

Students' perception to integrate education 4.0 in Science program.

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Abstract

This study aims to explore students' perception of integrating education 4.0 in the Science program. The technology acceptance model was used to determine students' understanding of integrating education 4.0 focusing on the Science program. This research was conducted using a qualitative approach. The interview was used to collect the data. Five respondents among Science students were interviewed. They were undergraduate students pursue study in a science education program. The finding of the interview result showed that students had positive responses in integrating education 4.0 for technological sustainable development. The results of the study showed that students had a positive understanding of the three aspects namely, readiness in integrating education 4.0 for the Science program, the impact of technology facilities, and enhancing digital skills for employability. We recommend further research to evaluate the preparation or readiness of students to integrate training using technology 4.0. Based on the results, further research is proposed to take into account new education skills among Science students in line with the industrial revolution 4.0.

Keywords: Industrial revolution 4.0; Science program; technological advancement; digital skills; students

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1. Introduction

In higher education institutions there has been a rise in understanding of sustainability and an increase in Science (Othman & Othman, 2012; Ahmad, 2012). The next generation of people who will help the sustainability movement needs to be developed in higher education institutions as skills demand grows (Swaim et.al, 2014). John and Cedric (2004) pointed to the relevance of higher education as new fields have become increasingly essential to continued growth, and the organization needs to remain relevant to learning through that period. Science and technological education demands continue to grow.

In the scope of higher education institutions, there are different needs of each university as to how sustainability is important to them. In the training and learning programs, higher education institutions have implemented environmental growth concepts and practices. It has been important to further establish ideas about what sustainability implies and the value of educational advancement to implement sustainable development. In higher education, sustainable growth is necessary because students are now ready to reach the job market, develop expertise, and translate knowledge with what they have learned. Jennie et al. (2008) claimed that higher education can serve as a change-maker in multiple communities and environments. Anthony (2003) also realized that higher education could act as a sustainable model by combining all elements of campus life.

The first industrial revolution began in the 1800s with the existence of mechanical advances such as the use of steam engines, cotton spinning, and trains. The second industrial revolution, which took place in the 1900s, initiated large production through installations and electrification. In the 1970s, the third technological revolution saw the presence of major computer skeletons, the presence of personal computers, and the Internet. Whereas nanotechnology, brainwaves, 3D printing as well as mobile and computer networks, became the subject of the fourth revolution. Industrial revolution 4.0 brings the vast usage of intelligent networked networks to innovate innovative goods, processes, and facilities into account. Since human lives will be transformed in the fourth revolutionary revolution, many countries including Malaysia, want to become an industrial society (Dzulkifli, 2017).

In compliance with the Malaysian Education Higher Education strategy 2015-2025 and the Global Industrial Revolution 4.0, the Malaysian Minister for Higher Education introduces a higher education framework. This framework is focused upon information and awareness align with the National Vision 2050 (TN50). The Malaysian government has initiated many programs and built the

necessary infrastructure to achieve TN50. One of the programs is to translate the training curriculum, in line with the revolutionary trends in the industrial revolution, as a way for organizations to remain successful (Malaysia Ministry of Higher Education Malaysia, 2018). Malaysia is changing to a knowledge-driven culture in 2050 with a shift toward industrialization.

1. 1. Industrial revolution 4.0 in Science program

One of the most challenging issues in Malaysia is the industrial revolution of 4.0. Industrial revolution 4.0 has evolved to change the employees' work and skills. New jobs and the introduction of new products and services are being developed in the industrial revolution 4 (Thomas & Gerold, 2016). Malaysia is bound towards a scientist-led economy by 2010 (Ng, 2014). Malaysia has been primarily concerned about the value of science education. From kindergarten to the higher education institution, the Sciences subject is taught. Science, Technology, Engineering and Mathematics (STEM) is one of the initiatives listed in the Malaysian roadmap that will help educationists integrate technology into the educational and learning process (Rose, 2016). In other words, STEM allows students to incorporate information and to think structurally and in a systematic way through subjects. The Sciences education curriculum must be thoroughly trained and aware of the latest industrial technology in compliance with the mandate of the Malaysian Minister for Higher Education to promote higher education in industrial revolution 4.0 in 2018. The use of technology in learning needs to be emphasized in line with the technical change in education, as stated by the Malaysian Qualifications Agency in 2018. It is limited to date and still considered at the early stage of adoption to accept the industrial revolution in Malaysia's context. Since the Malaysian education system requires studies examining industrial revolution 4.0, limited information was gathered.

Science students need to be equipped and ready for the emergence of the industrial revolution 4.0. They will compete in the global markets for jobs and must be knowledgeable of emerging technology industries. There will be jobs replaced that can be automated. The rapid revolutions during the industrial revolution 4.0. Katharina et.al., (2015), also agreed to equip students and train them to fulfil industry demands 4.0. Hence the education system needs to be revised. In this respect, universities must ensure that their academic curriculum or services for Science students are compatible with industrial revolution 4.0.

Malaysian universities must integrate different techniques to enhance the progress of learners in their studies in the integration of Science education with the industrial revolution 4.0.

Technologies such as big data, automated robotics, simulation; uniform systems integration; cybersecurity; cloud computing; additive manufacturing; and growing reality are among the nine foundations of technological advancement in industrial revolution 4.0. The use of modern technology will help improve the teaching and learning experience and generate a learner's interest in the learning materials by incorporating them into teaching and learning Science programs. Casarus et.al., (2018) stated that the usage of multimedia is an effective learning material to support the teaching and learning process. Since the newest technical development 4.0 in education and training has evolved, Blaschke (2012) claims the need to bring modern pedagogical approaches into consideration.

The role of technologies is to promote digital competencies with the growth of new digital technologies (Halili, 2019). The digital competencies are essential in industry 4.0 which are relevant for students (Ulrike, 2018). Digital competencies include related digital skills, ranging from basic literacy skills to the total population in digital skills related to emerging digital technology, and products and services innovations. Educators must however ensure that students are educated and aware of these emerging technologies. Therefore, it is important to ensure that Science students are prepared to fulfil the needs of their potential employers with the knowledge, expertise, and understanding of industrial revolution 4.0. This article is therefore intended to respond to the following research question: What is the students' perception in integrating education 4.0 in Science program?

2. Methodology

The technology acceptance model (TAM) by Davis (1989) is used in this study as an instrument to identify factors influencing Science students' perception in integrating education 4.0 for technological sustainable development. The rationale of using the TAM model in this study is that this model is widely used in various studies such as the World Wide Web, mobile banking, multimedia, and healthcare. The TAM model is one of the most well-known models in the field of technology adoption and has great potential for testing and predicting attitudes toward information technology use. (Moore, 2012; Park, 2009). TAM model stipulates that factors are influencing the users' acceptance toward the use of particular technology. In this study, the TAM model is focused on two main constructs such as Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). These

two constructs are key determinants of the TAM model that is the level at which a user believes that using a particular technology will improve individual performance and the degree to which a person believes that the use of technology would enhance his/her job performance (Pai & Huang, 2011).

The research focused on the Science program due to its challenging process with the highest difficulty compared with other subjects (Kubilay & Ozden, 2012). The selected population for this study consisted of Science students in one of the top universities in Malaysia. They were undergraduate students pursue study in a Science education program. The researcher selected the sample using purposive sampling. Since the choice of sample is based on purposive sampling; the sample characteristics have already been defined. Six students were invited and selected as the subjects of research. They were chosen because they were the senior in the university and have learned course in the technology-based subject since the first year. They were named U1, U2, U3, U4, U5, and U6. Two males and four females participated. Qualitative analysis is performed in natural systems and uses words instead of numbers. For a small sample size of six, the qualitative method such as the interview would be a more appropriate way to collect data (Tracy, 2013). Patton (2002) also agreed that six to ten people are suitable to be involved in the qualitative method and usually involved in a small focus group interview. Further, this interview aims to improve participants' confidence in explaining their ideas. The researcher chooses to implement the semi-structured interview because its casual style allows more flexibility and freedom in communication. This is because according to Kajornboon (2004), semi-structured is a freestyling interview compared to a structured interview.

The interview questions were modified from previous research done by Suguneswary (2016). The questions were focused on two main constructs in the TAM model such as Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The duration of an interview session was carried out in ten to fifteen minutes after the class session in the fourteen weeks. The researcher referred to Miles and Huberman (1994) on the analyzing procedure in analyzing the data from the interview session. In this study, after conducting the semi-structured interview with a group of respondents, the researcher immediately processes, and records raw data collected during the interview session. The researcher gathers data that is significant to the research and simplifies it to be understood by the reader. All answers and feedback received from the interview session are categorized based on the interview questions. The content was characterized accordingly to answer

the interview questions. After identifying the contents into a theme, the researcher arranges the data and reports it descriptively according to the themes.

3. Findings

The finding of the interview result showed that students had positive responses in integrating education 4.0 for technological sustainable development. Based on the students' agreement in the interview process, the majority of the respondents hold positive views regarding the use of technology in the Science program for sustainable development. In this study, the researcher classifies the raw data related to students' perception into specific themes. The themes are the overall discussions which are based on the interview findings. It has become easier for the researcher to put it into themes for analysis. Three interlocking themes emerged during the interview process in terms of students' learning: (1) Readiness in integrating education 4.0 for the Science program, (2) Impact of technology facilities, and (3) Enhancing digital skills for employability.

3.1 Theme 1: Readiness in integrating education 4.0 for Science program

In this section, when the researcher began asking students about their perceptions in integrating education 4.0, all of them responded that they were ready to embrace education 4.0 in the Science program. The majority of the students mentioned that they were motivated and gained more knowledge using technology 4.0 compared to traditional approaches.

U1 and U3 declared, *"I like the way this subject was taught. I can get more knowledge in learning."* (U1 & U3).

U2 stated, *"Yes, I am actively involved in-class activity and I am more motivated to learn."* (U2).

U4 commented, *"Yes, I am ready to embrace education 4.0 in learning Science. I am more motivated to learn Science"* (U4).

U6 said, *"I can use the teachers' learning resources. As a student, I need to equip myself with the new current of the educational system for my knowledge"* (U6).

Based on the interview analysis, the majority of the Science students agreed that they were able to increase students' interest, gain more knowledge and motivation in learning Science. The finding is coherent with a study by Ali (2016) that revealed students had a positive attitude and ready to use technology in learning. This is aligned with the research done by Contreras and Hilles (2015) which stated that students are ready to embrace the latest technology in the future. However, U5 mentioned that he was not ready to embrace education 4.0 in learning Science. They stated that he had no information and exposure on how the integration of industrial revolution 4.0 embraces education. Thus, the researcher believes that more awareness needs to be delivering to students since the study on education 4.0 is limited to date.

4.2 Theme 2: Impact of Technology facilities

Respondents were asked to describe facilities to embrace education 4.0 for technological sustainable development. Almost all respondents mentioned that they were not able to use technologies 4.0. In other words, most respondents mentioned that lack of technology facilities will give an impact to embrace education 4.0 for technological sustainable development.

U1 noted that "*The facilities should be considered as a positive factor for planning education 4.0.*" (U1).

Student (U2) agreed and stated: "*Lack and poor learning facilities can foster negative impacts and hinder the growth of sustainable development*" (U2).

Student (U4) and student (U6) noted that inadequate facilities may give an impact on the development of education 4.0 in the Science program.

Student (U6) mentioned: "*The ability to serve more students with advanced technology facilities is needed to sustain in this era.*" (U6).

Almost all students agreed that lack of technology facilities can contribute to negative impacts. Since students were ready to use technology in their learning, it is a challenge for the

institutions to provide sufficient infrastructures to students (Anuar et.al., 2016; Afolabi, 2015). Penalzoza and Vargas (2017) also agreed that there are many challenges to integrating technology in the teaching and learning process. The researcher believes that although improving the technology facilities is costly, however, it can give a positive impact on the institutions to sustain as a reward for investments.

4.3 Theme 3: Enhancing digital skills for employability

Although the students agreed that they were ready to embrace education 4.0 for technological sustainable development, however, they still need guidance from teachers to enhance their digital skills to increase employability.

Student (U1) mentioned: *“The teacher can make a difference as guidance to me. The teacher should expose us more to the use of technology 4.0 in class. Quality of teacher learning experience is important to enhance our digital skills for our future employment.”* (U1).

Student (U2) agreed and stated: *“I need more hands-on activity to enhance my digital skills in learning Science. It is an important requirement for future jobs.”* (U2).

Student (U4) mentioned: *“I need to constantly up-skill my knowledge in digital usage so that I can meet future skills demand.”* (U4)

Student (U5) also mentioned: *“I believe that as a student, I need to accelerate skills acquisition in the age of intelligent technologies I need guidance from the lecturer to enhance my digital skills so that I can be marketable in future.”* (U5)

Student (U6) reported: *“I understand the demand for skills in future, thus I need guidance from lecturer to guide me.”* (U6).

The finding of this study showed that digital skills are becoming globally requirements and it is important for students for their employment. Previous research related to industrial focus more on employability skills to fulfil the needs of industry and graduate (Thi et.al., 2018; Track, 2017;

Beaumont et. al., 2016; Dacre et. al., 2014; Bridgstock, 2009). To embrace education 4.0 for technological sustainable development, students need to equip with high-skilled job. Thus, there is an increased demand for digital skills and acquiring these skills is important in this era.

4. Conclusion and Recommendations

Sustainable organizations consider the economic, social, and environmental effects of their activities to ensure they work in a well-balanced manner towards the achievement of an equitable society. With current technologies, information is accessible almost everywhere and learning has become very dynamic. This means the Science curriculum needs to be designed in such a way that it creates more room for students to fulfil their learning needs. The technological advancements of the fourth revolution were mentioned by Klaus (2017) in different fields, economies, industries, and almost all facets of daily life.

This article has a strong effect on the Malaysia Industrial 4.0 trends, which will help institutions establish industrial revolution 4.0 education by Malaysia Education Blueprint 2013-2025. This article has many direct consequences. To remain relevant, higher education institutions need to change the framework of academic programs. It will help students confront and recognize the demands of the Industrial Revolution 4.0 (Centre for Teaching Excellence and Academic Quality, 2017).

In this research, it was found that students were ready to accept education 4.0 for technical sustainable development; but they need to be equipping with technology facilities and will need feedback from teachers to improve their digital skills to increase employability. Policymakers sometimes neglect the effect of facilities, hence the results of this study indicated that greater focus should be provided on the impacts of technology facilities as it will provide long-term cost-benefit aspects to keep maintain in this period. In the Malaysian Science academic program, the introduction of industrial revolution 4.0 has already been incorporated and has been taken into account in early implementation phases. In this respect, it is important for the universities, to fulfil global market demands after their graduation, to ensure their curriculum and programs for science students are in line with industrial revolution 4.0.

This study only investigated the understanding of science students in the integration of education 4.0 using the TAM model. We recommend further research to evaluate the preparation or

readiness of students to integrate training using technology 4.0. Further analysis is also proposed in line with the industrial revolution of 4.0 and takes into account the latest educational skills amongst Science students. It is a clear way of recognizing the education skills needed to bring about a 4.0 transition in business. Education skills, such as teamwork, communication, critical thinking, innovation, and collaboration are important in 21st-century education (Lorna, 2016; Deanna, 2016; Miller, 2015). Therefore, it is important to learn the training skills needed for the sense of the industrial revolution 4.0 to fulfil the needs of the employer and enable Science students in the Malaysian Education Blueprint 2013-2025 to become energetic, imaginative, and innovative.

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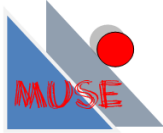
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