogun, 2013). It was also found that gender plays a significant role in shaping the intention to accept new technology (Goswami & Dutta, 2015). Besides, gender differences moderate the social influence and self-management learning effects on the intention to use mobile learning (Wang, Wu, & Wang, 2009).

Gender difference in the attitude toward technology use in education has been a long concern (Cai, Fan & Du, 2017). A meta-analysis study of seventeen years prior literature by Cai, Fan & Du (2017) summarized that, in general, males showed more favorable attitudes toward technology use than those in females. Due to this fact, it is interesting to investigate the relationship between gender and perceived challenges in Education 4.0. Thus, this study hypothesized that:

H₁: There is a significant positive relationship between gender and perceived challenges in Education 4.0 implementation.

3.0 METHODOLOGY

3.1 Population and sample

Three categories of public universities in Malaysia include research universities, comprehensive universities and focused universities (Kementerian Pendidikan Malaysia Pendidikan Tinggi, 2019). The categories reflect universities' primary focus, which includes research (research universities), various courses and fields of study (comprehensive universities), and specific fields related to its establishment (focused universities).

Based on the non-probability sampling of purposive (judgment) sampling, a sample of the study comprised of the academicians at a comprehensive university. According to Sekaran and Bougie (2010), purposive sampling is "*confined to specific types of people who can provide the desired information, either because they are the only ones who have it, or conform to some criteria set by the researcher*" (p276). In total, 352 academicians at the selected comprehensive university formed as the population of the study.

3.2 Data collection and instruments

This research used a quantitative approach through online questionnaires to gauge the demographic information of respondents, and perceived challenges among academicians towards the implementation of Education 4.0. The online questionnaire was distributed through Google Forms link shared with 352 academicians from various faculties in the selected comprehensive university. Ultimately, 127 valid responses were returned and analysed using Statistical Package for Social Science (SPSS).

The questionnaire consists of eight (8) items on challenges in the implementation of Education 4.0, as derived from past studies namely Gambari and Okoli (2007). Those challenges include the following:

1. I am resistance to change
2. My technical skills are outdated
3. My teaching and learning skills are outdated
4. I am lack of pedagogical skills
5. Lecturers are unequipped with psychology knowledge to the new generation preference and needs
6. Lack of network infrastructures
7. Lack of budget to cover high internet costs
8. Limited expertise and ICT skills levels

Respondents had a choice to select more than one answer to indicate the challenges they perceived in Education 4.0 implementation.

4.0 RESULTS AND DISCUSSION

Using SPSS, frequency distribution was generated to present the respondents' demographic background and to assess their perceived challenges towards Education 4.0 implementation. Also, the Chi-square test for independence was conducted to explore the relationship between respondents' background and perceived challenges for Education 4.0 implementation.

4.1 Demographic profile of respondents

Table 2 shows the respondents' demographic information. Out of the total respondents, 79.5% were male and 20.5% were female. The majority of respondents fall in the age group between 31 to 40 years old (52.4%). Consequently, 33.3% were in the age group between 41 to 50 years old, while 11.9% aged more than 51 years old and 2.4% aged less than 30 years old. In terms of the highest qualification, 114 respondents (89.8%) with master's degree, while 13 respondents (10.2%) were Ph.D. qualified. The biggest number of respondents were from the Faculty of Accountancy (20.5%) while only 0.8% were from the Faculty of Chemical Engineering.

Table 2: Demographic profile of respondents

| Respondents' Profile | | Frequency | Percentage (%) |
|----------------------|---------------|-----------|----------------|
| Gender | Male | 101 | 79.5 |
| | Female | 26 | 20.5 |
| Age (Years) | 30 and below | 3 | 2.4 |
| | 31-40 | 66 | 52.4 |
| | 41-50 | 42 | 33.3 |
| | 51-60 | 15 | 11.9 |
| Qualification | Master Degree | 114 | 89.8 |
| | Ph. D | 13 | 10.2 |
| Faculty | FKE | 22 | 17.3 |
| | FKK | 1 | 0.8 |
| | FKM | 5 | 3.9 |
| | FP | 26 | 20.5 |
| | FPHP | 15 | 11.8 |
| | FPP | 15 | 11.8 |
| | FSG | 2 | 1.6 |
| | FSKM | 23 | 18.1 |
| | OTHERS | 18 | 14.2 |

As the respondents were highly qualified academicians representing various faculties in the selected comprehensive university, they are credible to provide vital feedback on Education 4.0. Thus, further analyses are conducted to gain more information concerning Education 4.0 implementation.

4.2 Frequency tabulation

The respondents' perceptions towards challenges in Education 4.0 implementation is summarized in Table 3 below.

Table 3: Perceived challenges

| | Perceived challenges | Frequency | Percentage (%) |
|---|---|-----------|----------------|
| 1 | I am resistance to change | 14 | 11 |
| 2 | My technical skills are outdated | 30 | 23.6 |
| 3 | My teaching and learning skills are outdated | 29 | 22.8 |
| 4 | I am lack of pedagogical skills | 35 | 27.6 |
| 5 | Lecturers are unequipped with psychology knowledge to the new generation preference and needs | 85 | 66.9 |
| 6 | Lack of network infrastructures | 108 | 85 |
| 7 | Lack of budget to cover high internet costs | 97 | 76.4 |
| 8 | Limited expertise and ICT skills levels | 97 | 76.4 |

Based on Table 3, the respondents perceived “*Lack of network infrastructures*” as the greatest challenge (85%) in implementing Education 4.0, followed by “*Lack of budget to cover high internet costs*”; and, “*Limited expertise and ICT skills levels*”, both at 76.4%. Another important challenge perceived by the respondents is “*Lecturers are unequipped with psychology knowledge to the new generation preference and needs*”, at 66.9%. However, “*I am resistance to change*” is not considered as a crucial challenge (11%) in Education 4.0 implementation. Similar perceptions indicated the challenges of “*My teaching and learning skills are outdated*”, “*My technical skills are outdated*”, and, “*I am lack of pedagogical skills*”, with 22.8%, 23.6% and 27.6%, respectively.

Results in Table 3 highlight that the majority of the respondents perceived IT infrastructure as the main challenge in implementing Education 4.0. This is consistent with Mian et al., (2020) which stated that the implementation of Education 4.0 requires among other things, effective financial planning and advanced infrastructure.

On the other hand, the skills of individuals were reflected as the least challenges towards Education 4.0 implementation. Though listed as the least challenges, the finding is still consistent with the past study, which indicated skilled staff as one of the challenges in the implementation of Education 4.0 (Mian et al., 2020). Challenges may arise due to the need among educators to change teaching techniques, as they may be unfamiliar with IT and need more training (Gerstein, 2014). In addition, challenges related to individual skills are due to constantly changing in the generation of students, and accelerating learning progress causing present knowledge to obsolete before one's entire career ends (Selamat et al., 2017).

4.3 Chi-square test

Further analysis of the Chi-square test for independence was conducted to explore the relationship between gender and perceived challenges for Education 4.0 implementation. Tables 4a and 4b summarize the results.

Table 4a: Chi-Square Tests

| | | Chi-Square Tests | | | | |
|---|-----------------------|------------------|----|-----------------------------------|----------------------|----------------------|
| | | Value | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
| 1. Resist to change | Fisher's Exact Test | | | | .161 | .127 |
| 2. Technical skills | Continuity Correction | .034 | 1 | .853 | | |
| 3. T&L skills outdated | Continuity Correction | .000 | 1 | 1.000 | | |
| 4. Lack of pedagogical skills | Continuity Correction | .000 | 1 | 1.000 | | |
| 5. Unequipped with psychology knowledge | Continuity Correction | .000 | 1 | 1.000 | | |
| 6. Lack Network | Fisher's Exact Test | | | | 1.000 | .578 |
| 7. Lack of Budget | Continuity Correction | .495 | 1 | .482 | | |
| 8. Limited expertise ICT | Continuity Correction | 1.491 | 1 | .222 | | |
| | N of Valid Cases | 127 | | | | |

Table 4b: Symmetric Measures

| | Symmetric Measures | | |
|---|--------------------|-------|--------------------------|
| | | Value | Approximate Significance |
| 1. Resist to change | Phi | -.133 | .134 |
| | Cramer's V | .133 | .134 |
| 2. Technical skills | Phi | -.039 | .657 |
| | Cramer's V | .039 | .657 |
| 3. T&L skills outdated | Phi | -.003 | .974 |
| | Cramer's V | .003 | .974 |
| 4. Lack of pedagogical skills | Phi | .007 | .935 |
| | Cramer's V | .007 | .935 |
| 5. Unequipped with psychology knowledge | Phi | .017 | .851 |
| | Cramer's V | .017 | .851 |
| 6. Lack of Network | Phi | .006 | .946 |
| | Cramer's V | .006 | .946 |
| 7. Lack of Budget | Phi | .085 | .336 |
| | Cramer's V | .085 | .336 |
| 8. Limited expertise ICT | Phi | .131 | .139 |
| | Cramer's V | .131 | .139 |
| N of Valid Cases | | 127 | |

Table 4a represents the results of Chi-square tests indicating the Sig. value of greater than .05 for all variables. It should be highlighted that the associated significance is determined based on Fisher's Exact Probability Test instead of Continuity Correction, for challenges "1. Resist change i.e I am resistance to change" and "6. Lack network i.e. Lack of network infrastructures". The reason is that these two items violated the assumption that the lowest expected frequency in any cell should be 5 or more (Pallant, 2010). Overall, there is no evidence of a significant association between gender and any of the perceived challenges items. It shows that regardless of male or female academicians, they have a similar perception of the challenges towards Education 4.0 implementation.

This result can be discussed from two different viewpoints. On one side, the insignificant in gender is consistent with prior research, which revealed no impact of gender found on students' teachers' attitude towards IT when they were exposed to the equivalent level of IT experience and were homogenous in

their prior background knowledge and skill (Wong & Hanafi, 2007). Similarly, in certain cases, gender differences were unable to determine the intention to accept new technology (Goswami & Dutta, 2015). On the other hand, the finding is contradictory with Cai, Fai & Du (2017) which stated that males showed more favorable attitudes toward technology use than those in females in their meta-analysis study of gender difference in the attitude toward technology use in education.

This may be rationalized by the fact that evolution in the education system is changing rapidly to the changes in education technology regardless of gender difference. Educators are said to be somewhat ready for the adoption of a new education system though limited resources provided in universities remain an issue (Muzira and Bondai, 2020).

5.0 CONCLUSION

Education 4.0 marked a new paradigm in the education sector as it focuses on innovation and maximizes the use of information, internet, and technology. Its implementation involves many stakeholders namely education authorities, educators and learners. Although it opens rooms for innovation in teaching and learning, its accelerating progress cannot run away from challenges. This study provides insight into some challenges perceived by the educators or academicians at the selected comprehensive university towards Education 4.0 implementation. In this study, IT infrastructure is perceived as the main challenge, while the skills of individuals have been reflected as the least challenges towards Education 4.0 implementation. The issue of gender is not associated with the perceived challenges found in this study.

As academicians play a crucial role in the success of Education 4.0 implementation, the findings should assist the Education 4.0 stakeholders to look into those perceived challenges and take necessary actions such as increasing budget allocation for IT facilities, as a support towards the success of Education 4.0 implementation. Future research may be undertaken to examine more specific infrastructure challenges in implementing education 4.0 at other comprehensive universities as well as at research universities and focused universities.

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