

IR 4.0 Knowledge and Readiness of Lecturers at the Teachers' Education Institute, Technical Education Campus, Malaysia

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This research undertakes to identify the knowledge and readiness of lecturers from the Teachers' Education Institute, Technical Education Campus (IPGKPT), Malaysia, to face the Industrial Revolution 4.0. The new technological waves from this revolution will bring changes and development to current technology, and the educational sector is bound to face a similar fate. In view of this, a research involving 63 lecturers from the IPGKPT was conducted. This descriptive research adopts a Likert scaled questionnaire, distributed through Google Forms. The findings from this research show that the knowledge and readiness of lecturers towards IR 4.0 is at a moderate level. The researchers, thus, suggest that the management of IPGKPT initiate programmes and activities related to IR 4.0, to enhance understanding of it.

Key words: *Industrial Revolution 4.0, Knowledge, Readiness, Lecturers IPGKPT.*

Introduction

The emergence of Industrial Revolution 4.0 (IR 4.0) could enable the dispersal of robots into all kinds of human activities; robots designed specifically to optimise human needs and comfort (Sousa et al. 2018). IR 4.0 will be experiencing the Internet of Things (IoT). That would not only improve the business world but almost every aspect of life, including education. The Teachers' Education Institute, Technical Education Campus (IPGKPT) is one institute with a niche in the field of technical and vocational education. As such, the lecturers from this institute should be well-versed to face the needs of IR 4.0. In this pretext, the role of lecturers is crucial to realising this educational revolution, through innovative teaching and learning in the classroom. The lecturers at the IPGKPT are required to train and produce



teachers of high self-esteem and commitment. Conspiringly, such an education requires adopting and adapting new ways of teaching, in line with the rapid development of today's technology. Ever inspiring technology has been greatly absorbed into today's working environment and life, and it is felt that previously acquired skills seem redundant for the future.

Common phrases such as robots, artificial intelligence, innovation and disruptive technologies are just some of the terms closely associated with discussions of IR 4.0. With such pertinent technological advancements, it becomes imperative to evaluate lecturers' knowledge and readiness. Are the lecturers prepared to integrate augmented reality into their teaching? Are they able to emphasise the components of innovation and creativity into their teaching and facilitating (TnF) aspects? Further, these approaches should focus on students' collaboration and interdependence. Notwithstanding, approaches of active learning, project-based learning, problem solving and inquiry, with opportunities to engage with the real world, should be the practice. Teachers are not the only primary source of information, during the rapid growth of open source information and online content. Nonetheless, it is baseless to conclude that teachers are less relevant in the current technological world, but rather their roles and styles of leadership are changing towards a more consultative manner. Lecturers should be accorded the freedom to customise their teaching process with their own teaching aids, in line with the Revival of Blended Learning in the classroom. Teaching should embrace personalised learning; learning designed for the student's needs and desires. Learning should not be confined to the classroom alone. Therefore, lecturers at IPGKPT should be prepared for the latest teaching approaches, in line with current developments that are the advent of IR 4.0.

Literature Review

The emergence of IR 4.0 is so fast and unexpected. In the twinkle of an eye, advancements in almost every strand of life are announced. Progress in today's industrial revolution plays an important element which is significant in shaping and driving development globally. Similarly, in today's educational world, rapid changes are seen to take place in line with the advent and presence of IR 4.0. By recognising this fact, teachers have a role in motivating and moulding students to become more purposive in the future. Moreover, the Teachers' Education Institute (IPG), which trains prospective teachers, should also embrace these challenges in line with current technological advancements. Hence, the programs at teachers' training institutes should instil among trainees the need to embrace the changing educational world. According to Mohamed Ali (2018), inculcating freedom of thinking should be emphasised in the context of Malaysian society as preparation for the arrival of IR 4.0 (Shi et al., 2019).

The First Industrial Revolution (1760-1830) began in England with the discovery of water vapour, revolutionising mechanical engineering and expanding throughout Europe and North America in the late eighteenth and early nineteenth centuries (Alp Ustundag, Emri Cevikcan, 2018). The world then continued to change with electric power, sparking the Second Industrial Revolution (1870-1914). That Revolution aimed at improving energy sources by using more low-cost and efficient electricity. Manufacturing experienced rapid growth during this time. In the 1950s the Third Industrial Revolution, or more specifically, the Digital Revolution, began in many developed countries. That Revolution was based on computers, information technology and the automated production of goods and services. In line with the Digital Revolution during the Third Industrial Revolution, the emergence of IR 4.0 is very different. It brings new waves of technology which are more integrated with society, or it seems to play a role as if it is a part of human anatomy. In fact, IR 4.0 will change the way we live and work since human life fundamentally involves the digital, biological and physical. For example, Facebook is capable of live streaming just like a television. Instagram and Twitter are also able to deliver the latest news to their users and the general public.

Meanwhile, in the education context, teaching in classrooms can no longer remain conventional, if we are to produce competitive, innovative and creative students. Those born in the era of mobile computer technology, known as Generation Z (Gen-Z), are fundamentally good at sharing information through social media. They have a strong desire to learn new things online. Thus, educators are required to initiate new learning experiences for them. There are three (3) steps that can be taken to achieve this goal (Mohamad Amin, 2016). Firstly, understand Gen-Z students and how they learn. Secondly, redefine conventional teaching from being teacher-centred content, if we want these students to stay relevant in preparing for the future. Thirdly, redesign twenty-first century learning to suit Gen-Z's needs.

Therefore, IPGKPT lecturers should be prepared to equip themselves and understand the needs of current teacher trainees, through the teaching pattern of IR 4.0.

Statement of Problem

The advancement of science and technology has changed the world since the First Industrial Revolution replaced human beings and animals through the advent of machines. The ensuing, Second Industrial Revolution emerged with electricity and combustion engines (Reischauer 2018; Ramirez-Mendoza et.al 2018; Sung 2018).

Essentially, IR 4.0 emphasises the construction of virtual reality technology with minimum use of human resources; it will certainly impact various aspects of life (Daricin et al. 2018). In this context, it is crucial that teacher education and training keep up with the latest developmental impacts. As such, how effective are the efforts of the IPG, particularly

IPGKPT, in producing quality trained teachers in technical education and vocational training (TVET), to educate the new generation of students?

However, the knowledge of Industry 4.0, and the preparation among trainees about facing the challenge of IR 4.0, are alarming. According to Sharita et al. (2018), fourth (4th) semester students from Muadzam Shah Polytechnic (POLIMAS) had only moderate knowledge about IR 4.0., and student readiness to pursue IR 4.0 was also low. The production of trainee teachers with high competence, knowledge and skills is the main agenda of the national education system, to contribute to effective learning among school students. Therefore, this study is important. It has been conducted at IPGKPT, to find lecturers' readiness and knowledge in facing the challenges of IR 4.0, in line with twenty-first century learning (PAK 21), and also to produce trainee teachers who are competent and ready for IR 4.0.

Research Objectives

Specifically, the objectives of this study are as follows:

1. To identify the level of knowledge of IPGKPT lecturers on IR 4.0.
2. To identify the level of readiness of IPGKPT lecturers to meet the challenge of IR 4.0.

Research Questions

The research questions of this study are as follows:

1. What is the level of knowledge of IR 4.0 among the lecturers of IPGKPT?
2. What is the level of readiness to meet the challenges of IR 4.0 among the lecturers of IPGKPT?

Research Findings and Discussions

Respondents' Demographic Analysis

Table 1 below refers to the gender of lecturers involved in this study. Of 63 respondents, about 28 (44.4%) respondents were male lecturers, while 35 (55.6%) were female. It is noted that there were fewer male lecturers than female lecturers involved in this study. This shows that female lecturers are dominating the field of teaching.

Table 1: The number and gender of respondents

Gender	Number of respondent (lecturer)	Percentage (%)
Male	28	44.4
Female	35	55.6
Total	63	100.0

Table 2 below refers to lecturers by their departments. Most lecturers in this study were from the Technical and Vocational Education Department (PTV), consisting of 17 (27%) lecturers. There was only one lecturer (1.6%) from each of the Science, Innovation Research and Teaching Professionalism, and Mathematics departments respectively, indicating they were the least involved in this study.

Table 2: The respondents by department

Department	Number of respondents (lecturer)	Percentage (%)
PTV	17	27.0
Language	10	15.9
Malay study	5	7.9
HEP	7	11.1
JKA	5	7.9
Japim	2	3.2
JIP	9	14.3
PIPK	1	1.6
Science	1	1.6
Mathematics	1	1.6
KOKO	4	6.3
Counseling	1	1.6
Total	63	100.0

Descriptive Analysis

Descriptive analysis was used to answer the research questions of this study. It consists of percentage, mean and standard deviation (SD) to identify the level of each variables. The interpretation of the mean scores used in this study is based on the recommendations from Pallant (2010), as stated in Table 3.

Table 3: Interpretation of Descriptive Mean Score

Mean score	Mean score interpretation
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Source: Pallant (2010)

The first research question deals with IPGKPT lecturers' level of knowledge about IR 4.0. There are 16 items used in this section, with two sub-constructs namely general knowledge of IR 4.0 (five items), and elements of IR 4.0 (11 items). Table 4 shows the mean and standard deviation of each sub-construct in the knowledge level of IR 4.0. The result shows that the mean for sub-constructs of knowledge level of "Have Heard About IR 4.0" is at the highest level with a mean 3.80, and SD 0.42. Meanwhile, a moderate of mean 3.00 and SD 0.47 is found for the knowledge level about Big Data. And the lowest level of knowledge is found for the sub-construct knowledge of Authentications & Fraud Detection, with a mean 2.90 and SD 0.73. Overall, the IPGKPT lecturer's knowledge level of IR 4.0 is still at a moderate level with an overall mean value of 2.91 and SD 0.32.

Table 4: Knowledge Level of IPGKPT Lecturer's on IR 4.0

Sub-Construct	n	Mean	SD	Interpretation
Have heard of IR 4.0	63	3.80	0.42	High
Knowledge of Big Data	63	3.00	0.47	Moderate
Knowledge about Authentications & Fraud Detection	63	2.90	0.73	Moderate
Overall mean	63	2.90	0.32	Moderate

The following table shows the frequency of percentage for each item in the IPGKPT lecturer's knowledge level variable on IR 4.0.

Table 5: Knowledge Level Questionnaire Items of IPGKPT Lecturer's on IR 4.0

No.	Item	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)
1.	I know about Industrial Revolution 4.0	0	3.2	52.4	44.4
2.	I have heard about the Industrial Revolution 4.0	0	1.6	30.2	68.3
3.	I understand the meaning of Industrial Revolution 4.0	0	11.1	46.0	42.9
4.	I understand well everything about IR 4.0	1.6	22.2	60.3	15.9
5.	I know there are 11 elements in the Industrial Revolution 4.0	3.2	30.2	54.0	12.7
6.	I know about Cloud Computing	0	30.2	54.0	15.9
7.	I know about Internet of Things (IOT)	0	34.9	55.6	9.5
8.	I know about Augmented Reality	1.6	38.1	50.8	9.5
9.	I know about Big Data	0	23.8	60.3	15.9
10.	I know about Mobile Devices	0	22.2	55.6	22.2
11.	I know about Location Detection Technologies	1.6	36.5	52.4	9.5
12.	I know about Advanced Human Machine Interfaces	1.6	47.6	44.4	6.3
13.	I know about Authentications & Fraud Detection	3.2	41.3	46	9.5
14.	I know about 3D printing	3.2	28.6	49.2	19.0
15.	I know about Smart Sensors	1.6	33.3	52.4	12.7
16.	I know about multilevel customer interaction and customer profiling	3.2	46.0	38.1	12.7
	Mean score	2.91			
	Standard Deviation (SD)	0.32			
	Level of interpretation	Moderate			

The second research question refers to the degree of readiness of the IPGKPT lecturers towards IR 4.0. There are five items in this section involving sub-constructs; namely general readiness for IR 4.0 (five items). Table 6, below, shows the mean and standard deviation of the sub-constructs of readiness level, as to IR 4.0. The results show that the mean for sub-constructs of readiness level with respect to IR 4.0 was moderate, with a of mean 3.1 and SD 0.56. The lowest level of readiness was the sub-construct of “Willingness to Change the Teaching Patterns” with mean of 2.8, SD 0.42.

Table 6: Readiness Level of IPGKPT Lecturer's on IR 4.0

Sub-construct	n	mean	SD	Interpretation
Ready for IR 4.0	63	3.10	0.56	Moderate
Willingness to change teaching patterns	63	2.80	0.42	Moderate
Overall mean	63	2.95	0.45	Moderate
Sub-construct	n	mean	SD	Interpretation

The following table shows the frequency in percentage of each item in the IPGKPT lecturers' readiness variable for IR 4.0.

Table 7: Readiness Level Questionnaire Items of IPGKPT Lecturers' on IR 4.0

No.	Item	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)
1.	I am ready to face IR 4.0	3.2	30.2	54	12.7
2.	I am physically and mentally prepared to face IR 4.0	0	30.2	54	15.9
3.	I am ready to change my teaching patterns to face IR 4.0	0	34.9	55.6	9.5
4.	I am ready with teaching aids for IR 4.0	1.6	38.1	50.8	9.5
5.	I am prepared with the infrastructure related to the teaching for IR 4.0	0	23.8	60.3	15.9
	Mean score	2.95			
	Standard deviation	0.45			
	Level of interpretation	Moderate			

In summary, the findings of this study show that IPGKPT lecturers are still at the moderate level of the process and are not fully knowledgeable on the elements of IR 4.0 as well as the

readiness for IR 4.0. IPGKPT lecturers are looking forward to programmes or related activities that will provide them with the knowledge and understanding of IR 4.0, in line with the requirement of the current education system namely PAK 21 and also to produce Generation Z people who can cope with technological changes in IR 4.0.

Discussion

This study shows that IPGKPT lecturers have not comprehensively understood IR 4.0. Nevertheless, lecturers recognise and realise that to embrace IR 4.0, they have to face challenges such as adapting to online and blended learning. However, internet access is relatively limited in the campus environment, which has left them behind in understanding the details of IR 4.0. This is in line with the study conducted by Ruslin Amir (2018) towards university students, which found that students face challenges in understanding and developing their potential while having to deal with challenges in problem solving, communication and forming a global network. The IPGKPT lecturers also need to be aware of ICT skills, high order thinking, working as a team, effective communication, and time management skills as an important aspect of additional elements in IR 4.0 knowledge acquisition.

Moreover, ever-changing technology is also a challenge that needs to be taken cautiously. Trainee teachers are also required to be ready, by equipping themselves with IR 4.0 knowledge. This is significant with the findings from Sharita (2018), who found polytechnic students' knowledge and readiness are still at a low level in understanding IR 4.0.

Recommendation

Based on the research findings, it is highly recommended that the IPGKPT campus provide the following:

- a. Organise IR 4.0 related courses so that lecturers can gain insights.
- b. Organise IR 4.0 workshops for lecturers by inviting industry experts.
- c. Provide facilities in line with IR 4.0 technology requirements.
- d. Conduct workshops in stages. The number of lecturers must be limited so that each lecturer can develop the knowledge of fellow members for continuity and skill.
- e. Provide IR 4.0 related instructional coaching.
- f. Encourage IPGKPT lecturers to read many of the latest technology- related readings in line with IR 4.0.
- g. Awareness by lecturers of technological developments and requirements in schools.
- h. Modify the current curriculum in line with the latest technology.
- i. Emphasise computational thinking in teaching by lecturers.



- g. Used frequently the teaching methods of heutagogy, pedagogy and cybergogy.
- h. Implement IR 4.0 elements in RMK / MK.
- i. IPGM needs to provide one real industry training program (industry training) for each TVET lecturer.
- j. IPGM needs to complete infrastructure at workshops, in accordance with the relevant field requirements.
- k. IPGM should not have a “Double Standard” attitude towards TVET development in IPGKPT compared to academic needs.
- l. Promote teaching applications in IR 4.0, as well as Teaching and Facilitation (TnC) concepts such as cybergogy, pedagogy and heutagogy in teachers’ training programmes.



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