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Perceptions of industry and education practitioners regarding 21st-century multiple intelligence qualifications for vocational education

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ABSTRACT

Workforce development in the 21st century requires new multiple intelligence qualifications to address the demands of vocational education (VE). This research identifies a new set of multiple intelligence qualifications, along with their application procedures and assessment methods, tailored for VE.
Industry practitioners and higher vocational education stakeholders were engaged to gather data on this topic. Data collection from practitioners was conducted in two stages: initial interviews followed by Focus Group Discussions (FGDs). The transcribed data was analyzed and interpreted using NVivo 12 Plus software. The findings reveal that four types of multiple intelligences are critical for industry practitioners and higher vocational education: interpersonal, intrapersonal, logical-mathematical, and naturalistic intelligence. Developing these intelligences requires several key supports: robust digital infrastructure, a strong emphasis on the responsibilities of all participants in the learning process, enhancing the readiness of both teachers and students prior to learning, and adopting learning strategies that foster student independence and deep exploration of learning objectives. The assessment of these intelligences is based on three main aspects: self-assessment methods, peer assessment, and meaningful project-based assessment. These findings provide crucial recommendations for education administrators and practitioners in VE to implement the four multiple intelligences effectively, aligning them with the current needs of the workforce.

Keywords: 21st century qualification, multiple intelligence, vocational education, vocational learning.

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INTRODUCTION

The development of science and technology in the 21st century has brought both significant challenges and immense potential across all employment sectors (Burgess et al., 2023; Oberländer et al., 2021; Rosário & Dias, 2023). The increasing trend of digitalization signifies a fundamental shift in the nature and methods of work operations (Burgess et al., 2023). These changes underscore the need for new qualifications to address these shifts effectively, enabling human resources (HR) to maximize opportunities and remain competitive (Haapanen & Tapio, 2016; Kuper, 2020). Consequently, developing human resources has become a crucial

effort for nations aiming to adapt qualifications to meet evolving demands (Haworth, 2013; Sapna et al., 2021). Countries with demographic bonuses, in particular, are striving to enhance their human resource qualifications in response to current and future transformations (Chiware, 2010; Othman, 2016; Udin, 2020). However, developing countries, such as Indonesia, face significant challenges in this regard. Instead of capitalizing on their demographic advantages, they are often burdened by macro- and microeconomic disparities (McWhorter, 2023; Udin, 2020). The rising unemployment index also indicates this problem is prolonged (Garavan et al., 2016). Without effective solutions, these issues risk triggering prolonged economic crises that could jeopardize national stability.

Vocational education (VE) serves as a key institution in addressing these challenges. As a platform for human resource development, VE equips individuals with work competencies relevant to industry needs through targeted learning (Billett, 2011). Additionally, VE must strive to maximize students' potential, enabling them to adapt to ongoing developments (Nuswantari et al., 2020; Yidana et al., 2022). However, over the past decade, critical issues have emerged within VE systems in various countries, particularly in developing nations [21], [22]. A primary concern is the misalignment between the quality of graduates and the qualification demands of the labor market. This misalignment results in low employment rates for VE graduates and extended waiting periods to secure jobs. Furthermore, many VE graduates end up in roles unrelated to their field of study.

To address these challenges, several studies advocate for updates to fundamental aspects of VE. These studies highlight a lack of relevance in the application of multiple intelligences (MI) in graduates' professional tasks. For instance, musical intelligence would only be applicable in specific fields within the broad scope of VE. This underscores the need to redefine MI as a new qualification aligned with 21st-century work demands, which are increasingly shaped by digitalization and sustainable development considerations.

MI has been identified as a key qualification that human resources must possess in all countries (Chew et al., 2021; Lei et al., 2021; Mendis & Dharmasiri, 2019). The concept of MI, or Multiple Intelligences, was first introduced by Howard Gardner in his theory of multiple intelligences. According to this theory, intelligence is not confined to verbal and logical-mathematical abilities as traditionally measured by IQ tests. Instead, Gardner identified multiple types of intelligence, each representing a distinct intellectual capacity with long-term impacts on qualifications throughout life (Gardner & Hatch, 1989). Gardner proposed at least eight types of MI: linguistic, logical-mathematical, visual-spatial, musical, kinesthetic, interpersonal, intrapersonal, and naturalist intelligences (Gardner & Hatch, 1989). Research has extensively explored the integration of MI into national human resource development efforts, particularly through

education. Education systems have increasingly incorporated MI into various stages, including planning, curriculum development, implementation, assessment, and evaluation.

However, several studies caution that not all aspects of MI are relevant for every specialty or job (Gardner & Hatch, 1989; Xie & Xu, 2022). The competency requirements in vocational education (VE) are particularly specific, necessitating targeted intelligences to support the achievement of work-related competencies. Previous research has not sufficiently addressed this need, leaving a gap in the literature regarding the identification of new MI qualifications and their practical application and assessment.

This gap is further highlighted by studies indicating that VE in developing countries still emphasizes strengthening general intelligence rather than cultivating specific intelligences. Each field of expertise must adapt to the unique MI requirements of emerging job qualifications (Gardner & Hatch, 1989). Therefore, education systems focused on specific MI need to adjust their approaches to better align with these evolving demands.

Most vocational educators (VEs) are often constrained by focusing on countries that have successfully implemented multiple intelligences (MI) while failing to fully understand their own unique problems and potentials (Almaraz-López et al., 2023). As a result, they face challenges due to high specifications derived from other countries that cannot be fully supported or implemented within their own contexts (Zimmermannova et al., 2021). Factors such as geographical conditions, socio-cultural contexts, political dynamics, and other considerations must be carefully evaluated before implementing MI-based learning in vocational education (Chew et al., 2021; Jain, 2022; Stock, 2021). Therefore, each country needs to develop a distinctive approach to transforming its vocational education system, ensuring that MI—recognized as a key qualification for the 21st century—can be optimally integrated.

To date, efforts to gather a broad range of perspectives from various stakeholders to identify the MI qualifications needed in vocational education, aligned with 21st-century job requirements, remain limited. Without such exploration, vocational education institutions risk falling short in equipping students with the qualifications necessary to meet future challenges.

Research by (Benchimol et al., 2022; Darmawan et al., 2021) highlights the importance of collaboration between industrial practitioners and vocational educators to develop MI qualifications tailored to the demands of 21st-century work.

Building on these issues, this study aims to explore the perceptions of industrial and vocational education practitioners to formulate MI qualifications as a foundation for strategic development, implementation, and evaluation. Specifically, the study seeks to address the following questions:

1) What are the new multiple intelligence qualifications that should be taught in vocational education?

2) How can these new multiple intelligence qualifications be implemented in vocational education?
3) How can these new multiple intelligence qualifications be assessed and evaluated in vocational education?

METHOD

Research Design

This study aims to explore the perceptions of industry practitioners and vocational education (VE) practitioners in formulating the multiple intelligence (MI) qualifications that VE students must possess in the 21st century. It employs a qualitative research approach based on the design outlined by (Cresswell, 2009), describing the exploration results that have been synthesized and reduced into key themes. The research was conducted through five main stages to ensure the credibility, accountability, and relevance of the findings in addressing the need for updated MI qualifications. These stages included preliminary studies, literature reviews, instrument preparation, pilot studies, semi-structured interviews, and focus group discussions. Informants were selected as data sources based on specific, relevant criteria. The collected data was transcribed and underwent a data reduction process to identify the primary themes.

Research Informants

The key informants who will be involved from both parties will be selected using a purposive sampling technique, based on several criteria relevant to the context of the study. Specifically, the characteristics of the key informants in the research are outlined in Table 1. The criteria for selecting key informants from industry practitioners include: having more than ten years of work experience, holding competency certification relevant to their industry field, working in industries that have collaborated with vocational education for at least five years, and holding a leadership position, such as head of a department or head of the human resources training division. The aim is to gain insights into the current situation and conditions related to new qualifications in the 21st-century era, as these practitioners are directly involved in them. In comparison, the criteria for selecting key informants from vocational education (VE) practitioners include: being lecturers in VE with more than ten years of teaching experience, and having experience in researching and publishing articles related to VE issues and development in reputable international journals. The aim is to align the potential of education and learning in developing strategies, as well as assessing and evaluating the management of MI in VE based on qualifications expressed by industry practitioners.

Ten key informants, consisting of five VE practitioners and five industry practitioners, were involved in data collection. The number of informants was determined based on Creswell's (2009) recommendation that there should be a minimum of three qualitative informants. Therefore, this

research meets the criteria for data triangulation. The experience of the key informants from industry practitioners ranges from 14 to 31 years, while the VE practitioners have between 15 and 36 years of experience. In terms of age, key informants from industry practitioners are between 42 and 52 years old, while VE practitioners are between 39 and 60 years old. The length of time in their respective positions, combined with their current age, indicates that the informants are capable of providing comprehensive insights into the phenomenon and can effectively explain the existing information.

Table 1. Key Informants Qualifications

Pseudonym	Role	Age	Experiences	Spesific backgrounds
HNA	Vocational education practitioner	48	22 years	Associate professor in the field of vocational education management; has a Scopus H-Index = 10
FM	Vocational education practitioner	60	38 years	Professor in the field of vocational learning; has a Scopus H-Index = 12
AKA	Vocational education practitioner	39	15 years	Associate professor in the field of vocational education curriculum; has a Scopus H-Index = 8
MAN	Vocational education practitioner	48	30 years	Professor in the field of vocational learning; has a Scopus H-Index = 9
MH	Vocational education practitioner	45	19 years	Associate professor in the field of vocational education technology; has a Scopus H-Index = 12
GB	Industry practitioner	42	15 years	Head of training and human resources development in the manufacturing sector
HAM	Industry practitioner	43	14 years	Head of training and human resources development in the tourism sector
NW	Industry practitioner	47	17 years	Head of human resources management and empowerment in the banking sector
QAR	Industry practitioner	44	17 years	Head of human resources management and empowerment in the transportation and logistics sector
PAJ	Industry practitioner	52	31 years	Head of training and human resources development in the energy and resources sector

Data Collection

Data collection was carried out in two stages, starting with interviews and followed by Focus Group Discussions (FGDs). The interview stage was also divided into two parts. The first set of interviews was conducted with five key informants from industry practitioners. These interviews took place in October-November 2023, with a duration of approximately 60-120 minutes. An interview guide, validated by VE practitioners and tested through a pilot study, was used. The interviews aimed to explore practitioners' experiences and opinions regarding the new MI qualifications that VE graduates should have.

The second set of interviews involved five key informants from higher education practitioners, specifically lecturers in VE. These interviews were conducted in January-February 2024, with a duration of approximately 60-120 minutes. The interview guide was again validated by VE experts before the pilot study and subsequent data collection.

In the final stage, industry and VE practitioners participated in an FGD to discuss the findings and develop new MI qualification concepts. As a result, a new formula was created between the two parties to authorize VE organizers to be more professional and effective in fostering MI growth among their students. This instrument was reviewed based on observations of relevant literature and a review by members to validate the input from ten key informants.

Data analysis produces

We then collected and transcribed the data. The data was then reduced or processed using NVivo 12 Plus software for clearer visualization. The data was explained thematically to identify, extract, and describe concepts/themes based on key informant responses. The stages of data analysis consisted of open coding, axial coding, and selective coding. Systematically, the research stages were as follows: first, the transcribed interview data was placed into a file container and read repeatedly; nodes were then created based on descriptive coding, followed by coding in NVivo 12 and the coding process. Next, the data was organized based on categories and themes to formulate a new MI qualification concept in VE. Second, the research team discussed the coding results, including code simplification and integration between themes. The next step was to present the data for detailed discussion, with the conceptualization of the analysis based on the research questions, as presented in Figure 1.

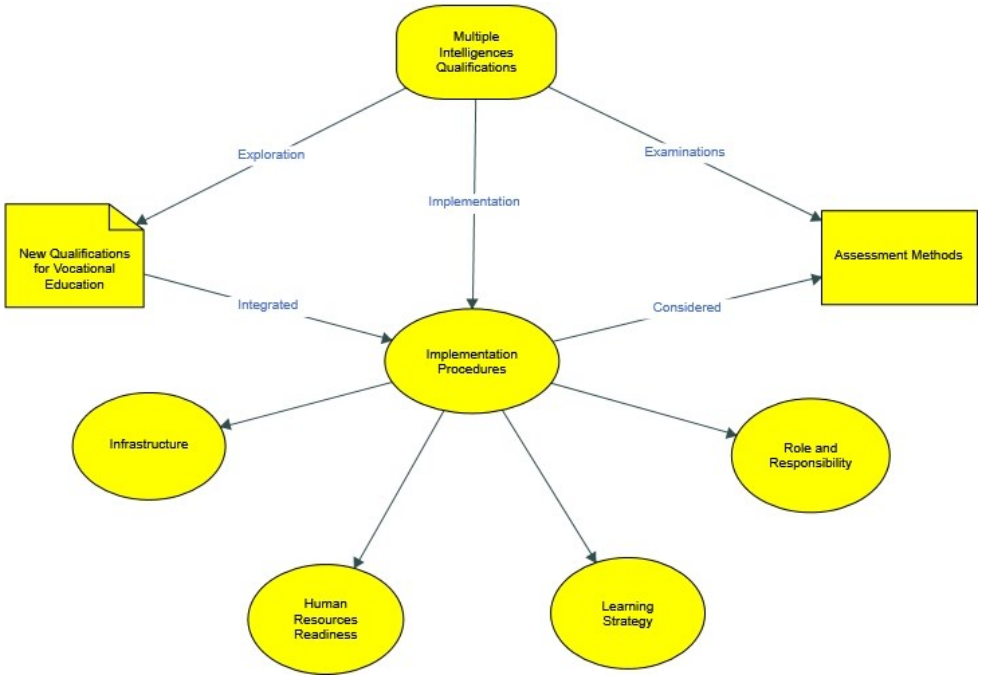

Figure 1. Conceptualization of The Presentation of Data Analyisis in This Study

RESULTS AND DISCUSSION

The results of the analysis we present reflect the conceptual framework we developed, based on methods derived from field findings. This approach was used to facilitate the development of concepts around this theme, ensuring that the conceptual presentation accurately represents the field situation. The research findings indicate that both industry practitioners and vocational education (VE) higher education practitioners are moving toward new qualifications for VE students in the 21st century, focusing on multiple intelligences. These findings are grouped into three main themes: new qualifications, application procedures, and assessment methods.

The themes related to new qualifications, as expressed by key informants, include interpersonal, intrapersonal, logistical, and naturalistic intelligences. The implementation of the recommended procedures involves four key aspects: infrastructure needs, human resource readiness, roles and responsibilities in the implementation process, and learning strategies. Finally, three important assessment methods are identified: meaningful project assessment, peer assessment, and self-assessment.

New Multiple Intelligence Qualifications for Vocational Education

The formulated multiple intelligences provide the foundation and serve as a core reference in their application. The qualifications outlined demonstrate their relevance to current needs and align with the qualifications expected by the workforce for graduates of vocational education (VE). The experience of experts actively involved in industrial processes contributes to the updated qualifications that higher education in this field should provide. As stated by industry practitioners, the new MI qualification in industry represents a shift from the previous one. Previously, existing MI qualifications were not fully utilized, as their full implementation could reduce the efficiency of work processes. Therefore, it is essential to prioritize the elimination of qualifications that no longer align with current developments in the workforce. This will prevent institutions responsible for improving MI from becoming trapped in inefficiencies related to unnecessary aspects.

Figure 2 illustrates the perceptions of industry and VE practitioners, highlighting four key intelligences that VE graduates must possess.

The first intelligence, which is a fundamental qualification for MI, is interpersonal intelligence. This encompasses the ability to adapt, build work networks, demonstrate leadership, and communicate effectively. These four aspects underline the importance of social intelligence, which leads to the ability to interact effectively. *"A person needs to build social interactions and communicate with others effectively* [AKA]." *"Social interaction is one of the keys to success in any field of work, so it is important to provide a foundation for this* [QAR]". VE higher education practitioners emphasize the significance of leadership and effective communication in the 21st-century workforce. *"Preparing human resources to work in various sectors requires effective*

leadership and communication. Both are crucial for managing, making decisions, and conveying work-related information" [AKA]. Meanwhile, industry practitioners stress the importance of HR adaptability and networking or working relationships. *"We are always confronted with constant change, so adapting over time is essential to surviving in the era of disruption in the 21st century. The adaptation process also requires strong networks or working relationships that help update scientific and technological developments"* [QAR].

They are shifting to the second main intelligence, namely intrapersonal intelligence. Industry practitioners agree on three important aspects of intrapersonal intelligence: self-awareness, self-reflection, and emotional intelligence. *"Individuals who are aware of the existing needs for 21st-century jobs in the world of work will be motivated to fulfill these needs"* [HAM*]. "While there is great potential related to the development of science and technology, it is used as a means to achieve these needs"* [GB]. *"Self-reflection helps individuals consciously and critically examine, evaluate, and understand their own thoughts, feelings, and behaviors. It will lead individuals to understand their needs and how to achieve them"* [HAM]. *"Finally, self-control, manifested in emotional intelligence, provides a foundation for individuals to continue working with high stability"* [GB].

Intelligence in logical and rational thinking is another key aspect worth considering from the perspective of higher education practitioners in vocational education (VE). *"Work in the 21st century is certainly faced with tasks of high complexity, so workers often encounter problems"* [MAN]. *"To address this, skills in problem-solving, critical thinking, and systematic thinking are needed"* [HNA]. *"Intelligence in problem-solving is crucial for individuals in adapting to technological developments and solving life's challenges. Possessing problem-solving intelligence stimulates the creation of useful creativity and innovations. This intelligence becomes a valuable asset for individuals to succeed and thrive in an increasingly dynamic and rapidly changing environment"* [MAN*]. "Furthermore, intelligence in systemic thinking and critical thinking enables individuals to understand situations holistically and adopt a broad perspective"* [HNA].

The final intelligence that is an important qualification for VE graduates is the ability to address challenges or issues related to the environment. This intelligence is known as naturalistic intelligence. *"In the 21st century, environmental issues must also be part of the intelligence applied"* [PAJ]. Three classifications of intelligence are important and must be considered for their continued application to help create a sustainable environment. These three include "green skills" [PAJ], "environmental awareness" [MH], and "risk analysis skills" [NW]. "Green skills refer to the ability to carry out conservation through work processes, such as handling waste generated from work or understanding how to use technology to improve efficiency and save energy" [PAJ]. *"Environmental awareness is important as a foundation for thinking about taking*

conservative actions" [MH*]. "Meanwhile, risk analysis plays a role in evaluating all forms of work carried out by individuals in relation to the potential impacts that may result"* [NW].

The current era of the 21st century offers great opportunities for people to be integrated and connected, especially humans. Social interaction between humans is the primary consequence and an important requirement in the workplace [33], [34]. Various studies have shown that the failure of human resources to develop in the world of work is often caused by weak interpersonal skills, which negatively affect their welfare and career paths (Briscoe et al., 2021; Sakinah et al., 2020; Sutiman et al., 2022). Therefore, interpersonal intelligence is a fundamental requirement that VE graduates must possess. These four key aspects of interpersonal intelligence provide essential insights for VE programs to enhance graduates' competitiveness in the workforce. Previous studies have emphasized that what is needed today are aspects related to self-direction to remain adaptive and build broad relationships to thrive in an era of disruption (Hardie et al., 2021). As a result, equipping students with social skills to build communication and work networks effectively has great potential, which can be facilitated by digital technology (Bell, 2010). Furthermore, adaptation—an important part of interpersonal communication—can also be fostered by strengthening digital literacy, enabling students to learn independently using virtual spaces and adapt to new qualifications in VE (Husain, 2023; van Laar et al., 2019, 2020). The potential of digital technology in the 21st century provides a vast space for facilitating human interaction, meeting basic needs without being constrained by time and space (Rojas-Romero et al., 2021; Šimberová et al., 2022). This need is critical, and HR must recognize the potential to be competitive in today's world of work (Rosário & Dias, 2023). Intrapersonal intelligence is the second most important intelligence and is also fundamental for working in the 21st century (He et al., 2023). This need is critical, and HR must recognize the potential to be competitive in today's world of work (Aksu et al., 2023). Understanding one's own needs and potential stimulates strong self-efficacy and motivation for continuous self-development (Moran, 2009). Self-control over the dynamics of one's psychological condition is a challenge to manage well, as work will not be optimal if psychological obstacles remain unaddressed (Okwuduba et al., 2021).

Then, the intelligence encompassed within logical intelligence is crucial for finding holistic and sustainable solutions, as it takes into account the broader impact on the entire system rather than addressing the problem in isolation (Omar, 2021). Critical and systemic thinking are particularly useful for solving complex and interrelated problems, such as environmental challenges, political systems, or organizational issues (Khalid et al., 2020; Osman et al., 2009). By critically understanding and addressing a problem as part of a complex system, individuals can develop more effective and sustainable solutions. Finally, an important consideration is the paradigm related to the green economy and sustainable development. This paradigm has shifted the way we think and approach efforts to create an environmentally friendly economy. As such, intelligence

and skills that focus on environmental sustainability are increasingly essential today. Human resources in the field of vocational education must develop a mindset and intelligence that promote environmental conservation through the work they do.

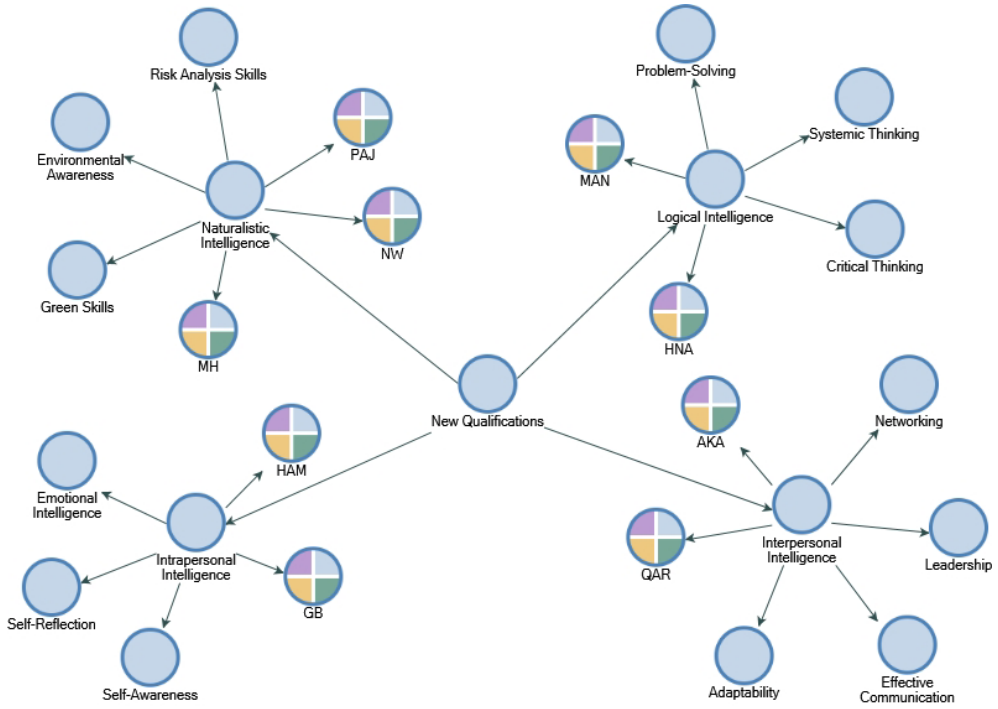

Figure 2. New multiple intelligence qualifications for vocational education

Procedure for Applying New Multiple Intelligence Qualification

This procedure explains the concept of application and the stages involved in applying the new qualifications of multiple intelligences (MI) for vocational education (VE). Perceptions from VE practitioners suggest that four main aspects are important for implementing the new multiple intelligences in VE (see Figure 3). These four aspects are fundamental and relevant for supporting the implementation of multiple intelligences, as identified in the previous discussion. They include: providing infrastructure, ensuring the readiness of human resources (HR), emphasizing roles and responsibilities, and employing effective learning strategies.

Infrastructure plays a crucial role in accommodating and facilitating the implementation of the new dual intelligence qualification. It is also essential to prepare human resources, such as teachers and education staff, to provide effective support in its implementation. Teachers and students—two key participants in the learning process—must have clear roles and responsibilities, which they should carry out with high commitment. Additionally, learning strategies must be designed to maximize the effectiveness and efficiency of applying the new qualifications.

The following details the perceptions of the informants:

Implementing the new qualifications of MI in education and learning requires adequate and relevant infrastructure that aligns with the identified qualifications. As one informant states, *"Infrastructure support is a fundamental aspect that must be prepared first by higher education institutions that will implement it"* [FM]. Another informant adds, *"Many have highlighted that weak intelligence impacts students' weak skills and competencies, as there is insufficient facilitation for stimulating intelligences with the potential to grow and develop"* [HNA].

Two categories of infrastructure are crucial for providing comprehensive support for the growth and development of multiple intelligences. The first category is digital infrastructure, which is now widely recognized for its high effectiveness and efficiency in implementing various key activities. As one informant mentions, *"Digital infrastructure is very familiar today and identified as providing high effectiveness and efficiency in implementing various important activities"* [AKA]. Intrapersonal intelligence, which involves socializing, building adaptability, and networking, greatly benefits from digital technology, enabling social interaction anytime and anywhere [MH]. Similarly, interpersonal intelligence, which relates to emotional awareness, emotional intelligence, and self-reflection, requires media for expression, with digital technology being an excellent facilitator for this [HNA]. *"Logical intelligence, which is crucial for problem-solving, is also significantly supported by digital technology, which offers quality information to help resolve issues"* [MH]. Lastly, natural intelligence, which pertains to environmental conservation, requires green infrastructure. As one informant points out, *"Green infrastructure must have characteristics that support the application of green skills and stimulate students' environmental awareness"* [FM]. *"It is essential that green infrastructure facilitates these objectives while fostering the growth of students' environmental consciousness"* [MN].

The second procedure in implementing the new Multiple Intelligences (MI) in education and learning at Vocational Education (VE) is to emphasize roles and responsibilities in its implementation. *"Roles and responsibilities need to be agreed upon from the start to ensure the smooth implementation of multiple intelligences"* [MH]. *"Roles and responsibilities must be divided fairly based on the abilities and responsibilities of the school community, specifically teachers and students as the implementers of learning"* [FM]. Two main subjects, in this case, play a direct role in implementing the new MI in learning: teachers and students. *"Teachers are an important subject in implementing multiple intelligences in [FM] learning. Teachers have a central role in facilitating and monitoring students during learning"* [MH*]. "Students must be able to learn independently and work as a team with colleagues or classmates [MH]. They learn based on the outline of the topic presented by the teacher, and in order to address the topic, they are responsible for exploring it further"* [FM].

The next procedure relates to the readiness of teachers and students who will be directly involved in implementing the new MI in learning. The new qualifications for MI in VE are not yet fully understood by the teachers who will implement them, so training is necessary before implementation begins to update and improve their capabilities. *"In this case, of course, the teachers are still too inexperienced to apply the new multiple intelligence qualifications that have been formulated. Therefore, their capabilities need to be enhanced through relevant training on new multiple intelligences"* [HNA]. Furthermore, to facilitate implementation, students also need to improve their literacy regarding the new MI qualifications they must achieve, including how to achieve them. *"Teachers are merely facilitators, while the dominance in learning lies with the students, so literacy needs to be enhanced before implementing new multiple intelligences"* [MAN].

Finally, strategies need to be carefully thought out by education and learning providers in an effort to successfully implement the new multiple intelligences in vocational education (VE). In this case, VE higher education practitioners outline three important strategies oriented towards case studies, teamwork, and self-regulated learning. *"Case studies will develop students' scientific abilities in investigating and uncovering problems and solutions needed in the workplace"* [MN]. *"21st-century jobs are dominated by roles that prioritize teamwork, so teamwork must be prioritized in determining learning strategies"* [HNA]. *"The variety of knowledge in virtual space provides flexibility for students to learn independently, without being constrained by time and place"* [FM]. *"The teacher's task is to spark questions and topics that become material for in-depth exploration by students"* [MAN].

The availability of relevant infrastructure to support student competency achievement is an essential responsibility of educational institutions. As infrastructure continues to evolve, adaptation to new developments is necessary. In the 21st century, various studies recommend the digitalization of infrastructure (Chan et al., 2022; Kashada et al., 2018; Rujira et al., 2020). The fundamental reason is that learning materials in any sector are increasingly digitized and can be easily accessed (Chan et al., 2022). This convenience also provides an opportunity to reduce budget costs for infrastructure allocation, enabling cost savings (Kashada et al., 2018). However, several studies also caution that digital infrastructure can pose a threat to student learning outcomes if not managed properly (Chetty et al., 2018; Mutohhari et al., 2021). Increasing awareness and digital literacy among students is crucial to achieving new qualifications in multiple intelligences. Another important consideration is that the interactions between learning and subject implementation must be clearly defined, based on roles and responsibilities. Often, unclear roles hinder optimal learning outcomes (Astuti et al., 2022; Mutohhari et al., 2021). 21st-century learning should be student-centered, where teachers act primarily as facilitators. However, to facilitate the implementation of learning based on MI's

new qualifications, teachers must first receive training. A teacher's lack of understanding can have serious consequences, particularly in the fundamental aspects of material topics that must be taught to students (Wang et al., 2021).

Furthermore, research warns that students also need increased literacy related to new intelligence to be achieved (Chetty et al., 2018). These efforts must also be complemented and supported by an appropriate implementation strategy. Learning in the 21st century should be oriented towards investigating and disclosing cases originating from issues developing in the real world (Malik, 2018). Teamwork must also be included in the learning strategy framework (van Laar et al., 2020). Apart from this, the strategy must lead to self-regulated learning, which emphasizes independent learning by students. This strategy has great potential in supporting learning, considering its flexibility, facilitated by digital technology, which is increasingly familiar to students (Yilmaz et al., 2020).

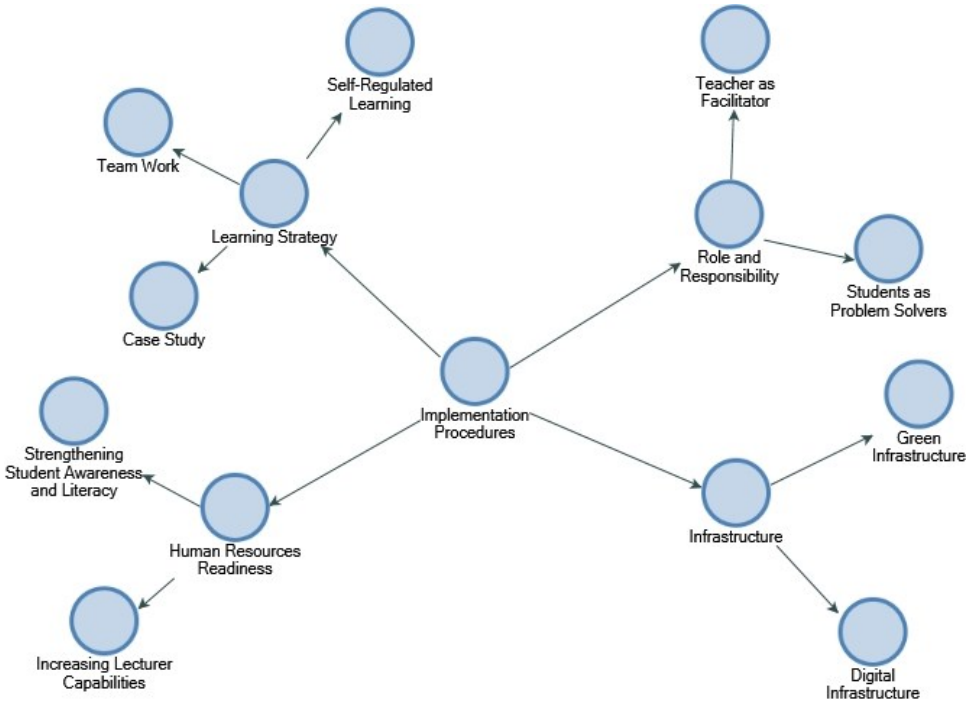

Figure 3. Procedure for implementation new multiple intelligences qualifications

Assements of new qualifications multiple intelligence

The new multiple intelligences (MI) framework must include essential aspects and parameters in its assessment. This section explains several important aspects and parameters for assessing the extent to which the new MI can be applied and provide results that align with 21st-century job qualifications. A combination of perceptions from vocational education (VE) practitioners and industry practitioners was gathered to formulate this assessment. Figure 4 illustrates three important aspects of assessing new MI in VE students.

Self-assessment is a fundamental aspect of assessment for students regarding the extent of their perceived understanding. Through this assessment, students must identify their personal progress. It also aims to increase students' sensitivity to their learning needs and achievements based on their orientation and vision. *"Assessment of multiple intelligences must be oriented towards self-understanding, focusing on the progress of achieving one's goals and vision" [HNA]. "Every student has needs and targets that must be achieved in learning, so they must understand the extent of their progress through a self-assessment mechanism"* [FM]. *"Self-assessment is valuable for increasing self-awareness and motivation in learning"* [AKA].

Next, teamwork, which is a crucial component of MI-based learning, requires peer assessment. Peer assessment emphasizes that students are responsible for the progress achieved by their group or peers. It can improve students' skills in analyzing and evaluating the progress made by their work teams. Additionally, this assessment can increase self-confidence in providing feedback and learning from one another. *"Peer assessment is an important part of the responsibility that students must take to evaluate the performance of their peers or work teams"* [HNA]. *"Peer assessment allows for reflection and improvement of teamwork, which positively impacts learning outcomes"* [MH]. *"Peer assessment fosters flexibility in students' thinking by encouraging them to give and receive feedback"* [FM].

Finally, the meaningfulness of the resulting project is the primary aspect considered when assessing the level of achievement of new MI in VE. A meaningful project is one that is highly relevant to the career and life of each student. A project is considered meaningful if it also benefits others, so it is not only the students who enjoy it. In addition, efficiency and effectiveness are essential for demonstrating the meaningfulness of a project. *"The project's relevance to the student's desired career path is important to assess"* [HAM]. *"Career suitability with the resulting project provides valuable experience"* [GB]. *"A meaningful project must meet criteria that ensure its benefits are felt by others, such as addressing problems faced by specific communities"* [PAJ]. *"Efficiency and effectiveness in the work results are important markers of the meaningfulness of projects resulting from learning"* [QAR].

Self-assessment is crucial in the 21st century because it accommodates significant changes in today's work and learning environments (Trilling & Fadel, 2009). By conducting self-assessments, individuals can identify their strengths and weaknesses in learning, which allows them to direct their efforts and achieve better results. Individuals who conduct regular self-assessments can quickly evaluate their abilities and adapt to changes around them (Turysbayeva et al., 2023). In addition, self-assessment helps develop personal responsibility for learning and performance (Shatri et al., 2022). Individuals skilled in self-assessment are more likely to take the initiative to improve themselves, plan learning goals, and manage time and resources more effectively (Turysbayeva et al., 2023). Peer assessment is also important for effectively

transmitting performance, progress, or learning outcomes between colleagues or fellow participants in a learning or work context (Adesina et al., 2023). Peer assessment encourages students or team members to collaborate, share knowledge, and help others understand material or complete assignments (Cheong et al., 2023). When assessing peers' performance, individuals also have the opportunity to reflect on their own performance. This process helps increase self-awareness and recognize strengths as well as areas that need improvement (Li et al., 2020). Finally, learning to create meaningful projects has many benefits in the 21st century, as the demands of both the world of work and the educational environment continue to evolve and grow more complex (Yunus et al., 2021). Through meaningful projects, students can develop practical skills essential for success in the workforce, such as research abilities, data analysis, problem-solving, leadership, and team collaboration (Miller & Konstantinou, 2022). Thus, career paths that are relevant to projects in learning also have the potential to be improved well (Matilainen et al., 2021).

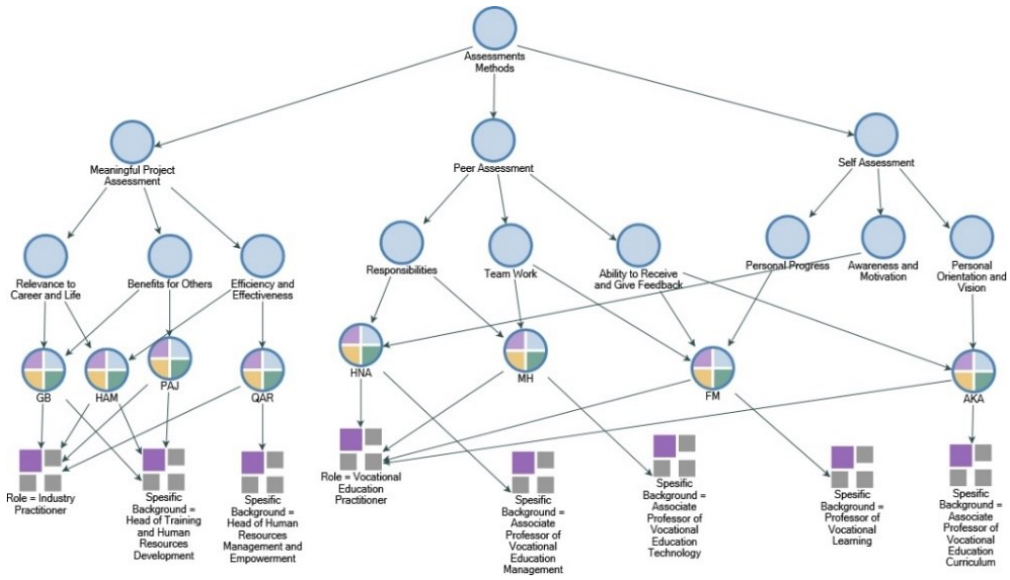

Figure 4. Assesments of new qualifications multiple intelligences

CONCLUSION

Work developments in the 21st century have significantly changed the implementation of education and learning in vocational education (VE) sector universities. One of the changes is the shift in the multiple intelligence qualifications required by current jobs. According to industry practitioners and VE educators, the sector now identifies four main types of multiple intelligences: interpersonal, intrapersonal, logical, and naturalistic intelligence. These four intelligences form an important foundation that is interconnected, giving rise to other intelligences and key skills necessary to adapt to the evolving demands of work.

The key findings of this research include the identification of new multiple intelligences, the implementation procedures, and the assessment aspects involved. Building these four intelligences requires infrastructure support, primarily through digital infrastructure. It also emphasizes the role of responsibility among those involved in learning, the readiness of teachers and students before learning, and the determination of learning strategies that encourage student independence in exploring the subject matter in depth.

These new intelligences are assessed through three main aspects: self-assessment, peer assessment, and meaningful project assessment. These findings offer important recommendations for education and learning administrators in vocational education to apply the four new multiple intelligences optimally, aligning them with current job requirements. The synergy between higher education institutions, the world of work, and other stakeholders is also crucial to strengthening and supporting the implementation of these new dual intelligences.

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