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Effects of Simulation Games on IS students' Work-readiness: Instructors' Perspectives

Nadia Faisal
Federation University, nadiafaisal@students.federation.edu.au

Mehmood Chadhar
Federation University Australia, m.chadhar@federation.edu.au

Andrew Stranieri
Federation University, a.stranieri@federation.edu.au

Anitra Gorris-Hunter
Federation University, a.goriss-hunter@federation.edu.au

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Completed Research

Nadia Faisal
Federation University, Australia
nadiafaisal@students.federation.edu.au

Mehmood Chadhar
Federation University, Australia
m.chadhar@federation.edu.au

Anitra Goriss-Hunter
Federation University, Australia
a-goriss-hunter@federation.edu.au

Andrew Stranieri
Federation University, Australia
a.stranieri@federation.edu.au

Abstract

Work-readiness is becoming a strategic priority for Australian higher education institutions (HEIs), with a shift from conventional teaching strategies towards experiential teaching techniques to boost students' learning experiences. One of these techniques is to employ simulation games to give students a risk-free, real-world reproduction of the soft and hard skills required by the information systems (IS) business. This exploratory research examined instructors' perceptions of the impact of simulation games on the work-readiness of information systems students. We conducted semi-structured interviews with instructors who run ERPsim game laboratories in Australian HEIs. The Work Readiness Integrated Competency Model (Prikshat et al. 2019a) was used to map the three kinds of learning outcomes resulting from these analyses: skills, knowledge, and attitudes. The mapping revealed that simulation games have the potential to foster the development of certain skills and attitudes required by the IS industry

Keywords

Work-readiness, simulation games, instructors, IS students

Introduction

Graduate work-readiness deficits have been wildly reported not only in emerging but advanced economies, leading to graduate underemployment and unemployment (Kadir et al. 2020). Australia is one of those advanced economies where graduates are suffering from these in their respective fields (Griffin et al. 2021). Research by the Australia Institute's Centre for Future Work (CFFW) has found that only 73 per cent of recent university graduates have found work – down from 85 per cent just before the global financial crisis in 2008. Underemployment and unemployment among graduates have risen from around 10% in 2008 to around 20% today (Standford 2019). A challenge for higher education institutes (HEIs) in the context of the fourth industrial revelation (4IR) is to prepare students for a dynamically changing job market by reviewing their pedagogical techniques and curriculums (Matthews et al. 2021).

Work-readiness refers to an individual's capacity to perform well in a variety of modern working contexts when they first enter the workforce (Burgess et al. 2017). The term has now been expanded to include the diverse capabilities that graduates will need to succeed in a labour market marked by fast technological changes. These capabilities are no longer restricted to technical skills; they now incorporate administrative qualities as well (Rodriguez-Abitia et al. 2012). HEIs are tackling the problem of preparing students for future jobs by using a variety of pedagogical techniques to increase students' learning opportunities. Experiential learning is one of the approaches (Koivisto and Hamari 2019). Experiential learning immerses students in an experience and then invites reflection on the event in order to foster the development of new abilities, attitudes, and ways of thinking. (Lewis and Williams 1994). Simulation games, which built their premises on experiential learning, have been proven to develop and enhance learning outcomes, motivation

and engagement (Faisal et al. 2019). Simulation games allow students to actively experiment in a life-like but risk-free environment by replicating real world scenarios. This fundamental world replication bridges the graduate skills gaps by developing hard and soft skills required by industry (Narayanan and Turner 2019).

To date, much of the research establishing link between experiential learning and work-readiness has tested the effects of internships and job-shadowing on the employability/work-readiness, ignoring simulations as an experiential learning tool (Foster and Pierce 2021). The contribution of this paper is the exploration of the effects of simulations on the work-readiness of IS graduates. This paper is a section of a larger research project conducted by the researchers to explore the effects of simulation games on the work-readiness of IS graduates in Australia (Faisal et al. 2021a). The project investigates the perspectives of three major stockholders (students, industry experts, and instructors) on the effectiveness of simulation games in developing work-readiness in IS graduates. This present paper focuses on the perspectives of instructors. During the simulation, the instructor undertakes a facilitation role providing a clear set of guidelines and expectations to the students (Wedig 2010). Instructors are often in a better position to assess the behavioural changes in students during simulations by playing a passive role in the experiential learning process (Certo 1976) . Despite being an integral part of the learning process, significant gaps in the simulation games literature were observed in exploring the instructors' perspectives of the effectiveness of these games on the students' learning. Also, the current literature is focused mainly on understanding the relationship between simulation games and learning outcomes and not on the translation of these outcomes into work-readiness (Hernández-Lara et al. 2019). This paper addressed these two identified gaps in the literature by empirically exploring the instructors' viewpoints on the effects of using simulation games to facilitate work-readiness of students and serves as the primary motivation for researcher to conduct this study. The guiding research question is:

"Are simulation games helping IS students to achieve higher learning and skill levels to be more work-ready?"

Literature review

Educators and academics have long acknowledged the importance of experience in facilitating efficient individual learning processes (Verma et al. 2018). In higher education, the experiential learning approach has found widespread use and met with considerable success (Kolb et al. 2005). Since its effectiveness in overcoming the shortcomings of traditional methods and meeting the needs of industry has grown over time, experiential learning has been integrated into the IS curriculum in various forms, such as simulations, work-ready learning, student-run businesses, internship programs and job shadowing, and has been widely popular (Spanjaard et al. 2018). Experiential learning literature suggests that students who have the opportunity to create and test their critical decision-making abilities while going through the experiential learning cycle are more likely to be ready for employment than students who only study via conventional means (Mavodza 2017). Many studies have been conducted demonstrating the effectiveness of this learning method on students' work readiness. However, most of the studies focused on work-integrated learning (internships, job-shadowing, etc.) as a form of experiential learning. For example, a survey was conducted from business graduates in a Spanish university to find out their perceptions on the use of internship to increase their job-readiness (Kapareliotis et al. 2019). The results showed the positive effects on internships on future employability, which resonated with other researches. Patil and Meena (2018) investigated the impact of an experiential learning method (spoken tutorial activity) on students' practical or technical knowledge of the subject. The results showed that active learning achieved by experiential techniques enhances students' employability.

Although having strong links with experiential learning (Towne et al. 2012), simulation games are often ignored in literature when it comes to empirically testing the effects of experiential learning techniques on the work-readiness of graduates. Students may engage in active learning via the use of simulation games by executing real-world transactions and making decisions, then receiving feedback and making adjustments to their choices (Loon and Bell 2018). Most of the studies that explored the effects of simulations on learning are either quantitative studies or address the issue solely from the students' perspective. Table 1 shows the recent key studies on the simulation games effects on the learning outcomes of students.

References	Methodology	Learning outcomes
(Bitrián et al. 2020)	Two-wave longitudinal study with a sample of 430 students' surveys	Perceived learning, satisfaction and skill outcomes
(Meltzer 2021)	3 years study conducting surveys with 120 students	Student engagement, motivation, higher self-esteem, critical thinking and problem solving, cognitive learning outcomes
(Paulet and Dick 2019)	Quantitative Study, survey from 170 students In Management Decision Making at one institution.	Effectively describe and analyse problems, Integrating internal and external business analysis, Generating alternatives
(Scholtz and Hughes 2019)	Full year long case study on two groups of BBA students. One using ERP simulation game and other Practice Enterprise Model to assess the learning outcomes for both models	Integration between systems, Business processes understanding, Teamwork, Cognitive, effective and psychomotor learning
(Nisula and Pekkola 2019)	Full year long case study on 117 first year business students who were taught ERP system by practice Enterprise Model (ERPsim). The study focussed on the assessment of the learning results pre and post-game.	Learning outcomes in the three domains of Bloom Taxonomy Cognitive outcomes: Effective Domain: Business process understanding, teamwork, motivation Psychomotor domain: Efficiency, accuracy, and response magnitude
(Gatti et al. 2019)	A case study on two universities in Switzerland using a before and after quasi-experimental design	successfully generate cognitive (knowledge and understanding) and affective learning outcomes (values, attitudes, and behavioral intentions)
(Dick et al. 2019)	Empirical study using only quantitative study design	Improve managerial decision making skills and student satisfaction

Table 1. Summary of literature on learning outcomes of simulation games

Motivation of the study

Despite the substantial progress made in recent years in the research of simulation-based learning, certain critical gaps remain. To begin with, most simulation studies focused solely on their effects on learning outcomes (Table 1), but they failed to explain how these learning outcomes can be translated to work-readiness (Faisal et al. 2021b). Secondly, less attention has been devoted to finding out the instructors' perceptions of the effectiveness of simulation. Most of the studies on simulations focused on students' viewpoints and failed to take into account an integral part of the instructor in the learning process (Alutu

2006). Thirdly, there is a lack of empirical evidence concerning the use of simulation to prepare students for future employments in IS sector. Most of the research is in medical or business field. Dynamics of IS sectors are totally different and need to be explored. Finally, research on the impact of simulation on the employability of IS graduates in the Australian educational setting is still non-existent. Considering these limitations, our study's primary goal is to examine the efficacy of simulation in preparing students for future work in the information technology industry. The following sections detail the research methods used to accomplish the study's goals.

Methodology

A critical component of increasing the job readiness of information systems students is exposing them to industry-relevant software and providing them with actual experience of using these software applications (Gatti et al. 2019). Enterprise Resource Planning (ERP) is one of these software solutions that automates several business operations in a single database, resulting in increased organisational efficiency, error-free transactions, and time savings. It is stated that familiarity with this program improves students' employability (Chauhan and Jaiswal 2016). Traditionally, ERP systems are taught using conventional learning methods (lectures and lab tutorials) in most universities and institutes. The traditional pedagogical methods of teaching ERP solutions focus more on specialised skills and knowledge in different functional areas, but they don't prepare students for critical decision making or self-analysis.. Previous studies on ERP integration into business and IT curricula also show that traditional pedagogical methods have many shortcomings, especially in terms of learning outcomes and engagement as well as their industry readiness (Léger et al. 2013). To cover the shortcomings of traditional teaching methods, many researchers and facilitators in enterprise system education emphasised on the need to introduce additional and more advanced pedagogical practices that can enrich students' learning experiences (Letourneau et al. 2017). One of these practices is the use of ERPsim game to teach ERP concepts to IT students (Goi 2018). Undergraduate and graduate students often enter the classroom with little business or professional experience. Without such experience, some of the concepts introduced in the classroom, especially in the field of management education, are difficult to comprehend. The ERP simulation game enables students to strengthen their comprehension and obtain actual practical experience with information-based decision making (Dick et al. 2018). This approach is based on learning by doing or experiential learning method. In the ERPsim game, learners operate fictitious virtual companies by making business decisions and managing day-to-day company's operations. The strength of this game is its close resemblance to the decision-making process required in an actual organisation running on an ERP system (Seethamraju 2011). In the ERPsim game, students have to directly interact with ERP software (SAP HANA). This game provides students with an authentic experiential learning environment where they can observe the consequences of their business decisions and then learn from their mistakes (Utesch et al. 2016).

Study design and sample

This qualitative study was a part of a larger project investigating the effects of the ERPsim game on IS students' work-readiness. The project collected data from three significant stakeholders in the education process: recruiters, instructors, and students. This study covered the project's second stage, where instructors' perceptions of using ERPsim in Australian universities were explored. In the absence of empirical research on the impact of simulations on IS students' preparation for the workplace, qualitative research was an excellent option for addressing the study topic. We used semi-structured interviews because they allow us to get deep insights, identify and comprehend points of view, make clarifications, and gather supplementary information with greater flexibility. The following predetermined qualifying criteria were used to narrow down the pool of potential participants for this research: (1) The instructors must be currently conducting or have previously conducted ERPsim games labs in an Australian HEI, and (2) they must have at least one year of experience conducting the labs. Participants were approached via the researchers' professional network. There are around thirty instructors running ERPsim games labs in different HRIs in Australia. Out of those instructors, twelve accepted the interview invites with experience running ERPS labs ranging from one to four years. Subsequent interviews were also done with the instructors to get additional insights. In total, fifteen interviews were conducted. Interviews were done until data saturation occurred, at which point no new insights emerged from the interviews. Interviews were conducted online during February and March 2021 and took between 30 and 70 minutes. Interviews were

audio recorded and then verbatim transcribed with the participants' permission. The guiding questions prompting discussion on this topic were:

- Have you observed any positive behavioural changes in students while playing simulations?
- Do simulations improve conceptual and factual knowledge of the subjects taught?
- What types of skills can simulation games develop or enhance in IT graduates?
- In your view, can IS graduates benefit from experiential learning methods to prepare them for the industry?

Data analysis

We followed Strauss and Corbin's (Strauss and Corbin 1998) recommendations for interview data analysis using the QSR NVivo program. Multiple cycles of data analysis were completed to get results that were both relevant and valid. The most prominent ideas and concepts were grouped into codes. The relational thematic analysis was also done manually by the researchers. Relational analysis extends conceptual analysis by investigating the links between ideas. The goal of relational analysis is to discover meaningful or semantic connections.

Results

The final categories and themes from the analysis are presented in Figure 1. Each of the broad categories and the themes within each category are described below. These themes represent the ERPsim game's learning outcomes reported by instructors during the interviews. The three main categories of learning outcomes emerged from the results: skills, knowledge, and attitudes.

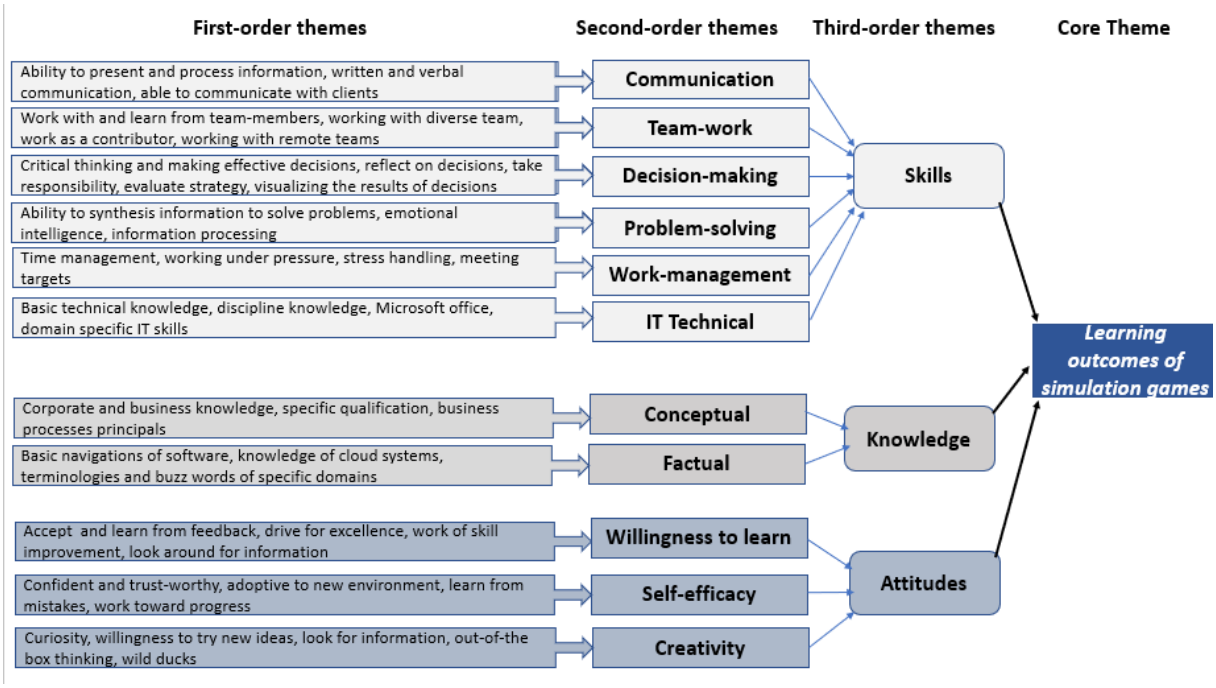

Figure 1 ERPsim learning outcomes according to instructors

Individual quotes from the data are used to illustrate the three main categories of learning outcomes of simulation games. The instructors were asked what generic and specific skills students gained by playing simulation games. Most of the instructors agreed with the positive effects of simulation on the teamwork skills

> *I think one of the biggest skills that it has developed is the team skill. Most of the students were randomly put into groups. And that made a big difference because they don't know who they're going to work which is exactly like the actual workplace.*

> *They're interacting with people from different backgrounds, and they must get along with them.*

Communication skills are the second most discussed skill by the instructors. According to the instructors, the students not only learn to communicate with each other, but they also learn to listen to and then act on the instructions, which is a part of effective communication.

> *As the students have to take up different roles from different departments within a company, they have to effectively communicate with each other. The person running the logistics has to communicate the information on timely manner to purchase department. Similarly, if a student is playing a sales manager role, the information processing and communication is vital for them. So, the game teaches them to communicate effectively.*

The researcher classified knowledge into two subcategories based on the findings: conceptual and factual knowledge. Conceptual knowledge refers to a grasp of a domain's fundamental principles, while factual knowledge refers to the fundamental parts that students must comprehend to solve issues and accomplish tasks. The qualitative feedback was positive in this area, since it is probable that the simulation supports greater knowledge and comprehension of the subject matter. Instructors commented:

> *If a student has better understanding of the business process and able to explain better in the interview, which of course is increased confidence compared to those who haven't done this course. The games teach them how actual corporations work, how is the integration between different departments take place which can give them an edge over a student who haven't practically experience this.*

Instructors were asked about their perceptions regarding the positive effects of playing simulations on students' attitudes. Instructors were aware of the impact of confidence in potentially performing better during the job interviews. They suggested that the active hand-on experience of running a software through simulation gives an edge to students to confidently answer the questions during job-interviews.

> *What is required in the job interviews is confidence. If there is an interview for logistics job and students are quite confident about how a logistics management is done using SAP RP system. they would be very confident going to an interview to explain what the business process and logistics are and how it is done in SAP system.*

According to instructors, simulations games simulate creativity as they encourage students to use innovative ways to win the game.

> *ERPsim simulates creativity as students have to reflect on their decision after every round and think of ways to overcome their poor performance and beat the other teams. They have to sometime think out of the box. The game provides them environment where they can take control of their actions and face the consequences*

Findings and Discussion

The purpose of this study was to explore instructors' perceptions about the use of simulation games to enhance the work-readiness of IS students. Our findings demonstrate the unique benefits of simulation games for teaching certain skills and traits. The qualitative data identifies three main learning outcomes' categories: skills, knowledge, and attitudes, and thirteen sub-categories (Figure 1).

According to instructors, the dynamic and cross-functional nature of the simulations used in this research engendered interdependence and promoted frequent and meaningful contact between team members. This encourages students to examine and learn from the viewpoints of their teammates, thereby fostering the development of an interconnected learning community rooted in practise. In a qualitative study, Drake et

al. (2006) collected data from students and instructors to evaluate the effect of a simulation on group dynamics and teamwork. The findings indicated that simulations not only foster teamwork capabilities but also a variety of foundational abilities simultaneously: communication skills, analytical abilities, decision-making abilities, and strategic thinking.

Instructors noted that the simulations' authentic nature, which replicated a variety of management and operational choices made in real-world firms, also gave the opportunities to gain or enhance understanding of business processes. A study by Seethamraju (2011) also found that simulations contribute to deep learning, resulting in a significant improvement in students' enterprise integration and business process knowledge.

According to instructors, students acquire self-regulation skills throughout the simulation game, such as the capacity to make and appraise choices, create objectives, and continue in action despite challenges. Self-efficacy enhanced their determination to act in the face of uncertainty, chaos, and unpredictability and resulted in desired outcomes. Numerous research on simulation games has shown a favourable influence on students' self-efficacy, resulting in increased confidence and a desire to master new skills (Dumblekar and Dhar 2020)

To demonstrate the positive effect of simulations on the work-readiness competencies of students (Figure 2), we mapped the learning outcomes extracted from these interviews with the work-readiness integrated competencies model (WRICM) presented by (Prikshat et al. 2019a). This model encompasses four primary elements of work-ready skills: intellectual, personality, meta-skill, and job-specific. This model has been used in many studies to assess the work-readiness of graduates (Clark 2013; Hossain et al. 2020; Prikshat et al. 2019b). The mapping showed that the learning outcomes achieved from simulation games are similar to the attributes highly regarded by the industry.

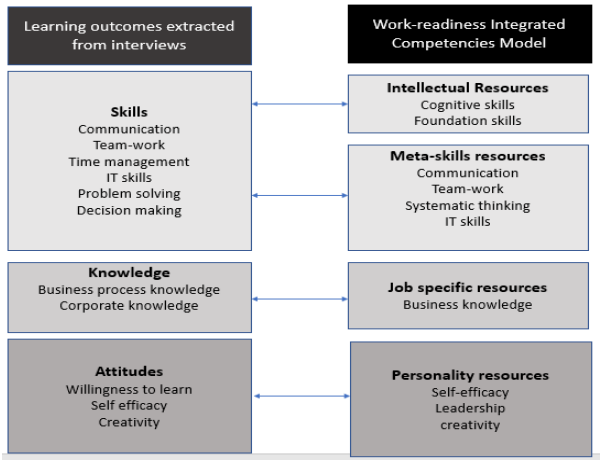

Figure 2. Mapping of study results with Work-readiness Integrated Competencies Model (Prikshat et al. 2019a)

In general, instructors' responses revealed that simulation had a beneficial influence on many characteristics associated with work-readiness.

Conclusion

Computer simulation games have increasingly been used in HEI in the recent years. However, empirical research analysing the impact of this phenomenon on IS students' work-readiness is scarce. To bridge this gap, researchers conducted semi-structured interviews with instructors exploring their perceptions of the effects of simulations on the work-readiness of IS students. The selected sample is using a simulation game, called ERPsim, to teach ERP concepts to students in different Australian universities. The results of the data analysis demonstrate the benefits of using this game on the work-readiness of students. The main learning outcomes include strong teamwork; communication and analytical skills; willingness to learn; confidence; increase in factual and theoretical knowledge of ERP systems; time management; problem

solving. The mapping of these outcomes with the Work Readiness Integrated Competency Model (Prikshat et al. 2019a) demonstrated the game's effectiveness in preparing students for future employment.

Theoretical and practical implications

Two significant theoretical contributions are made in this paper. While past research on game-based learning has shown that it improves learning outcomes (Subhash and Cudney 2018), few studies have examined work-readiness in the context of simulation games. Therefore, this study contributes to the body of knowledge by mapping learning outcomes of simulation games to the Work Readiness Integrated Competency Model. (Prikshat et al. 2019a) to propose a framework for instructors to focus more on the attributes required by the industry. In particular, this study overcomes the limitations of earlier research by exploring the learning outcomes related to the positive attitude changes in students. Second, past research analysing learning outcomes has mostly relied on quantitative data. Thus, this study adds to the literature by examining instructors' perceptions using a qualitative research approach that yielded rich insights, identified and understood opposing opinions, clarified points of view, and gathered supplemental material.

Additionally, this research makes practical recommendations for developing learning activities that use business simulation games in a way that would place more emphasis on the learning outcomes, which can enhance work-readiness in students. Our findings have shown that, although all of the participants confirm the benefits of using the games on the learning outcomes, the labs are designed to focus more on teaching skills rather than positive attitudes. Therefore, considering that positive attitudes like self-efficacy, willingness to learn, and creativity are the most sought-after attributes by employers (insert citation), it would be worthwhile to design the activities to simulate students' learning and practicing these attributes. In addition, this study has demonstrated the potential benefits of using these games to make students more work-ready if the labs are designed to focus more on the desirable attributes of the industry. One approach to doing this is to design the game in such a manner that provides students with pertinent information, such as the expected outcomes, so that they can progressively reorient their strategies to focus on developing positive attitudes, as they are often ignored by students in pursuit of winning the competition from other teams.

Limitations and future research

The study's limitations suggest future research areas. Firstly, the study's conclusions are solely based on instructors' perceptions of the learning outcomes. Although Instructors are an essential part of learning process, it's crucial to remember that there are other essential stakeholders in work-readiness process, including current students, and industry (Borg et al. 2019). Secondly, this study describes work-readiness in terms of students' skills, attributes and knowledge. Although these factors have been used in the previous literature, they are not the only factors that can affect the work-readiness. The extrinsic factors can affect the learning process and need to be considered. It would be interesting for future studies to use these factors too. A second limitation is the use of instructors' perceptions as learning outcomes assessment which can lead to biasness. Therefore, another route for future study may be to include other measures of learning performance, such as application exams, memory retention, or transfer learning, in order to further investigate the effect of simulation games on work-readiness. Finally, the limited demographic context of this study presents another limitation as the selected instructors are conducting labs in a single, developed nation. However, the mapping of the learning outcomes with the work-readiness integrated competency model provides a basis for other scholars to generalise the findings. To further improve the generalizability of the findings, more research in different geographical regions is recommended.

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