# Development of Metacognitive Strategies Framework through Education 4.0 for Graduate Employability and Learning Sustainability

**Nur Sakinah Ahmad Nasaruddin[1] , Mohd. Shukri Nordin[1*],**
**Muhammad Sabri Sahrir[2] & Afiza Mohamad Ali[3]**

*[1]Department of Curriculum and Instruction,*
*Kulliyyah of Education, International Islamic University Malaysia,*
*Kuala Lumpur, Malaysia*
*[2]Department of Language and Literacy,*
*Kulliyyah of Education, International Islamic University Malaysia,*
*Kuala Lumpur, Malaysia*
*[3]Department Of English Language,*
*Kulliyyah Of Sustainable Tourism and Contemporary Languages,*
*International Islamic University Malaysia,*
*Muar, Malaysia*

*\*Corresponding Author: nmshukri@iium.edu.my*

## Abstract

The main goal of entering higher education institutions (HEI) is employability. In response to the 4th Industrial Revolution (IR), Education 4.0 enables new potentials and promises through technology. Despite the benefits of Education 4.0 stated, there are challenges present in the system. The objectives of this study were to identify the metacognitive strategies and how Education 4.0 enhance learning sustainability and graduate employability. The next objective was to examine the effectiveness of the metacognitive strategies framework on sustainable learning and employability through Education 4.0. Mixed methods were used in data collection using exploratory sequential design. Semi-structured interviews were conducted with participants from three categories of university alumni, lecturers, and experts from the industries. From the findings of the interviews, an instrument was developed and distributed to experts in higher education and new employee hiring. Two rounds of the Fuzzy Delphi Method (FDM) were conducted to analyse the data from the quantitative method. There are seven metacognitive strategies that enhance graduate employability and learning sustainability which are showcase self, self-improvement, exposure, self-study and study group, career development and training, reflection of learning, and teaching approaches. Three themes were identified in response to how Education 4.0 enhances learners' learning sustainability and employability which are Purpose, Advantages, and Disadvantages. A framework was then developed, integrating both metacognitive strategies and Education 4.0. This framework could assist graduates in equipping themselves with the skillsets needed to become more visible to employers and increase their employability and learning sustainability in the future.

# INTRODUCTION

Upon graduation, graduates will face an important phase of their career; the main goal of entering higher education institutions in the first place is employability. Remarkable degrees and results are inadequate to guarantee one's employability (Abd Majid et al., 2020). Besides certifications and practical skills, graduates are expected to possess soft skills to be more visible to their potential employers (Ang, 2015). The mentioned skills are mostly enhanced during students' involvement outside of the classroom such as extra-curricular programmes and collaborations with the industries (Ma'dan et al., 2020). Some of the soft skills highlighted are teamwork, communication, critical thinking and problem-solving (Ang, 2015; Mohd Tahir et al., 2018; Nadarajah, 2021; O'Leary, 2016; Tran, 2019). The mentioned skills make up the skill sets advised by the Ministry of Education for graduates to learn and practice (Ministry of Higher Education, 2018, p. 110). These skill sets are also parallel with graduate attributes outlined in Malaysia Education Blueprint 2015-2025 (Ministry of Education, 2015, pp. 14-15).

Besides producing graduates with future-proof skill sets, Education 4.0 benefits 21st-century instructors by equipping themselves with digital skills and fulfilling the needs of learners from different generations (Lawrence et al., 2019).

## Issues related to the Pandemic

During the first stage of COVID-19, there was a worldwide quarantine whereby face-to-face interaction was not permitted (Darma et al., 2020). All industries had to either pause operations or operate completely online which also includes the education system in Malaysia. Home-based learning and teaching (PdPR) was first introduced in March 2020. Nambiar (2021) reported that when PdPR was introduced, everything was 100 percent online. This created issues for the parents in managing their children and for teachers especially in terms of access to gadgets and Internet connection as not all families are privileged enough to provide adequate online learning (Nambiar, 2021).

Excessive access to technology is devoid of human touch which in return, deeply impacts students' mental health and acceptance to learn online (Mat Nor et al., 2021). Teachers reported less participation from the students during online learning compared to face-to-face lessons done before COVID-19 (Mahalingam & Jamaludin, 2021). 40 percent of Malaysian students have experienced learning loss for not being able to join PdPR and in Kuala Terengganu alone, more than 7000 students faced this issue (Amar-Singh et al., 2022; Zolkiply & Bakar, 2021).

## Issues related to Employability

The COVID-19 pandemic also affected graduate employability. Due to several Movement Control Orders (MCO) in Malaysia, the unemployment rate in 2020 increased by 4.4% compared to 2019 (Mahidin, 2021). Fortunately, the percentage decreased to 4.1% in 2021 after business operations slowly returned to normal in the endemic phase (Department of Statistics Malaysia, 2022). There are many factors behind this phenomenon and learners' visibility is one of them (Jones, 2013). Learners' visibility to the stakeholders and future employers is crucial in determining learners' employability. To increase learners' visibility, they should start to be independent lifelong learners and sustain their learning (Jones, 2013).

Besides visibility, employers reported another issue among graduates which they lack 21st-century skills such as critical thinking, communication skills and English language proficiency (Ministry of Education, 2015). Mismatch of skills between industries and graduates is also a contributing factor to employability (Ang, 2015). According to Ang (2015), six mismatches of skills

were ranked at 1. Commercial awareness about the business, 2. Self-management, 3. Computer literacy, 4. Information retrieval, 5. Planning, and 6. Resolving conflict. In terms of gender comparison, female graduates are clearer in terms of employers' expectations of graduates' employability skills compared to male graduates.

Another factor affecting employability is the employability gap among graduates and the competencies required in job markets (Nadarajah, 2021). Problem-solving, communication and analytical skills were noted as the top three skills that employers are looking for among graduates. Unfortunately, most graduates still have a lot to learn to improve the skills mentioned (Ang, 2015; Mohd Tahir et al., 2018; Nadarajah, 2021; O'Leary, 2016; Tran, 2019).

Previous studies highlighted the positive effects of metacognitive strategies particularly on graduates' learning sustainability, performance, self-regulation and self-confidence (Abd Latip et al., 2020; Anthonysamy, 2021; Philip, 2018; Yildiz, 2020). Metacognitive strategies are crucial in addressing the issues mentioned earlier as graduates are expected to have critical thinking and problem-solving skills upon entering the workforce. These skills could be nurtured through metacognitive strategies (Abd Latip et al., 2020; Anthonysamy, 2021; Philip, 2018; Yildiz, 2020). Therefore, this study intended to develop a metacognitive strategies framework through the use of Education 4.0 tools in enhancing learners' employability to address the problems stated earlier.

## OBJECTIVE OF THE STUDY

The three objectives of the study are:

1) to investigate the required metacognitive strategies in enhancing learners' learning sustainability and employability through Education 4.0.

2) to propose a metacognitive strategies framework for sustainable learning towards employability through Education 4.0, and

3) to examine the effectiveness of the metacognitive framework for sustainable learning towards employability through Education 4.0.

## LITERATURE REVIEW

### Education 4.0

The concept of the 4th industrial revolution, as coined by Klaus Schwab, signifies a society where interconnected technologies such as the Internet of Things (IoT), cloud computing, and big data redefine daily life, transitioning seamlessly between online and offline worlds (Xu et al., 2018). Education 4.0 is a response to this paradigm shift which leverages technology to unlock new potential in learning (Aziz Hussin, 2018), defined by Joshi (2022) as an approach aligned with the fourth industrial revolution, Education 4.0 aims to revolutionise education through advanced technology and automation. Fisk (2017) lists the key elements of Education 4.0, emphasising learner-centredness, ubiquitous learning access, and the role of educators as facilitators rather than instructors.

Fisk's (2017) nine key trends associated with Education 4.0 include the accessibility of learning anytime, anywhere through online and self-paced learning platforms, the adoption of flipped classrooms to enhance interactive learning experiences, and tailored instruction that progresses from basic to advanced stages based on each learner's needs. Learners are empowered with freedom of choice in their learning preferences, while project-based learning replaces traditional exam-oriented goals to foster practical skills that are essential for employability (Fisk, 2017). Furthermore, learners engage in hands-on experiences through internships and projects, acquire data analytical skills, and undergo new assessment methods that emphasise applied knowledge and collaborative curriculum design (Fisk, 2017). Instructors transition into facilitators, guiding learners in their self-directed and lifelong learning journeys. These changes highlight how the role of teachers is changing over time, emphasising the need to accept and adapt to the evolving educational environment (Aziz Hussin, 2018; Fisk, 2017).

## Advantages of Education 4.0

Education 4.0 offers numerous benefits to stakeholders in the educational ecosystem. Choi et al. (2020) and Kunnari et al., (2021) emphasise how improved communication facilitated by tools such as visual thinking strategies (VTS) and online platforms could enhance student engagement and collaboration. Additionally, Education 4.0 promotes learner-centeredness, empowering students through active participation and self-directed study. Skills development and employability are further enhanced as students engage with digital tools, fostering essential technological and critical thinking skills needed for employability (Kunnari et al., 2021; Porubčinová et al., 2020). Furthermore, Education 4.0 transforms assessment methods, promotes collaboration among educators, as well as facilitates cost-effective industry-institution partnerships and provides valuable real-world learning experiences for students Overall, Education 4.0 revolutionises the educational landscape by promoting learner-centred learning, fostering skills development, and facilitating collaboration between academia and industry (Choi et al., 2020; Kunnari et al., 2021; Porubčinová et al., 2020; Vilalta-Perdomo et al., 2022).

## Challenges in Employability

Graduates face complex challenges in securing employment, including lacking essential skills, skill gaps between educational outcomes and industrial needs, and issues in academia and the workforce. Studies such as Albina and Sumagaysay (2020) and Aloui and Shams Eldin (2020) reveal the lack of skills in critical thinking, problem-solving, and digital skills among graduates in the Philippines and Saudi Arabia, while Chan et al. (2021) identify shortcomings in communication, leadership, and interpersonal skills among graduates in Hong Kong. This misalignment between acquired skills and what the employers demand increases the difficulty of securing employment (Graham, 2017; Pheko & Molefhe, 2017).

Moreover, graduates struggle to link their past experiences to future job prospects, as observed by Gilbert et al. (2022). Gender and disability barriers are other factors that complicate graduate employability, with women and individuals with disabilities facing additional hurdles in accessing job opportunities (Moriña & Biagiotti, 2022; Ritchie et al., 2022). Outdated curricula in higher education contribute to the skill mismatch and this hinders graduates' readiness for the job market. These challenges have also been highlighted in the contexts of India and South Africa by Bhatt and Smita (2021) and Chigbu and Nekhwevha (2022) respectively, by drawing attention to traditional teaching methods that fail to equip students with the practical and soft skills valued by employers.

Additionally, poor management practices in educational institutions and industries increase the employability challenge, with factors such as overwork among educators and inadequate communication between institutions and industries (Bhatt & Smita, 2021; Moriña & Biagiotti, 2022). Furthermore, the absence of cohesive government policies tailored to address employability issues has worsened the situation, with discrepancies between government objectives and employer expectations obstructing the efforts made to enhance graduate employability (Cheng et al., 2022; Manan et al., 2021; Pheko & Molefhe, 2017).

## Application of Metacognitive Strategies

Metacognitive strategies play a crucial role in enhancing learning outcomes, encompassing three main stages: planning, monitoring, and evaluating. During the planning stage, educators and students engage in pre-learning preparations. As highlighted by Ali and Yasmeen (2019), teachers invest time in creating concept maps or outlines before lessons, aligning objectives with students' abilities. Similarly, Cer (2019) observed that before writing tasks, students plan their compositions by focusing on the ideas they wish to convey. Moreover, in reading comprehension, learners are encouraged to select suitable metacognitive strategies tailored to their needs (Çakici, 2017; Khellab et al., 2022). Additionally, studies such as those of Cervin-Ellqvist et al. (2021) and Ghasemi et al. (2019) show how students utilise metacognitive planning to set goals and develop action plans for learning activities, such as during vocabulary acquisition and problem-based learning tasks.

The monitoring stage involves ongoing assessment and adjustments to ensure effective learning. As noted by Ali and Yasmeen (2019), teachers monitor students' progress, offer feedback, and maintain awareness of deadlines. Similarly, in writing tasks, as observed by Cer (2019), students engage in self-assessment to identify errors and necessary improvements. In reading, learners utilise problem-solving and support strategies to adjust reading speed, predict meanings, and enhance comprehension (Çakici, 2017; Khellab et al., 2022). Furthermore, Cervin-Ellqvist et al. (2021) highlight how students practice problem-solving to assess their understanding of key concepts, reflecting the monitoring aspect of metacognitive strategies. In problem-based learning, monitoring entails reasoning within the context to ensure tasks are meaningful and this promotes active participation among learners (Rivas et al., 2022).

Finally, the evaluating stage involves reflection and self-assessment to strengthen learning. Drawing from Ali and Yasmeen (2019), teachers evaluate previous lessons to identify areas for improvement. In writing tasks, students evaluate their writing quality, provide feedback to peers, and revise accordingly (Cer, 2019). Similarly, in reading activities, learners engage in inner monologues to evaluate the effectiveness of strategies and discuss reflective thoughts with peers and instructors (Çakici, 2017; Khellab et al., 2022). Similarly, Cervin-Ellqvist et al. (2021) demonstrate how students summarise and reflect on practice problems to consolidate learning. In problem-based learning, self-evaluation and peer feedback are necessary to identify mistakes, discuss improvements, and facilitate learning growth (Heuzeroth & Budke, 2021; Lobczowski et al., 2021; Rivas et al., 2022).

## Challenges in Sustainable Learning

There are several identified challenges in achieving sustainable learning, including mental health barriers, time constraints, communication barriers, and technological limitations. Mental health is a significant concern, particularly during the COVID-19 pandemic when remote learning exacerbated the feeling of isolation and affected students' motivation (Chaves, 2021; Gu et al., 2022). Quarantines and online classes contributed to increased mental pressure, necessitating counselling services to cope with anxiety and stress (Jaradat & Ajlouni, 2021).

Time management poses another obstacle to sustainable learning, with many students struggling to balance academic commitments with other responsibilities. Poor time management skills hinder their ability to adhere to online class schedules and assignment deadlines (Jaradat & Ajlouni, 2021; Dwi et al., 2020). Additionally, some postgraduate students face challenges juggling work and studies, leading to difficulties in participating effectively in virtual learning environments (Sarvestani et al., 2019).

Communication barriers can affect learning sustainability, as students encounter difficulties communicating with professors and peers in online settings. Unclear instructions and lack of support from instructors lead to increased time spent completing tasks and hinder effective peer collaboration (Almossa, 2021; Xia et al., 2022). Moreover, technological barriers, such as poor internet connection and inadequate devices, impede their access to online resources and impact their ability to communicate effectively (Dwi et al., 2020; Sarvestani et al., 2019). Limited exposure to technological skills can also impact learning sustainability, as students struggle with basic tasks such as downloading software and sharing files (Xia et al., 2022; Mhandu et al., 2021).

Among the reviewed literature, most studies were focused on graduate employability and sustainable learning, with the majority of them regarding the two as separate research fields (Albina & Sumagaysay, 2020; Ali & Yasmeen, 2019; Heuzeroth & Budke, 2021; Pheko & Molefhe, 2017; Rivas et al., 2022; Xia et al., 2022). However, there is a lack of studies conducted on developing a metacognitive strategies framework for sustainable learning in enhancing graduate employability through Education 4.0 among Malaysian higher education learners. Therefore, this study was conducted to fill that gap.

## METHODOLOGY

### Research Design

The study utilised an exploratory sequential design to explore and gather data comprehensively before administering instruments (Creswell & Clark, 2018). Qualitative interviews preceded quantitative questionnaire development, with two rounds of the Fuzzy Delphi Method used to analyse the data from 42 experts to develop the metacognitive strategies framework.

### Phase 1: Analysis

A systematic literature review (SLR) was conducted to examine learners' problems in developing metacognitive strategies for sustainable learning toward employability and provide a background for researchers to plan new research activities (Kitchenham & Charters, 2007, p. 3). Based on the SLR and the research questions, an interview protocol was developed and used during the interviews with the participants in Phase 2. Across the three respondent categories, several questions were similar while other questions were worded differently based on each category. The third research question was not included as it was intended to be answered through the quantitative method in this study.

**Table 1**

*Interview Protocol*

| Respondent Category | University Alumni | Lecturers | Industrial Experts |
|---|---|---|---|
| **Research Question** | **Interview Questions** | | |
| 1. What are the required metacognitive strategies to enhance learners' employability and learning sustainability through Education 4.0 from the perspective of experts, lecturers and alumni? | 1. How do you feel that your Bachelor's degree has prepared you for employment?<br>2. What can be done by the university and lecturers for better learning sustainability and employment?<br>3. What do you think are some of the attributes and competencies that employers consider important among graduates?<br>4. Out of the attributes mentioned earlier, rank them from the most to the least important for employability and learning sustainability. Why do you arrange it in that order?<br>5. Why do you think these attributes are important for employability and learning sustainability? Kindly elaborate.<br>6. What are the strategies that you think graduates should develop and practice earlier during academic years to increase employability and learning sustainability?<br>7. What have you learnt in the industry currently that you wished you had learnt earlier during university?<br>8. To what extent does your degree help you in the current industry? If not, how do you upskill yourself to match the industry's expectations?<br>9. Do you have a lecturer in mind who taught you something really valuable, that impacted your employability? What was the knowledge taught that you wish this knowledge should be taught in universities so everyone will be highly employable? | 1. How do you feel that the degree has prepared your graduated students for employment?<br>2. How well are you preparing your students for the job market? What else could be done to enhance the chances of being employed?<br>3. What skills have your students gained during their degree that make them attractive to employers in their field?<br>4. What do you think are some of the attributes and competencies that employers consider important among your graduates?<br>5. Out of the attributes mentioned earlier, rank them from the most to the least important for employability and learning sustainability. Why do you arrange it in that order?<br>6. Why do you think these attributes are important for employability and learning sustainability? Kindly elaborate.<br>7. What are the strategies that you think graduates should practice to enhance the attributes mentioned, particularly through Education 4.0?<br>8. What are the skills that you are teaching your students to help them learn better?<br>9. Throughout the years you've been teaching, have you ever predicted students who will stand out and will be highly employable in the future? What made you predict that? Do they showcase skills or evidence that made you predict this? How are they now in their career? | 1. How do you decide whether a graduate is employable or not? Could you share your hiring process for new employees?<br>2. What do you think are some of the attributes and competencies that you consider important among graduates?<br>3. Out of the attributes mentioned earlier, rank them from the most to the least important for employability and learning sustainability. Why do you arrange it in that order?<br>4. Why do you think these attributes are important for employability and learning sustainability? Kindly elaborate.<br>5. Out of the candidates that you have interviewed, what did they showcase that made them stand out from the rest? Can you share an example of skills or evidence?<br>6. Did the graduates use Education 4.0 tools like e-portfolio, video resume, e-certificates, etc.? Did the tools help them with employability?<br>7. What are the strategies that you think graduates should practice to enhance the attributes mentioned, particularly through Education 4.0?<br>8. For employment opportunities, does it matter which university the graduates are from and why?<br>9. What are the skillsets that you want to see in graduates' e-portfolio? |

**Table 1**

*Interview Protocol*

*(continued)*

| Respondent Category | University Alumni | Lecturers | Industrial Experts |
|---|---|---|---|
| **Research Question** | **Interview Questions** | | |
| 2. How does Education 4.0 enhance learners' learning sustainability and employability from the perspective of experts, lecturers and alumni? | 1. What skills have you gained during your degree that makes you attractive to employers in your field? <br> 2. How do you package yourself that influences employer(s) to hire you? <br> 3. What are some Education 4.0 tools that you are using for graduate employability and learning sustainability? <br> 4. How are the Education 4.0 tools above being used for graduate employability and learning sustainability? <br> 5. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for graduate employability? <br> 6. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for learning sustainability? <br> 7. When you were in university, were you taught how to document skillsets and reflect learning (i.e. using Education 4.0 tools like e-portfolio or video resume)? How did these help you in employability and learning sustainability? | 1. Which Education 4.0 tools that your students are using for graduate employability and learning sustainability? <br> 2. How are the Education 4.0 tools above being used for graduate employability and learning sustainability? <br> 3. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for graduate employability? <br> 4. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for learning sustainability? <br> 5. Do you teach your students to document skillsets and reflect learning (i.e. using Education 4.0 tools like e-portfolio or video resume)? How did these help you in teaching your students about their employability and learning sustainability? | 1. How well did the university prepare graduates for the job market? What else could be done to enhance their chances of being employed? <br> 2. Which Education 4.0 tools that graduates are using for employability and learning sustainability? <br> 3. How are the Education 4.0 tools above being used for graduate employability and learning sustainability? <br> 4. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for graduate employability? <br> 5. What are the advantages and disadvantages of each Education 4.0 tool stated earlier for learning sustainability? <br> 6. Were the graduates taught how to document skillsets and reflect learning (i.e. using Education 4.0 tools like e-portfolio or video resume)? How did these help the industry? |

## Phase 2: Development and distribution

## Selection of Participants

Crouch and McKenzie (2006) suggest that interview-based data collection with fewer than 20 participants yield better data quality due to enhanced rapport-building. Thus, nine informants were selected for the semi-structured interviews in this study. There were three categories of informant which were industrial experts, lecturers, and university alumni.

**Table 2**

*Criteria of Participants for Phase 2 according to Category*

| Participant Category | Criteria |
|---|---|
| Industrial Experts | Three experts in industries who have been involved in the new employee hiring process |
| Lecturers | Three lecturers from public higher learning institutions in Malaysia |
| Alumni | Three alumni who graduated from a public higher learning institution in Malaysia |

**Demographic Information**

The table below shows the demographic information of the informants interviewed:

**Table 3**

*Demographic Information of Informants*

| Informant Category | Informant | Gender | Industrial sector | Job experience (years) | Education level | Education background | Current role in the industry |
|---|---|---|---|---|---|---|---|
| Industrial experts | 1 | Female | Construction | 35 | Bachelor | Architecture | Project Architect |
| | 2 | Male | Oil and gas | 11 | Diploma | OSH | OSH Officer |
| | 3 | Male | Manufacturing | 14 | Master | OSH | OSH Auditor |
| Lecturers | 4 | Male | Education | 24 | PhD | English Language and Literature Education | Assistant professor |
| | 5 | Male | Education | 5 | PhD | Physics Education | Assistant professor |
| | 6 | Female | Construction | 20 | PhD | Civil Engineering | Associate professor |
| Alumni | 7 | Female | Finance | 8 | Bachelor | English Language and Literature | Life planner |
| | 8 | Female | Education | 2 | Bachelor | English Language and Literature | Junior Lecturer |
| | 9 | Male | Finance | 9 | Bachelor | Manufacturing Engineering | Tax officer |

**Interview Procedure**

The interview procedure involved face-to-face interviews and online interviews for some participants who were unavailable for a physical meeting. The participants were given a choice to answer in English language or their mother tongue to ensure comfort and natural conversation (Hoyos & Barnes, 2012). Lead-in questions were used to establish rapport, and participants were assured of anonymity and encouraged to provide honest responses. Interviews were conducted in a relaxed manner to facilitate open communication, enhancing data quality. The participants gave their oral consent for the interviews to be recorded and analysed later.

**Data Analysis Procedure**

The interview data was analysed following the procedure by Hoyos and Barnes (2012) which includes transcription, coding, and thematic analysis. Transcripts were generated using Buzz, a transcribing app and manually checked for accuracy. This was then followed by coding using ATLAS.ti. Thematic analysis identified emerging themes and sub-themes, which will be further explored and explained in the findings section.

**Inter-rater reliability**

Inter-rater reliability (IRR) was used to ensure consistency in the coding process, minimizing bias and maintaining open communication among researchers (McAlister et al., 2017). A high level of agreement among coders, typically 80% or higher, was sought to validate the coding process and ensure the reliability of the findings. For this study, two experts in Instructional Technology were engaged as coders, resulting in a total IRR percentage of 78.55%.

**Phase 3: Validation and refinement**

The validation of the framework was assessed during this phase using the Fuzzy Delphi Method (FDM). FDM was developed by Kaufmann and Gupta (1998) and combines fuzzy set theory and Delphi techniques. It is an instrument that 'improves' the existing Delphi technique (Mohd Ridhuan Jusoh & Nik Mohd Rahimi Nik Yusoff, 2015). This study used FDM to obtain expert consensus on the content items of the metacognitive strategies framework that will be developed based on findings from Phase 2. There were two rounds of FDM. Round 1 was conducted first and Round 2 was conducted after the instrument has been refined.

**Selection of Participants**

To ensure high uniformity in the FDM, a sample of 42 experts was chosen purposively, meeting the criteria of experts which scholars have defined as those who are experienced in the field for more than five years, highly knowledgeable and skilled, have academic qualifications, good record, availability, and willingness to participate voluntarily (Berliner, 2004; Gambatese et al., 2008; Mohd Jamil & Mat Noh, 2020; Swanson & Holton, 2001).

In this study, the experts selected fulfilled the criteria listed above, primarily focusing on participants who are lecturers in Malaysian HEI or those who have experience in new employee hiring as recruiters or interviewers. The table below shows an overview of the demographic information of the 20 experts from the first round of FDM.

**Table 4**

*Demographic information of expert panel from Round 1*

| Demographic data | N = 20 | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 8 | 40% |
| Female | 12 | 60% |
| **Academic Qualification** | | |
| Bachelor's Degree | 7 | 35% |
| Master's Degree | 5 | 25% |
| PhD | 8 | 40% |
| **Years of experience** | | |
| 6 - 10 years | 10 | 50% |
| 11 - 15 years | 2 | 10% |
| 16 - 20 years | 2 | 10% |
| More than 20 years | 6 | 30% |
| **Field of expertise** | | |
| Higher education | 12 | 60% |
| Public HEI | 5 | 42% |
| Private HEI | 7 | 58% |
| New employee hiring | 8 | 40% |
| **Work sector** | | |
| Construction | 2 | 10% |
| Education | 17 | 85% |
| Finance and economic | 1 | 5% |
| **Total** | 20 | 100% |

For the second round of FDM, 22 participants were selected as the expert panel.

**Table 5**

*Demographic information of expert panel from Round 2*

| Demographic data | N = 22 | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 6 | 27% |
| Female | 16 | 73% |
| **Academic Qualification** | | |
| Bachelor's Degree | 8 | 36% |
| Master's Degree | 9 | 41% |
| PhD | 5 | 23% |
| **Years of experience** | | |
| 6 - 10 years | 11 | 50% |
| 11 - 15 years | 4 | 18% |
| 16 - 20 years | 1 | 5% |
| More than 20 years | 6 | 27% |

**Table 5**

*(continued)*

| Demographic data | N = 22 | Percentage |
|---|---|---|
| **Field of expertise** | | |
| Higher education | 12 | 55% |
| Public HEI | 5 | 42% |
| Private HEI | 7 | 58% |
| New employee hiring | 10 | 45% |
| **Work sector** | | |
| Construction | 1 | 5% |
| Education | 17 | 77% |
| Food and beverage | 1 | 5% |
| Hospitality and tourism | 1 | 5% |
| Manufacturing | 2 | 9% |
| **Total** | 22 | 100% |

**Instrument**

The research instrument for this phase was a five-point Likert scale questionnaire that was developed based on the findings from semi-structured interviews done in Phase 2. To implement the FDM, the researchers determined and organised the items through the findings of Phase 2 into a neat and manageable form that was easy for a panel of experts to understand. The collected data was translated into fuzzy numeric data form and analysed using Microsoft Excel.

Based on the result obtained from Round 1 of FDM, the instrument was further refined. Then, Round 2 of FDM was conducted among another panel of experts. The same questionnaire was modified and distributed to obtain their consensus on the content items of the metacognitive strategies framework. The collected data was again translated into Fuzzy numeric data form and analysed using Microsoft Excel.

**Data Analysis Procedure**

After data was collected using the questionnaire, it was analysed through two rounds of the Fuzzy Delphi Method (FDM). FDM consists of two key concepts which are known as Triangular Fuzzy Numbers (TFN) and Defuzzification (Manakandan et al., 2017). In this study, the researchers used Microsoft Excel for data analysis. A Microsoft Excel template developed by Mohamad et al. (2015) was adapted for this study. In the template, the formula for the calculation of Triangular Fuzzy Numbers and Defuzzification were pre-saved. The researchers adapted it by filling in variables such as the number of experts, the number of items for each construct, and each expert's Likert scale score for each item. After the values were entered, TFN and Defuzzification were automatically calculated based on the pre-saved formulas entered into the template. This process was repeated for each construct in the questionnaire. The item in the questionnaire was accepted if the threshold value (d-construct) was ≤ 0.219 and the expert consensus was ≥ 75%. As for the ranking, items were ranked within their respective constructs after conducting the Defuzzification process.

## FINDINGS AND DISCUSSION

**Research Question 1**

*What are the required metacognitive strategies to enhance learners' employability and learning sustainability through Education 4.0 from the perspective of experts, lecturers, and alumni?*

The study aimed to identify metacognitive strategies required to enhance learners' employability and learning sustainability in the context of Education 4.0. Nine participants consisting of experts, lecturers, and alumni were interviewed, revealing seven strategies: showcasing oneself, self-improvement, exposure, self-study and study groups, career development and training, reflection of learning, and teaching approaches. These findings align with Brown's Model of Metacognition, particularly the Regulation of Cognition component, which encompasses planning, monitoring, and evaluating (Brown, 1987; Nordin, 2016)

**Figure 1**

*Brown's (1987) Model of Metacognition (adapted)*
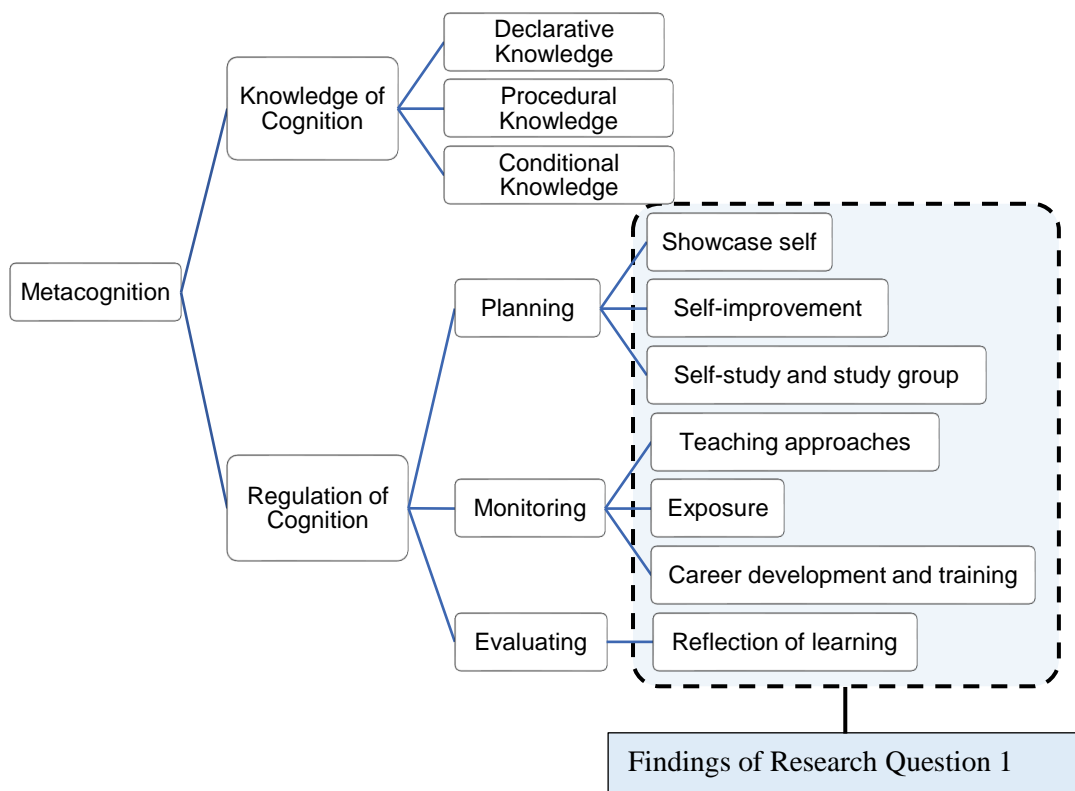


Planning involves decision-making before the learning process (Brown, 1987). This study found that effective resume and e-portfolio building are essential to enhance employability. These support the findings by studies emphasising error-free resumes and the use of tools such as e-RAP (Electronic Resume Analyser Portal) (Green et al., 2020; Shore et al., 2021). Preparation for job interviews and self-presentation skills also contribute significantly to employability, as evidenced by the positive impact of mock interviews and candidates' self-confidence (Anaza et al., 2023; Dimopoulos, 2020). Self-improvement through continuous learning, particularly in time management

and critical thinking skills, is crucial for graduates, which is parallel with previous studies' findings (Bennett et al., 2020; Jin & Ji, 2021).

Monitoring involves tracking performance during the learning process (Brown, 1987). The findings showed that effective teaching approaches and authentic assessments bridge academic and professional practice, enhancing students' academic performance and employability skills. These findings support the findings of Miller and Konstantinou (2022). The current and previous studies' findings revealed that continuous exposure to real-world tasks and engagement with alumni and industries provide valuable experiences and skills essential for employability (Harun et al., 2020; Ismail et al., 2021; Ma'dan et al., 2020; Nanda et al., 2021). In addition, lecturers' guidance and teaching industry-specific skills also play a vital role in preparing students for the workforce, which have also been highlighted in previous studies (Ranaraja et al., 2022; Ma'dan et al., 2020).

Evaluating involves assessing the effectiveness of strategies (Brown, 1987). This study suggested that reflection on learning aids students in identifying areas for improvement, contributing to academic performance and motivation, as discussed by Cavilla (2017). Similarly, it helps lecturers improve future lessons, supporting an earlier study highlighting the positive impact of student feedback on teaching reflection and professional development (Göbel et al., 2021). These findings pointed to the importance of metacognitive strategies in enhancing learners' employability and learning sustainability through Education 4.0.

## Research Question 2

*How does Education 4.0 enhance learners' learning sustainability and employability from the perspective of experts, lecturers, and alumni?*

Notably, this study identified the efficacy of tools such as e-portfolios and video resumes in showcasing graduates' strengths, reflecting Gutiérrez-Santiuste et al.'s (2022) observation of how e-portfolios are instrumental in aiding students' workforce planning. However, Apers and Derous (2017) discovered that recruiters may not accurately assess candidates' personalities through various resume formats, challenging the perceived positive impact of video resumes.

Additionally, both the current study and Lawrence et al. (2019) highlighted the role of Education 4.0 in enhancing teaching methods and promoting independent learning. Education 4.0 is effective in addressing challenges, especially during crises such as the COVID-19 pandemic, echoing Darma et al.'s (2020) findings on the efficacy of blended and project-based learning during educational disruptions. Furthermore, this study found the importance of digital exposure which aligns with Metilda and Neena's (2017) findings regarding the positive correlation between digital exposure and skills development among graduates. Similarly, skill development appears to be supported by Budu et al.'s (2021) findings on the positive impact of technology-based learning methods on graduates' technical skills.

The benefits of saving cost and time are parallel with Hosain and Liu's (2020) findings on the cost-effectiveness of platforms such as LinkedIn for recruitment purposes. The study reported that LinkedIn is a popular platform among respondents in Bangladesh and India because it is free for both job seekers and employers. However, in terms of privacy, the same study found that the respondents were less concerned about privacy issues when using LinkedIn. This study's findings do not support their findings as the respondents have expressed their worries about the lack of privacy when using Education 4.0 tools.

Additionally, the convenience and accessibility of Education 4.0 tools support other findings on students' positive engagement with mobile learning. For instance, it was found that Education 4.0 such as e-portfolios motivates learners to produce high-quality work, according to Segaran and Hasim (2021), based on the positive correlation they found between self-regulated learning and portfolio quality. The current study also found the benefit of e-portfolio customisability which aligns with Tucker et al. (2020)'s study on the value of customisable e-portfolio tools in engineering education. Additionally, it has been highlighted that Education 4.0 offers bite-sized content which resonates with Manning et al.'s (2021) findings on the positive effects of bite-sized teaching on students' attitudes and knowledge recall. However, this study's emphasis on Google as a knowledge source contrasts with the findings by Atkinson and Barker (2021) on the potential negative impact of internet searches on critical thinking and learning sustainability. Finally, this study found the benefit of income generation through platforms such as Freelance and Upwork aligns with Caballero-Morales et al.'s (2020) research on the role of Education 4.0 in job creation and social development.

**Research Question 3**

*How does the metacognitive strategies framework affect sustainable learning and employability through Education 4.0 from the perspective of experts?*

Based on both the qualitative and quantitative findings, the researchers have developed a framework of Metacognitive Strategies for Graduate Employability and Learning Sustainability through Education 4.0. This framework is designed to answer the third research question.

**Figure 2**

*Metacognitive Strategies Framework for Graduate Employability and Learning Sustainability through Education 4.0*
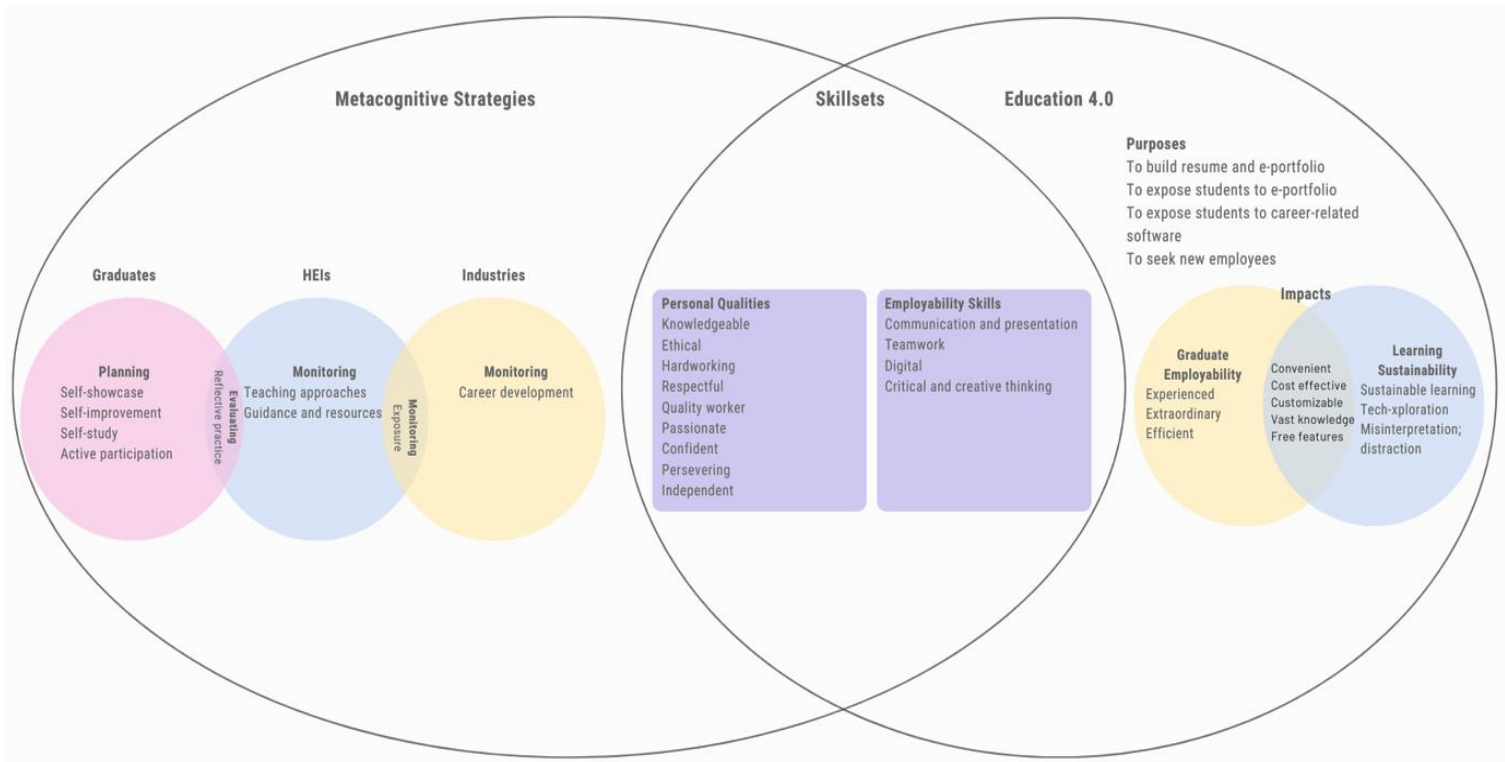
The framework illustrates a comprehensive approach to enhancing graduate employability and learning sustainability by integrating Brown's Regulation of Cognition and Education 4.0 (Brown, 1987). The circle on the right representing Education 4.0 overlaps with the left circle of Metacognitive Strategies, showing how both constructs should be integrated to produce graduates who possess the skillsets shown in the overlapping part.

By integrating the metacognitive strategies and Education 4.0 highlighted earlier, this framework provides a blueprint for developing graduates with personal qualities and employability skills that would boost their employability and learning sustainability.

**Table 6**

*Skillsets that graduates will have with successful integration*

| Personal Qualities | Employability Skills |
|---|---|
| 1. Knowledgeable | 1. Communication and presentation |
| 2. Ethical | 2. Teamwork |
| 3. Hardworking | 3. Digital |
| 4. Respectful | 4. Critical and creative thinking |
| 5. Quality worker | |
| 6. Passionate | |
| 7. Confident | |
| 8. Persevering | |
| 9. Independent | |

Graduates who possess these skills would also exemplify the aspirations highlighted in Malaysian Education Blueprint Higher Education (MEB HE) (2015-2025). The Ministry of Education has outlined the attributes that graduates should acquire in order to fulfil the aspirations of Malaysian higher education (Ministry of Education, 2015). These attributes were based on the vision of the National Education Philosophy of a balanced education as its foundation for individual student aspirations. The Ministry has outlined the importance of achieving a balance between knowledge and skills (ilmu) and ethics and morality (akhlak). The student aspirations outlined in the MEB HE is centred around six core attributes: ethics and spirituality, leadership skills, national identity, language proficiency, critical thinking skills, and knowledge. The following figure portrays how some of the skillsets discussed in this study connect to four of the core attributes mentioned, particularly to ethics and spirituality, leadership skills, critical thinking skills, and knowledge. However, based on the findings, there are no skillsets associated with the other two attributes, i.e. national identity, and language proficiency.

**Figure 3**

*The Relationship between Skillsets and Core Attributes of Graduates (adapted from Ministry of Education, 2015, p.10)*
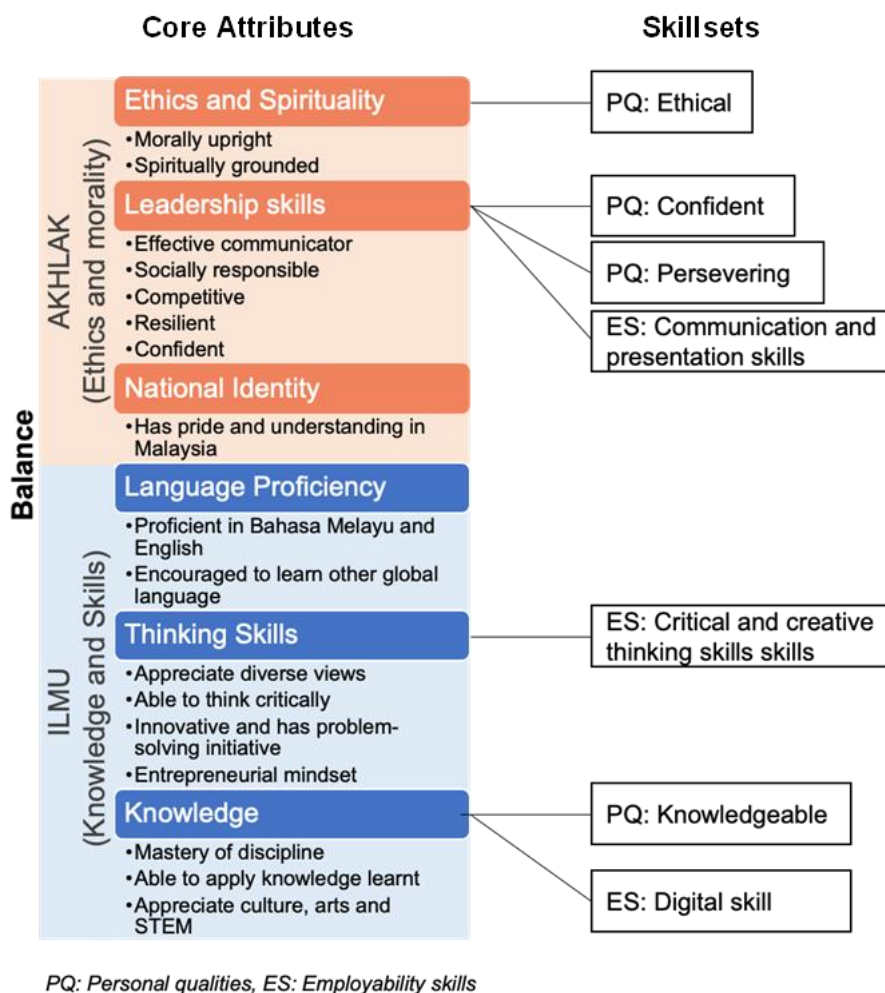


The study's findings on personal qualities align with earlier studies that attempted to identify the key attributes for success in the workplace. Sadiq et al. (2023) explored the professional attributes of healthcare educators, emphasising characteristics such as personality, expertise, and commitment to improvement, similar to this study's emphasis on being knowledgeable and independent. Similarly, Walker and Rossi (2021) surveyed nursing students and identified qualities such as enthusiasm, self-motivation, and communication skills as crucial for success in work-integrated learning, which corresponds to the importance of passion, confidence, and communication skills highlighted in the current research. Additionally, Kichula et al. (2019) compared teaching methods among medical students and found that practical skills and personal qualities such as responsibility and emotional resilience are crucial for competent doctors, mirroring the emphasis on perseverance and independence in the study's findings.

The study's findings on employability skills also echo the findings of other previous studies, offering insights into the factors influencing graduate employability. Hosain et al. (2023) surveyed hiring managers to identify key employability factors and highlighted that skills such as communication, personality, and teamwork significantly impact graduate employability. These

findings align with the study's emphasis on communication and presentation skills, teamwork, and critical and creative thinking skills as crucial for graduate employability. However, while this study considers digital skills as important, Hosain et al. (2023) suggested that technical skills are not significant for graduate employability. Nanda et al., (2021) highlighted soft skills such as communication and leadership as crucial in the business industry, which aligns with the study's focus on communication and presentation skills and critical and creative thinking skills. However, teamwork and digital skills were not discussed by Nanda et al. (2021), contrasting the findings of the current study. Furthermore, Nadarajah, (2021) identified a range of skills sought by employers, including communication, analytical, organisational, and numeracy skills, which mirrors this study's emphasis on communication and presentation skills, teamwork, digital skills, and critical and creative thinking skills. Overall, these studies collectively acknowledge the importance of a diverse range of skills, particularly communication, teamwork, and critical thinking, in enhancing graduate employability (Hosain et al., 2023; Nadarajah, 2021; Nanda et al., 2021).

## CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

In essence, this study has discussed as well as developed a framework on metacognitive strategies for graduate employability and learning sustainability through Education 4.0. Based on the findings. There were seven metacognitive strategies employed to enhance graduate employability and learning sustainability which were the Showcase self, Self-improvement, Exposure, Self-study and study group, Career development and training, Reflection of learning, and Teaching approaches. Three themes were uncovered on how Education 4.0 enhances learners' learning sustainability and employability which were 1. Purpose, 2. Advantages, and 3. Disadvantages. The advantages of using Education 4.0 are 1. Able to showcase self and enhance employability, 2. Improve and sustain learning, 3. Solve problems, 4. As an exposure, 5. Gain skills, 6. Save cost and time, 7. Convenient, 8. Produce the best result, 9. Customisable, 10. Bite-sized content, 11. Vast knowledge available, and 12. Generate income. A framework was developed, integrating both metacognitive strategies and Education 4.0. This framework could help produce graduates who possess the skillsets needed to enhance their employability and capture the interest of future employers. These findings address the knowledge gap regarding skills mismatch and the poor understanding of the metacognitive strategies for graduate employability and learning sustainability through Education 4.0 in the literature, especially in the context of Malaysia.

In terms of theoretical implication, the findings emphasise the significance of integrating metacognitive strategies with Education 4.0 to enhance graduate employability and learning sustainability. Drawing upon Brown's Model of Metacognition, particularly the Regulation of Cognition component, this study highlighted how planning, monitoring, and evaluating strategies are crucial in facilitating students' transition from academia to the workforce (Brown, 1987; Nordin, 2016). Furthermore, aligning the skillsets with the core attributes outlined in the Malaysian Education Blueprint Higher Education (MEB HE) demonstrated the importance of fostering not only knowledge acquisition but also communication, leadership, critical thinking, language proficiency, and digital skills among graduates. By recognising the relationship between the findings and MEB core attributes, educational institutions can future-proof students with the skillsets required to become balanced individuals who will become successful in their careers (Ministry of Education, 2015).

The practical implications of the current findings offer actionable insights for students, educational institutions, and industries. Firstly, students can leverage the identified metacognitive strategies through effective resume and e-portfolio building, self-improvement through continuous learning, and reflection on learning experiences to enhance their employability. Through Education 4.0, students can actively engage in self-directed learning and seek exposure to real-world tasks, to develop the necessary skills and competencies valued by employers. Secondly, educational institutions play a vital role in facilitating the adoption of metacognitive strategies through tailored

teaching approaches, authentic assessments, and guidance on career development. Curriculum enhancement efforts should prioritise the integration of metacognitive strategies through skill-building activities and practical experiences that bridge academic learning with industrial needs. Lastly, collaboration between educational institutions and industries is essential to provide students with meaningful career development opportunities, mentorship, and industry-specific training. By fostering partnerships that facilitate knowledge exchange and skill development, both parties can contribute to narrowing the skills gap and ensuring graduates are well-prepared for the demands of the future workforce.

This study has a few recommendations for students, institutions, industries and future studies. Students and graduates should do early planning, including building a comprehensive resume and an e-portfolio to showcase their skills, engaging in continuous learning through relevant online courses, and thorough preparation for interviews. As for educational institutions, it is recommended to integrate real-life tasks into teaching methods and offer courses that develop high-demand skills. Institutions should also engage alumni for experience-sharing sessions and collaborate with the industries to stay updated on the current industrial trends and needs. Additionally, industries should collaborate with academic faculties to provide feedback and narrow the gap of skills mismatch as well as provide career development opportunities and continuous training for current employees to upskill themselves. It is recommended for future studies to diversify sample sources by engaging a broader range including participants from other work sectors and private institutions. Future researchers could also use varied data collection methods, and replicate studies in other settings besides Malaysia for a comprehensive understanding of this phenomenon.

**REFERENCES**

Abd Latip, N. A., Swanto, S., & Din, W. A. (2020). Metacognitive Awareness of Listening Strategies Among Science Pre-University Students. *Universal Journal of Educational Research*, *8*(11), 5265–5270.https://doi.org/10.13189/ujer.2020.081127

Abd Majid, M. Z., Hussin, M., Norman, M. H., & Kasavan, S. (2020). The Employability Skills Among Students of Public Higher Education Institution in Malaysia. *Malaysian Journal of Society and Space*, *16*(1). https://doi.org/10.17576/geo-2020-1601-04

Albina, A. C., & Sumagaysay, L. P. (2020). Employability Tracer Study of Information Technology Education Graduates From a State University in the Philippines. *Social Sciences and Humanities Open*, *2*(1), 100055. https://doi.org/10.1016/j.ssaho.2020.100055

Ali, S., & Yasmeen, R. (2019). Practice to Preach Self-Regulation: Use of Metacognitive Strategies by Medical Teachers in Their Learning Practices. *Pakistan Journal of Medical Sciences*, *35*(6), 1642–1646. https://doi.org/10.12669/pjms.35.6.550

Almossa, S. Y. (2021). University Students' Perspectives Toward Learning and Assessment During COVID-19. *Education and Information Technologies*, *26*(6), 7163–7181. https://doi.org/10.1007/s10639-021-10554-8

Aloui, L., & Shams Eldin, A. Y. (2020). Socio-Emotional Competencies, Socio-Economic Factors, and the Employability Process of Female Graduates in the Kingdom of Saudi Arabia. *International Journal of Engineering Business Management*, *12*, 1–14. https://doi.org/10.1177/1847979020980903

Amar-Singh, Puay-Hoon, O., Raja, G, Ganapathy, S., Lai-Thin, N., & San, Y. (2022). *Our Children's Learning Loss: A Path to Post-Covid School Recovery in Malaysia*. Code Blue. https://codeblue.galencentre.org/2022/05/09/our-childrens-learning-loss-a-path-to-post-covid-school-recovery-in-malaysia-dr-amar-singh-hss-dr-ong-puay-hoon-gill-raja-srividhya-ganapathy-ng-lai-thin-yuenwah-san/

Anaza, E., Mabrey, P., Sato, M., Miller, O., & Thompson, J. (2023). *Multimodal Mock-Interview Assignments*. 164–176.

Ang, M. C. H. (2015). Graduate Employability Awareness: A Gendered Perspective. *Procedia - Social and Behavioral Sciences*, *211*(September), 192–198. https://doi.org/10.1016/j.sbspro.2015.11.083

Anthonysamy, L. (2021). The Use of Metacognitive Strategies for Undisrupted Online Learning: Preparing University Students in the Age of Pandemic. *Education and Information Technologies*, *26*(6), 6881–6899. https://doi.org/10.1007/s10639-021-10518-y

Apers, C., & Derous, E. (2017). Are They Accurate? Recruiters' Personality Judgments in Paper Versus Video Resumes. *Computers in Human Behavior*, *73*, 9–19. https://doi.org/10.1016/j.chb.2017.02.063

Atkinson, P., & Barker, R. (2021). 'Hey Alexa, What Did I Forget?': Networked Devices, Internet Search and the Delegation Of Human Memory. *Convergence*, *27*(1), 52–65. https://doi.org/10.1177/1354856520925740

Aziz Hussin, A. (2018). Education 4.0 Made Simple: Ideas For Teaching. *International Journal of Education and Literacy Studies*, *6*(3), 92. https://journals.aiac.org.au/index.php/IJELS/article/view/4616

Bennett, D., Knight, E., Dockery, A. M., & Bawa, S. (2020). Pedagogies for Employability: Understanding the Needs of STEM Students Through a New Approach to Employability Development. *Higher Education Pedagogies*, *5*(1), 340–359. https://doi.org/10.1080/23752696.2020.1847162

Berliner, D. C. (2004). Describing the Behavior and Documenting the Accomplishments of Expert Teachers. *Bulletin of Science, Technology & Society*, *24*(3), 200–212.

Bhatt, A. K., & Smita. (2021). Employability of Students in Indian Higher Education: Challenges and Opportunities. *Asian Journal of Economics, Finance and Management*, *3*(4), 10–17.

Brown, A. L. (1987). Metacognition, Executive Control, Self-Regulation, and Other More Mysterious Mechanisms. In F. E. Weinert, & R. Kluwe (Eds.), *Metacognition, Motivation, and Understanding* (pp. 65-116). Hillsdale: L. Erlbaum Associates.

Budu, K. W. A., Asante, E., & Asare, A. O. (2021). Enhancing Graduate Employability Skills: A Case for E-learning Environment in Higher Education Delivery. *European Academic Research*, *9*(6), 3209- 3229.

Caballero-Morales, S.-O., Cordero Guridi, J. de J., Alvarez-Tamayo, R. I., & Cuautle-Gutiérrez, L. (2020). Education 4.0 to Support Entrepreneurship, Social Development and Education in Emerging Economies. *International Journal of Entrepreneurial Knowledge*, *8*(2), 89–100. https://doi.org/10.37335/ijek.v8i2.119

Çakici, D. (2017). An overview of Metacognitive Strategies In Reading Comprehension Skill. *The Journal of Academic Social Science Studies*, *4*(57), 67–82. https://doi.org/10.9761/jasss7074

Cavilla, D. (2017). The Effects of Student Reflection on Academic Performance and Motivation. *SAGE Open*, *7*(3), 1–13. https://doi.org/10.1177/2158244017733790

Cer, E. (2019). The Instruction of Writing Strategies: The Effect of the Metacognitive Strategy on the Writing Skills of Pupils in Secondary Education. *SAGE Open*, *9*(2). https://doi.org/10.1177/2158244019842681

Cervin-Ellqvist, M., Larsson, D., Adawi, T., Stöhr, C., & Negretti, R. (2021). Metacognitive illusion or Self-Regulated Learning? Assessing Engineering Students' Learning Strategies Against the Backdrop of Recent Advances in Cognitive Science. *Higher Education*, *82*(3), 477–498. https://doi.org/10.1007/s10734-020-00635-x

Chan, K. O. W., Ng, M. K. W., So, J. C. H., & Chan, V. C. W. (2021). Evaluation of Generic Competencies Among Secondary School Leavers From The New Academic Structure For Senior Secondary Education in Hong Kong. *Public Administration and Policy*, *24*(2), 182–194. https://doi.org/10.1108/PAP-07-2020-0033

Chaves, M. G. F. (2021). Remote Learning Readiness and Challenges: Perceptions and ExperiencesAamong Tertiary State University Management Students. *Recoletos Multidisciplinary Research Journal*, *9*(1), 79–89. https://doi.org/10.32871/rmrj2109.01.08

Cheng, M., Adekola, O., Albia, J., & Cai, S. (2022). Employability in Higher Education: A Review of Key Stakeholders' Perspectives. *Higher Education Evaluation and Development*, *16*(1), 16–31. https://doi.org/10.1108/heed-03-2021-0025

Chigbu, B. I., & Nekhwevha, F. H. (2022). Academic-Faculty Environment and Graduate Employability: Variation of Work-Readiness Perceptions. *Heliyon*, *8*(3), e09117. https://doi.org/10.1016/j.heliyon.2022.e09117

Choi, J., Eun, S., Choi, S., Kang, B., Hyun, S., Bae, J., Tate, J. A., & Son, Y. (2020). Integration of Visual Thinking Strategies to Undergraduate Health Assessment Course: a Mixed-Method Feasibility Study. *Nurse Education Today, 113*, 105374.

https://doi.org/10.1016/j.nedt.2022.105374

Creswell, J. W., & Clark, V. L. P. (2018). *Designing and Conducting Mixed Methods Research* (3rd ed.). SAGE Publications, Inc. https://doi.org/10.1177/1937586719832223

Crouch, M., & McKenzie, H. (2006). The Logic of Small Samples in Interview-Based. *Social Science Information*, *45*(4), 483–499. https://doi.org/10.1177/0539018406069584

Darma, D. C., Ilmi, Z., Darma, S., & Syaharuddin, Y. (2020). COVID-19 and its Impact on Education: Challenges from Industry 4.0. *Aquademia*, *4*(2), 1–4. https://doi.org/10.29333/aquademia/8453

Department of Statistics Malaysia. (2022). Graduates Statistics 2021. In *Labour Market Information*. https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=476&bul_id=N0w0QU 95YklKRDFoQWhSV3F6N3NHQT09&menu_id=Tm8zcnRjdVRNWWlpWjRlbmtlaDk1UT0 9

Dimopoulos, A. (2020). Applicant's Self Confidence Influence in Employment Interview Process According to Recruiters Perceptions. An Exploratory Study in Greece. *International Journal of Human Resource Studies*, *10*(2), 82. https://doi.org/10.5296/ijhrs.v10i2.16701

Dwi, M. D. S., & Karimah, S. (2020). Challenges of Having Online Learning Activities: University Students' Perspectives. *The International English Language Teachers and Lecturers Conference*, 9–14.

Fisk, P. (2017). *Education 4.0 … The Future of Learning Will be Dramatically Different, in School and Throughout Life*. Peterfisk. https://www.peterfisk.com/2017/01/future-education-young-everyone-taught-together/

Gambatese, J. A., Behm, M., & Rajendran, S. (2008). Design's Role in Construction Accident Causality and Prevention: Perspectives From an Expert Panel. *Safety Science*, *46*(4), 675–691. https://doi.org/10.1016/j.ssci.2007.06.010

Ghasemi, A. A., Yazdani, H., & Mozaheb, M. A. (2019). The Role Of Metacognitive Strategy Training in Fostering Vocabulary Acquisition. *Learning and Teaching in Higher Education: Gulf Perspectives*, *16*(1), 45–57. https://doi.org/10.18538/lthe.v16.n1.331

Gilbert, G., Turner, M., & Haass, O. (2022). Working Up to Work: Perceived Employability of Students Commencing a Project Management Degree. *Project Leadership and Society*, *3*, 100048. https://doi.org/10.1016/j.plas.2022.100048

Göbel, K., Wyss, C., Neuber, K., & Raaflaub, M. (2021). Student feedback As a Source for Reflection in Practical Phases of Teacher Education. In W. Rollett, H. Bijlsma, & S. Röhl (Eds.), *Student Feedback on Teaching in Schools: Using Student Perceptions for the Development of Teaching and Teachers* (pp. 173–189). Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-75150-0_11

Graham, D. (2017). Embedding Employability Behaviours. *Journal of Work-Applied Management*, *9*(1), 35–50. https://doi.org/10.1108/JWAM-01-2017-0001

Green, N., Liu, M. X., & Murphy, D. (2020). Using an Electronic Resume Analyzer Portal (e-RAP) to Improve College Graduates Employability. *Information Systems Education Journal (ISEDJ)*, *18*(3), 28–37. https://isedj.org/;http://iscap.info

Gu, Z., Li, P., Zhang, A., Xu, X., & Gu, F. (2022). The Role of Mental Health and Sustainable Learning Behavior of Students in Education Sector Influences Sustainable Environment. *Frontiers in Psychology*, *13*, 1–15. https://doi.org/10.3389/fpsyg.2022.822751

Gutiérrez-Santiuste, E., García-Segura, S., Olivares-García, M. Á., & González-Alfaya, E. (2022). Higher Education Students' Perception of the E-Portfolio as a Tool for Improving Their Employability: Weaknesses and Strengths. *Education Sciences*, *12*(5). https://doi.org/10.3390/educsci12050321

Harun, D., Din, N. C., Rasdi, H. F. M., & Shamsuddin, K. (2020). Employment Experiences Among Young Malaysian Adults With Learning Disabilities. *International Journal of Environmental Research and Public Health*, *17*(1). https://doi.org/10.3390/ijerph17010115

Heuzeroth, J., & Budke, A. (2021). Metacognitive Strategies for Developing Complex Geographical Causal Structures—An Interventional Study in The Geography Classroom. *European Journal of Investigation in Health, Psychology and Education*, *11*(2), 382–404. https://doi.org/10.3390/ejihpe11020029

Hosain, M. S., & Liu, P. (2020). Linked in For Searching Better Job Opportunity: Passive Jobseekers' Perceived Experience. *Qualitative Report*, *25*(10), 3719–3732. https://doi.org/10.46743/2160-3715/2020.4449

Hosain, M. S., Mustafi, M. A. A., & Parvin, T. (2023). Factors Affecting The Employability of Private University Graduates: An Exploratory Study on Bangladeshi Employers. *PSU Research Review*, *7*(3), 163–183. https://doi.org/10.1108/PRR-01-2021-0005

Hoyos, M. de, & Barnes, S.-A. (2012). *Analysing Interview Data* [PowerPoint slides]. Warwick Institute for Employment Research.

Ismail, F., Syafiqah, S., & Fuad, H. (2021). Role, And Perceived Development of Employability Skills. *International Journal of Modern Trends in Business Research (IJMTBR)*, *4*(16), 17–31.

Jaradat, S., & Ajlouni, A. (2021). Undergraduates' Perspectives and Challenges of Online Learning During the COVID-19 Pandemic: A Case From the University of Jordan. *Journal of Social Studies Education Research*, *12*(1), 149–173.

Jin, M., & Ji, C. (2021). The Correlation of Metacognitive Ability, Self-Directed Learning Ability and Critical Thinking in Nursing Students: A Cross-Sectional Study. *Nursing Open*, *8*(2), 936–945. https://doi.org/10.1002/nop2.702

Jones, M. (2013). *Improving Visibility as a graduate to employers*. Student Employment Services. https://www.studentemploymentservices.co.uk/blog/improving-visibility-as-a-graduate-to-employers

Joshi, N. (2022, March). *Understanding Education 4.0: The Machine Learning- Driven Future Of Learning*. Forbes. https://www.forbes.com/sites/naveenjoshi/2022/03/31/understanding-education-40-the-machine-learning-driven-future-of-learning/?sh=57c9de515bc2

Jusoh, M. R., & Nik Yusoff, N. .M R. (2015). Aplikasi Kaedah Fuzzy Delphi Dalam Pembangunan Modul Pembelajaran Tatabahasa Arab. *Jurnal Sultan Alauddin Sulaiman Shah (JSASS)*, *2*(2), 193–211.

Karim, R. A., Abu, A. G., Mohd Adnan, A. H., & Suhandoko, A. D. J. (2018). The Use of Mobile Technology in Promoting Education 4.0 For Higher Education. *Advanced Journal of Technical and Vocational Education*, *2*(3), 34–39. https://doi.org/10.26666/rmp.ajtve.2018.3.6

Kaufmann, A., & Gupta, M. M. (1998). *Fuzzy Mathematical Models in Engineering and Management Science.* Elsevier Science Publishers.

Khellab, F., Demirel, Ö., & Mohammadzadeh, B. (2022). Effect of Teaching Metacognitive Reading Strategies on Reading Comprehension of Engineering Students. *SAGE Open*, *12*(4), 1–19. https://doi.org/10.1177/21582440221138069

Kichula, M., Oleksii, K., & Korolova, T. (2019). Evaluating Professional Qualities of Medical Students. *Advanced Education*, *6*(13), 44–53. https://doi.org/10.20535/2410-8286.154723

Kitchenham, B. A., & Charters, S. (2007). *Guidelines for Performing Systematic Literature Reviews in Software Engineering.* EBSE Technical Report.

Kunnari, I., Jiang, L., & Myllykoski-Laine, S. (2021). Emvitet-Project Developing Education 4.0 Competencies - Impacts and Experiences During COVID-19. *Journal of Technical Education Science*, *62*(62), 3–16. https://doi.org/10.54644/jte62202152

Lawrence, R., Ching, L. F., & Abdullah, H. (2019). Strengths and Weaknesses of Education 4.0 in the Higher Education Institution. *International Journal of Innovative Technology and Exploring Engineering*, *9*(2S3), 511–519. https://doi.org/10.35940/ijitee.b1122.1292s319

Lobczowski, N. G., Lyons, K., Greene, J. A., & McLaughlin, J. E. (2021). Socially Shared Metacognition in a Project-Based Learning Environment: A Comparative Case Study. *Learning, Culture and Social Interaction*, *30*(PA), 100543. https://doi.org/10.1016/j.lcsi.2021.100543

Ma'dan, M., Ismail, M. T., & Daud, S. (2020). Strategies to Enhance Graduate Employability: Insight From Malaysian Public University Policy-Makers. *Malaysian Journal of Learning and Instruction*, *17*(2), 137–165.

Mahalingam, N. A., & Jamaludin, K. A. (2021). Impak Dan Cabaran Pelaksanaan Pengajaran Dan Pembelajaran Atas Talian Semasa Perintah Kawalan Pergerakan. *Jurnal Dunia Pendidikan*, *3*(4), 104–115. http://myjms.mohe.gov.my/index.php/jdpd

Mahidin, M. U. (2021). *Statistics of Graduates in the Labour Force Malaysia*. Department of Statistics Malaysia. https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=U1ltVWpwNXRNRUR2Nlh RSHZmenRMUT09

Manakandan, S. K., Ismail, R., Mohd Jamil, M. R., & Ragunath, P. (2017). Pesticide applicators questionnaire content validation: A Fuzzy Delphi method. *Medical Journal of Malaysia*, *72*(4), 228–235.

Manan, S. A., David, M. K., & Haidar, S. (2021). Soft Skills, Policies, Practices, and Self-Assessment: Employability Challenges and Opportunities of University Graduates in Pakistan. *Journal of Educational Sciences & Research*, *8*(1), 117–140.

Manning, K. D., Spicer, J. O., Golub, L., Akbashev, M., & Klein, R. (2021). The Micro Revolution: Effect of Bite-Sized Teaching (BST) on Learner Engagement and Learning in Postgraduate Medical Education. *BMC Medical Education*, *21*(1), 1–11. https://doi.org/10.1186/s12909-021-02496-z

Mat Nor, F., Mohd Tahir, M. A. A., & Azman, A. (2021). Pengaruh e-pembelajaran dan tahap tekanan pelajar. *8th International Conference on Management and Muamalah*, 739–748. http://conference.kuis.edu.my/icomm/8th/images/021-059.pdf

McAlister, A. M., Lee, D. M., Ehlert, K. M., Kajfez, R. L., Faber, C. J., & Kennedy, M. S. (2017). Qualitative coding: An Approach to Assess Inter-Rater Reliability. *ASEE Annual Conference and Exposition, Conference Proceedings*, *2017-June*. https://doi.org/10.18260/1-2--28777

Metilda, R. M., & Neena, P. C. (2017). Impact of Digital Technology on Learning to Enhance the Employability Skills of Business Management Graduates. *Journal of Scientific Research*, *5*(2), 35–41.

Mhandu, J., Mahiya, I. T., & Muzvidziwa, E. (2021). The Exclusionary Character of Remote Teaching and Learning During The COVID-19 Pandemic. An Exploration of The Challenges Faced By Rural-Based University Of Kwazulu Natal Students. *Cogent Social Sciences*, *7*(1). https://doi.org/10.1080/23311886.2021.1947568

Miller, E., & Konstantinou, I. (2022). Using Reflective, Authentic Assessments to Embed Employability Skills in Higher Education. *Journal of Work-Applied Management*, *14*(1), 4–17. https://doi.org/10.1108/JWAM-02-2021-0014

Ministry of Education. (2015). *Malaysia Education Blueprint 2015-2025 (Higher Education)*.

Kementerian Pendidikan Malaysia. https://doi.org/10.1088/1751-8113/44/8/085201

Ministry of Higher Education. (2018). Framing Malaysian Higher Education 4.0: Future-Proof Talents. In *Ministry of Higher Education Malaysia* (Vol. 7, Issue 1). Department of Higher EducationMalaysia.https://drive.google.com/file/d/1tpRfpLaQbTif0o8mHGIox2MAgYVuGTvX/view

Mohamad, S. N. A., Embi, M. A., & Nordin, N. (2015). Determining e-Portfolio Elements in Learning Process Using Fuzzy Delphi Analysis. *International Education Studies*, *8*(9), 3–9. https://doi.org/10.5539/ies.v8n9p171

Mohd Jamil, M. R., & Mat Noh, N. R. (2020). *Kepelbagaian Metodologi Dalam Penyelidikan Reka Bentuk Dan Pembangunan*. Qaisar Prestige Resources.

Mohd Tahir, L., A. Samah, N., Omar, W., Mohammad, S., Abdul Latif, A., Mohd Yusof, S., Mohd Amin, N. F., Abdul Hamid, M. Z., Arsat, M., & Musta'amal @Jamal, A. H. (2018). Re-examine Malaysian HEIs graduates' employability: Comparing perspectives from graduates and employees. *The Turkish Online Journal of Design, Art and Communication*, *September*, 1666–1685.

Moriña, A., & Biagiotti, G. (2022). Inclusion at university, Transition to Employment and Employability of Graduates With Disabilities: A systematic review. *International Journal of Educational Development*, *93,* 0–2. https://doi.org/10.1016/j.ijedudev.2022.102647

Nadarajah, J. (2021). Measuring the Gap in Employability Skills Among Malaysian Graduates. *International Journal of Modern Trends in Social Sciences*, *4*(15), 81–87. https://doi.org/10.35631/ijmtss.415007

Nambiar, P. (2021, July 23). Teachers, Students, Parents Adapting to Home Learning. *The Sun*. https://thesun.my/home_news/teachers-students-parents-adapting-to-pdpr-GH8108383

Nanda, H., Putri, S., Putri, D., Ermayda, R., & Palil, M. (2021). *Study of Alumni Engagement and its Relationship to University Curriculum Reforming* [Conference Presentation]. 3rd International Conference on Economics, Business and Economic Education Science. https://doi.org/10.4108/eai.22-7-2020.2307898

Nordin, M. S. (2016). *Exploring the Development of Metacognitive Strategies in Learning Technologies among Pre-service Teacher Trainees through an E-space Community Framework* [University of Nottingham]. http://eprints.nottingham.ac.uk/31236/

O'Leary, S. (2016). *Enhancing Graduate Attributes and Employability Through Initiatives With External Partners*. *12*(3), 505–518.

Pheko, M. M., & Molefhe, K. (2017). Addressing Employability Challenges: A Framework for Improving the Employability of Graduates in Botswana. *International Journal of Adolescence and Youth*, *22*(4), 455–469. https://doi.org/10.1080/02673843.2016.1234401

Philip, B. (2018). Academic Self-Regulation of Cognition and Metacognition among Undergraduates: A Malaysian Perspective. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, *23*(3), 13–22. https://doi.org/10.9790/0837-2303071322

Porubčinová, M., Novotná, I., & Fidlerová, H. (2020). The Use of Education 4.0 Tools in Tertiary Education System in Slovakia. *Information Technologies and Learning Tools*, *80*(6), 161–175. https://doi.org/10.33407/itlt.v80i6.4004

Ranaraja, I., Jollands, M., & Date, A. (2022). The *Evolving Role Of The Lecturer In Employability Learning Of Students* [Conference presentation]. 33rd Australasian Association for Engineering Education Conference.

Ritchie, L., Egdell, V., Danson, M., Cook, M., Stavert, J., & Tolson, D. (2022). Dementia, Work and

Employability: Using the Capability Approach to Understand the Employability Potential for People Living with Dementia. *Work, Employment and Society*, *36*(4), 591–609. https://doi.org/10.1177/0950017020961929

Rivas, S. F., Saiz, C., & Ossa, C. (2022). Metacognitive Strategies and Development of Critical Thinking in Higher Education. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.913219

Sadiq, N., Fatima, F., Rauf, A., Fatima, S., & Ayub, R. (2023). Identifying Professional Attributes and Behaviors of Healthcare Educators in Distance Learning Programs. *International Journal of Interactive Mobile Technologies*, *17*(14), 163–176. https://doi.org/10.3991/ijim.v17i14.39783

Sarvestani, M. S., Mohammadi, M., Afshin, J., & Raeisy, L. (2019). *Students ' Experiences of E-Learning Challenges ; a Phenomenological Study*. *10*(3), 1–10.

Segaran, M. K., & Hasim, Z. (2021). Self-Regulated Learning through ePortfolio: A Meta-analysis. *Malaysian Journal of Learning and Instruction*, *18*(1), 131–156. https://doi.org/10.32890/MJLI2021.18.1.6

Shore, T., Tashchian, A., & Forrester, W. R. (2021). The Influence of Resume Quality and Ethnicity Cues on Employment Decisions. *Journal of Business Economics and Management*, *22*(1), 61–76. https://doi.org/10.3846/jbem.2020.13670

Swanson, R. A., & Holton, I. E. F. (2001). *Foundations of human resource development*. BerrettKoehler Publishers.

Tran, T. T. (2019). Graduate employability: Beyond the skills Agenda. *Innovate Higher Education to Enhance Graduate Employability: Rethinking the Possibilities*, 158–168. https://doi.org/10.4324/9780429058899-14

Tucker, T., Vernooij, E., LaBore, C., Wolf, A. R., Bo-Linn, C., Baird, R. T., Dancholvichit, N., & Liebenberg, L. (2020). *Transforming an engineering Design Course Into an Engaging Learning Experience Using Eportfolios* [Conference presentation]. *2020 ASEE Virtual Annual Conference Content Access* https://doi.org/10.18260/1-2--35401

Vilalta-Perdomo, E., Michel-Villarreal, R., & Thierry-Aguilera, R. (2022). Integrating Industry 4.0 in Higher Education Using Challenge-Based Learning: An Intervention in Operations Management. *Education Sciences*, *12*(10). https://doi.org/10.3390/educsci12100663

Walker, S. B., & Rossi, D. M. (2021). Personal Qualities Needed By Undergraduate Nursing Students For a Successful Work Integrated Learning (WIL) Experience. *Nurse Education Today*, *102*. https://doi.org/10.1016/j.nedt.202

Xia, Y., Hu, Y., Wu, C., Yang, L., & Lei, M. (2022). Challenges of Online Learning Amid the COVID-19: College Students' Perspective. *Frontiers in Psychology*, *13*, 1–13. https://doi.org/10.3389/fpsyg.2022.1037311

Xu, M., David, J. M., & Kim, S. H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, *9*(2), 90–95. https://doi.org/10.5430/ijfr.v9n2p90

Yildiz, S. G. (2020). Geometrical Problem-Solving Performance of Preservice Teachers: Exploring the Effectiveness of Metacognitive Strategies. *Malaysian Online Journal of Educational Sciences*, *8*(4), 34–47.

Zolkiply, Z. I., & Bakar, B. (2021). Lebih 7, 000 Murid B40 Terengganu Tercicir Ikuti PdPR [More than 7,000 Terengganu B40 Students Drop Out Follow PdPR]. *Harian Metro*.