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Relationship of Students' Knowledge and Readiness towards Industrial Revolution 4.0: A Study at Politeknik Hulu Terengganu

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Abstract: Technology has advanced quickly as a result of the establishment of the Industrial revolution 4.0, especially in the area of education. The existence of numerous educational electronic tools and applications that communicate with one another increases the flexibility and interactivity of the learning system. This study, which was undertaken at the Politeknik Hulu Terengganu, aimed to determine the relationship between students' knowledge and their readiness to face the challenges of the Industrial revolution 4.0 (IR 4.0). It can also create the newest teaching and learning strategies in accordance with technological advancements. A series of questionnaires served as the research tool for this descriptive study. Participants in this study included 241 individuals who completed their Diploma in Tourism Management, Diploma in Resort Management, Diploma in Recreational Tourism and Diploma in Accountancy programs at Politeknik Hulu Terengganu during semesters 1 through 5. Questionnaires are gathered, completed, and examined. Statistics were used in the data collection and analysis processes. The results indicate that, with a mean score of 3.52, the understanding and preparedness of Politeknik Hulu Terengganu students for the difficulties of IR 4.0 is still at a modest level. It is suggested that the polytechnic hold seminars and other events pertaining to IR 4.0 technology to expose students to this technology and raise their level of knowledge and preparedness for the upcoming era of industrial revolution 4.0. This will help to develop a generation of students who are not only proficient in using technology but also creative and innovative in their thinking.

Keywords: Knowledge, challenges, industrial revolution 4.0

1. Introduction

The advent of the Internet network and other physical processes, coupled with the growth of automation, is what is known as the Industrial revolution 4.0 (IR 4.0). Automation, simulation, big data analytics, robots, cloud computing, and the Internet of Things (IoT) are some of the latest technologies. According to Ilias & Ladin (2018), claimed that Industry 4.0 is transforming our way of living and working, especially with regard to automation technologies. This poses new difficulties for the nation as a whole, notably in the field of education. In the area of education, IR 4.0 stipulates that students must be fluent in both writing and oral communication, high-level thinking skills mastery, complex problem solving, and technology use. According to Jamaludin (2005), the national education system has evolved as a result of societal paradigm shifts. The growth and widespread availability of multimedia and the internet can help students get readier for the coming Industrial revolution 4.0. Saud et al. (2018) asserts that education is crucial to the Industrial revolution 4.0. Because of this, learning methods must adapt to the growth of automation in order to stay competitive and relevant, since employment prospects will likewise shift.

Polytechnic Malaysia and Community College are involved in addressing the issues raised by IR 4.0. It can be seen through the 2019 Robotics Competition organized by the Malaysian Ministry of Education (MoE) in collaboration with the International Islamic University of Malaysia (UIAM), witnessing Politeknik Mersing Johor (PMJ) has been designated as the Technical Training Center for the southern zone. Students' ability to demonstrate their abilities,

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inventiveness, and ingenuity in the field of robot design may be enhanced by this competition, which may also indirectly raise students' awareness of the robotics community (Valeyeva et al., 2020).

Citing Deputy Secretary-General (development) of the Ministry of Higher Education speech at the 2017 convocation ceremony of the community polytechnics in Melaka and Negeri Sembilan, he stated that one of the initiatives the community polytechnics took to get ready for the revolution was to outfit the teaching and learning system with the tools that the modern industry requires. Authorities in higher education are constantly working to make sure that graduates and students have all the tools they need to prepare for the increasingly difficult nature of the workforce, particularly in the age of Industry 4.0 (Shahroom & Hussin, 2018). The current state of technologies has been made evident by the development of the industrial revolution 4.0 (IR4.0). Students mostly use technology without understanding its growth or the demands of the revolution. According to Ilias & Ladin (2018), students at the IPG Ipoh campus in semester 6 have a moderate level of understanding about revolution 4.0 and a moderate desire to take on difficulties. Therefore, it is important that this study is conducted to find out the readiness of Politeknik Hulu Terengganu students in dealing with the challenges of industrial revolution 4.0. Modern life is impacted by a wide range of cutting-edge technologies brought forth by the industrial revolution 4.0 (IR4.0), including automation, artificial intelligence (AI), and the Internet of Things (IoT). Balakrishnan et al. (2021) stated that while IR4.0 is predicted to bring about new job opportunities in the technology sector, it will also result in job losses in industries that depend on routine and physical labour.

Despite the increasing use of this technology, the research reveals that students remain unaware of its actual requirements and evolution. According to a study by Rosmiati et al. (2022), pupils' understanding and preparedness for the industrial revolution 4.0 were rated as moderate. Furthermore, due to the lack of necessary skills and technological expertise, the majority of Malaysian graduates are ill-prepared to enter the labour market that is impacted by industry 4.0, according to a report published by the Malaysian Investment Development Authority (MIDA). This occurrence raises questions about how prepared the younger generation is to deal with the difficulties posed by IR4.0. Students could find it as challenging to adjust and take advantage of the opportunities presented by these new technologies if they lack a thorough understanding and sufficient preparation.

In order to evaluate the knowledge and preparedness of Politeknik Hulu Terengganu students to meet the challenges of the industrial revolution 4.0, it is crucial that this study be carried out. This study will assist in identifying current knowledge and preparation gaps and make recommendations for actions to improve the instruction and training that students require to succeed in this age of advanced technology. The research objective of the study are: 1) Knowing the level of knowledge of PHT students on IR 4.0; 2) Knowing the level of readiness of PHT students in meeting the challenges of IR 4.0; and 3) Identifying the relationship between student knowledge and student readiness to meet the challenges of IR 4.0.

Meanwhile, the research questions of this study are:

1) What is the level of knowledge of PHT students on IR 4.0?
2) What is the level of preparedness of PHT students in facing the challenges of IR 4.0?
3) Is there a relationship between knowledge and willingness of students to take on the challenges of IR 4.0?

2. Literature Review

Around the year of 1800, which was the beginning of industrial revolution 1.0, it has led to the use of steam engine-based power and waterpower in the production process. This marked the beginning of the four phases of the Industrial revolution (Idris & Bacotang, 2023; Schwab et al., 2017). The utilization of energy for mass production in the industrial revolution 2.0 had enhanced the quality of life for everyone on the planet. Subsequently, the globe entered the third phase of the industrial revolution, where information technology and the usage of electronic tools became the key components of automated manufacturing. The industrial revolution 3.0 has given way to the industrial revolution 4.0, or the digital revolution, which is currently at its peak in the world. According to Ellitan, (2020) and Schwab et al. (2017), autonomous robots, simulation, cloud computing, system integration, smart device technology or Internet of Things (IoT), cyber security, additive manufacturing (3D printing), virtual reality, and big data analysis are the nine main pillars that guide the Industrial revolution 4.0, a combination of technologies that blur the boundaries between physical, digital, and biological. Similar to the preceding industrial revolutions 1.0–3.0, 4.0 is anticipated to strengthen the international economy and raise living standards for people everywhere (Schwab et al., 2017).

Malaysia is among the nations actively mobilizing efforts to integrate the industrial revolution 4.0 into many facets of national growth. Due to the awareness of the significance of this automation-based technological transformation to meet challenges and stay competitive in line with the rapid advancement of the modern world landscape, the Industrial revolution 4.0 has come into the focus of many parties, including government agencies, various industrial sectors, and the general public (Alaloul et al., 2020; Liao et al., 2018). Malaysia is the first nation to include parts of the industrial revolution 4.0 into the National Development Plan, having formulated this industrial strategy into the Education (Higher Education) Development Plan 2015–2025. The country embraces the challenge presented by the industrial revolution 4.0. Education, as we all know, is essential to the development of a civilized society and is something that every individual need in order to live a better life.

For this reason, Malaysia requires higher education establishments to be more adaptable and equipped to take on new challenges in order to ensure that no community is left behind in the age of globalization and digitalization. It's even

said that in this day of advanced technology, when everyone is using information and communication technology (ICT) systems, the traditional "chalk and talk" learning style in the classroom is obsolete. According to Bangun & Pragholapati (2021), the education system's adaptation to the Industrial revolution 4.0 calls for students to possess advanced critical thinking abilities, inventive and creative thinking, problem-solving skills, digital and verbal communication proficiency, and a solid technological grasp. This is a result of the fact that machines and robots lack human intelligence. As a result, students must adjust to technology advancements that support and enhance both everyday living activities and the educational process. Future changes to the education system, particularly in higher education, are anticipated as a result of the Industrial revolution 4.0 (Shahroom & Hussin 2018). The purpose of this study was to evaluate the students' preparedness and understanding of the Industrial revolution 4.0 at Politeknik Hulu Terengganu. With the help of the information gathered, educators will be able to design a more effective teaching and learning program (PdP) that considers students' knowledge and readiness levels while also making sure that Malaysia's educational system keeps up with the rapidly evolving Industrial revolution 4.0.

3. Methodology

3.1 Research Design

Examining the degree of knowledge and preparedness of Politeknik Hulu Terengganu students for IR 4.0 is the goal of this descriptive research study. This study's design was implemented using a questionnaire method in a quantitative manner. It is one of the techniques employed in descriptive surveys to get respondent feedback. Researchers can obtain thoughts and insights on certain study subjects by using questionnaires, which are a common way of obtaining information from target participants, most researchers choose questionnaires for a number of reasons (Bell et al., 2022).

These include the low cost and short preparation time for the questionnaire, the ability for respondents to select the most convenient time and location for them to complete it, the ability for researchers to collect data from a larger number of respondents more quickly, and the ease of use and analysis of closed-ended questions due to the consistency of respondents' responses. Google Forms was used to create the questionnaires for this study since it offers respondents an easy-to-use and comfortable platform. Participants in the study from Facebook, Instagram, and Telegram were given enough time to complete the questionnaire, which may have led to more accurate responses (Snowball & Willis, 2011). The quality of the data gathered for the study is enhanced by this method. The findings of the study will offer conclusions and address the raised research questions. Students received the questionnaires via WhatsApp and Telegram in addition to being distributed online using the Google Forms tool. The survey forms are made available online, in order to speed up access to research questions without regard to location or time limitations.

3.2 Respondents

Students from semesters 1 through 5 of all programs currently enrolled in diploma-level courses at Politeknik Hulu Terengganu made up the study's sample. Simple sampling was used to pick respondents using a non-probability sampling technique. 241 of the 270 respondents who took the survey were approved and used in this study's analysis (Hulland et al., 2017; Krejcie & Morgan, 1970).

3.3 Instruments

The research tool utilized in this study is a three-part questionnaire that asks about the respondent's information, the Politeknik Hulu Terengganu students' degree of struggle on IR 4.0, and their level of knowledge preparedness. The goals and inquiries of the study serve as the foundation for the questionnaire's development. WhatsApp and Telegram users were given access to a Google Form questionnaire in order to complete the survey. Scale 1 strongly disagree (STS), scale 2 strongly disagree (TS), scale 3 uncertain (TP), scale 4 strongly agree (S), and scale 5 highly agree (SS) are the aspects examined using a 5-point Likert scale (Romy et al., 2019).

4. Results

Three primary sections of the data were analyzed for this study: Part A included an examination of the respondents' demographics. The characteristics pertaining to students' willingness to learn about the IR 4.0 industry are analyzed in Part B, and the variables pertaining to students' ability to confront and overcome the industry's obstacles are analyzed in Part C. The data analysis is likewise predicated on the study's original goals and aims to address the identified research topics.

4.1 Demographic Analysis

Questionnaires (DAT) were distributed to 650 students in four different study programs: The Diploma in Tourism Management (DUP), the Diploma in Resort Management (DHR), the Diploma in Recreational Tourism (DRT), and the Diploma in Accounting. Out of the 241 (n = 241) respondents, 37.07% have contributed. Table 1 shows that 89 respondents, or 36.9% of the total, were male students, and 152 respondents, or 63.1% of the student body, were female.

There are 66 respondents or 27.4%, Diploma in Resort Management (DHR), 75 respondents, or 31.1%, in Diploma in Tourist Management (DUP), 71 respondents or 29.5%, Diploma in Recreational Tourism (DRT) and 29 respondents or 12.0% Diploma in Accounting (DAT). Regarding the number of semesters, out of the 50 respondents, or 20.7%, 20.0% are students in semester 1, 35.7% are students in semester 2, 27 respondents, or 11.2%, are students in semester 3, 24 respondents, or 10.0%, are students in semester 4, and 54 respondents, or 22.4%, are students in semester 5.

Table 1: Respondent profile

Demographics		n	Percent (%)
Gender	Male	89	36.9
	Female	152	63.1
Programme	Diploma in Resort Management (DHR)	66	27.4
	Diploma in Tourism Management (DUP)	75	31.1
	Diploma in Recreational Tourism (DRT)	71	29.5
	Diploma of Accountancy (DAT)	29	12.0
Semester	Semester 1	50	20.7
	Semester 2	86	35.7
	Semester 3	27	11.2
	Semester 4	24	10.0
	Semester 5	54	22.4

4.2 Descriptive Analysis

Utilizing descriptive analysis, the research questions are addressed. The standard deviation, mean, and percentage are used to determine each variable's level. Pallant's (2010) guidelines are cited in the interpretation of the mean score utilized in this investigation. The interpretation of the mean score is displayed in Table 2.

Table 2: Interpretation of mean scores (Pallant 2010)

Min Score	Interpretation Min Score
1.00 – 2.33	Low
2.34 – 3.67	Medium
3.68 – 5.00	High

There are 14 items employed, comprising 2 sub-constructs: general knowledge of IR 4.0 (3 items) and knowledge of 11 elements of IR 4.0 (11 items). These are based on research questions 1 and 2, which ask about the general knowledge of Politeknik Hulu Terengganu students on the Industrial revolution 4.0. The item "Industrial revolution 4.0," which I have heard mentioned, has the greatest mean value (mean = 3.76, standard deviation = 0.898) (See Table 3). The items "I understand the meaning of the Industrial revolution 4.0" (mean value = 3.51) and "I know about the Industrial revolution 4.0" (mean value = 3.55) come next. These average numbers have demonstrated a basic degree of understanding. This indicates that the respondent is aware of the submitted item. With a mean of 3.60 and a standard deviation of 0.76, the overall results of this sub-construct show that general understanding of IR 4.0 is at a moderate level.

Table 3: Sub-construct questionnaire items readiness level general knowledge of IR 4.0

No	Item	Min	Standard Deviation	Interpretation
1.	I know about IR 4.0	3.55	0.958	Low
2.	I've heard the word IR 4.0	3.76	0.856	High
3.	I understand the meaning of IR	3.51	0.907	Medium
Overall assessment		**3.60**	**0.76**	**Medium**

The mean and standard deviation of the knowledge sub-constructs for each of the 11 IR4.0 elements are displayed in Table 4 below. The item about mobile devices that I am aware of has the highest mean value mean = 3.65 and standard deviation = 0.762 among the 11 elements that are offered. The items I am aware of regarding 3D printing (mean value = 3.63, standard deviation = 0.985) and smart sensors (mean value = 3.62, standard deviation = 0.940) come after this. These average numbers have demonstrated a basic degree of understanding. This indicates that the respondents are aware of the submitted item. The sub-construct's overall results indicate that, with a mean of 3.52 and a standard deviation of 0.96, the degree of knowledge for the 11 aspects of IR 4.0 is at a medium level.

Table 4: Knowledge readiness level sub-construct questionnaire items of the 11 elements of IR 4.0

No	Item	Min	Standard Deviation	Interpretation
1.	I know about Cloud Computing	3.30	1.054	Medium
2.	I know about Multilevel Customer Interaction and Customer Profiling	3.46	1.037	Medium
3.	I know about Smart Sensors	3.62	0.940	Medium
4.	I know about 3D Printing	3.63	0.985	Medium
5.	I know about Authentication & Fraud Detection	3.56	0.995	Medium
6.	I know about Advanced Human Machine Interfaces	3.55	0.957	Medium
7.	I know about Location Detection Technologies	3.55	0.957	Medium
8.	I know about Mobile Devices	3.65	0.762	Medium
9.	I know about Big Data Saya tahu tentang Big Data	3.50	0.980	Medium
10.	I know about Augmented Reality	3.51	0.984	Medium
11.	I know about the Internet of things	3.63	0.984	Medium
	Overall assessment	**3.52**	**0.96**	**Medium**

As a result, based on Tables 3 and 4 taken together, it can be seen that, as indicated in Table 5, the mean (3.52) and standard deviation (0.96) of the Politeknik Hulu Terengganu students' knowledge is at a high level. This shows that the respondent agrees with the points made in this section.

Table 5: Overall level of knowledge

Sub-Construct	Min	Standard Deviation
Level of knowledge of IR 4.0	3.52	0.96

Five items containing one sub-construct readiness to meet and conquer the obstacles of IR 4.0 are used to address Study 2's question, which asks what level of preparation Politeknik Hulu Terengganu students have for facing and overcoming the challenges of the Industrial revolution 4.0. The mean and standard deviation values for each of these sub-construct items are displayed in Table 6 below. My item, "I have prepared to face IR 4.0," has the highest mean value of 3.71 and standard deviation of 0.907 out of the five that were submitted. My items, " I am mentally prepared to face IR 4.0" and " I am physically ready to face IR 4.0" also have the highest mean values of 3.71 and 0.884, respectively. The item “I am willing to take the challenge of IR 4.0”, with a mean value of 3.69 and a standard deviation of 0.856, comes next. The item “I perfectly understand the challenge IR 4.0” displaying the lowest mean, i.e., mean value = 3.49 and standard deviation = 0.958, is fully understood by my item. The sub-construct's overall results, with a mean of 3.67 and a standard deviation of 0.89, are modest.

Table 6: Sub-Construct Questionnaire Items Readiness to Face and Overcome the Challenges of IR 4.0

No	Item	Min	Standard Deviation	Interpretation
1.	I perfectly understand the challenge IR 4.0	3.49	0.958	Medium
2.	I am willing to take the challenge of IR 4.0	3.69	0.856	High
3.	I have prepared to face IR 4.0	3.71	0.907	High
4.	I am mentally prepared to face IR 4.0	3.71	0.884	High
5.	I am physically ready to face IR 4.0	3.71	0.884	High
	Overall assessment	**3.67**	**0.89**	**Medium**

The overall findings of the study support the conclusion that, with a mean of 3.67 and a standard deviation of 0.89, Politeknik Hulu Terengganu students' general knowledge of IR 4.0, their understanding of its eleven elements, and their readiness to meet and overcome its challenges are all still at moderate level. This result is nearly identical to that of Romy et al. (2019) study, which found that trainee teachers at the Institute of Teacher Education Technical Education Campus (IPGKPT) have a moderate level of knowledge and preparation for the Industrial revolution 4.0.

Table 7: Correlation table the relationship between the level of knowledge and readiness students of Politeknik Hulu Terengganu in meeting the IR 4.0

		Knowledge	Challenge
Knowledge	Pearson Correlation	1	.703**
	Sig. (2-tailed)		.000
	N	241	241
Challenge	Pearson Correlation	.703**	1
	Sig. (2-tailed)	.000	
	N	241	241

The findings of the correlation analysis between the knowledge and preparedness of Politeknik Hulu Terengganu students in facing the difficulties of Industrial revolution 4.0 (IR 4.0) are displayed in Table 7. This table indicates that students' preparedness to meet the difficulties of IR 4.0 and their degree of knowledge are positively and significantly correlated. There is a substantial positive association between these two variables, as indicated by the derived Pearson correlation coefficient of 0.703. This implies that students are more prepared to handle the demands of IR 4.0 when the more knowledgeable they are. The table displays a significant value (Sig. 2-tailed) of 0.000. This number suggests that there is a statistically significant correlation between students' preparation and knowledge levels. The term "significant" here refers to the extremely low likelihood (less than 0.1%) that the observed association is the result of pure coincidence. Overall, these results imply that students are more equipped to handle the difficulties posed by these developments if they have a deeper understanding of IR 4.0. This emphasizes how crucial it is to raise students' knowledge levels in order to better prepare them for the IR 4.0 age.

5. Discussion

This study shows that students at Politeknik Hulu Terengganu still do not comprehend IR 4.0 sufficiently. The students' level of knowledge ability is still moderate and they are likewise at a moderate level of readiness to accept and confront the difficulties of IR 4.0. These results are consistent with a study conducted by Zabidee & Adnan (2024), which found that students at Universiti Sultan Zainal Abidin (UNISZA) in the fifth semester of the Accounting Management Degree program had a moderate understanding of the Industrial revolution 4.0 and were moderately prepared to pursue it. Students who do not have access to internet in the university vicinity also miss out on learning about IR 4.0. According to Kim & Grunig (2011), in addition to the difficulties they currently confront in communicating, problem-solving techniques, and building strong worldwide networks, students also confront obstacles and hurdles in realizing and realizing their own potential. There is a significant and positive association between the students' level of knowledge and their readiness to face the difficulties of IR 4.0 at Politeknik Hulu Terengganu. A study by Suhaimi & Awaludin (2018), which discovered that English language proficiency has a significant role in affecting how well IT students perform in their preparation for the Industrial revolution 4.0, supported the findings. This is consistent with the results of Ilias & Ladin (2018) study, which demonstrated a strong correlation between Universiti Malaya and IPG's readiness to meet the challenges of the Industrial revolution 4.0 and their soft skills in that regard.

All of the research issues about the IR revolution 4.0 have been addressed by the study conclusion. This indicates that an assessment of the students' knowledge and preparedness for the challenges of the Industrial revolution 4.0 at Politeknik Hulu Terengganu has been carried out effectively. The study's findings are anticipated and should serve as a notice to parents, students, teachers, lecturers, and school management about advancements in IR 4.0 technology. Students' preparedness for IR 4.0 difficulties and their degree of knowledge readiness are still at a reasonable level. To ensure that students continue to follow the evolution of this technology, all parties involved need to work together. This is a result of how quickly and how much technology has changed throughout time. The World Economic Forum lists five superior skills that graduates of the twenty-first century need to be strengthened with: the ability to solve complex problems with ease, the capacity to lead and collaborate well with others, the ability to communicate effectively both orally and in writing, emotional intelligence and integrity, and moral values that are commendable. To work with robots and other systems to speed up manufacturing processes and output, highly skilled, effective, and efficient workers are required (Imran et al., 2018).

6. Conclusion

Based on the study's findings, Politeknik Hulu Terengganu should give the students access to the internet so they may more easily discover information online, including information about IR 4.0 technology. Furthermore, events such as competitions, conferences, workshops, and courses pertaining to Industry 4.0 ought to be organized to offer students both direct and indirect exposure to this technology. Putting together competitions for innovation in robotics, services, and products with an emphasis on post-COVID-19 applications and technology is one example. IR 4.0 technology can be used to construct a variety of tools and applications to address this problem. Students will be exposed to IR 4.0 technology in an indirect manner, along with global challenges that are now causing problems. Students' access to research and

development materials makes them even more crucial. Additionally, lecturers must be aware of the advancements in IR 4.0 and possess a high degree of technological sensitivity. Lecturer preparation for the teaching and facilitation process (PdP) requires familiarity with the most recent IR 4.0 teaching and learning methodologies. The PdP approach can make use of a variety of applications, such as flipped classrooms, blended learning, mobile learning, and more. Students can learn a lot about IR 4.0 through this. Lastly, students must take on a role of their own in which they must constantly be willing to learn new things and keep up with the advancement of technology. As a result, students are always learning new things and have more chances to get employment. According to Shultz's human capital theory, students with skills will have a higher probability of being in demand in the job market, whereas less talented students will encounter challenges in getting a job offer. This means that skilled students will be more in demand in the labor market.

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