The Learning for the Future Workforce Through Digital Innovation

Vongsa Laovoravit[1*], Watana Manon[2], Wilawan Inchamnan[3], and Banyapon Poolsawas[4]

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Abstract

This qualitative research aimed to 1) specify virtual reality technology's quality characteristics and reinforcement factors in transformative learning of higher education that supports students' learning ability and 2) understand virtual reality technology's role in shaping attitude and behavior based on pedagogical values through intrinsic motivation that enhances students' learning performance and satisfaction. The data were gathered and utilized using focus group discussions and observation methods from 36 undergraduate students in their second and third year at the College of Aviation Development and Training, Dhurakij Pundit University, who all were key informants. The result indicated that applying virtual reality technology as a tool to bridge new educational challenges in response to the Thai higher education reform policy to leverage the country's workforce competency level helps researchers understand the importance of positive reinforcement in 3 areas that are 1) stimulation and motivation for learning 2) promoting understanding during learning and 3) building confidence in the learning outcomes. While digital innovation plays an essential role in shaping the future of education, ensuring that new teaching tools are used effectively will require a new generation of educators who understand the importance of students' connection in the classroom. Moreover, the research results also help deepen the researchers' understanding of the role of digital technology innovation in increasing students' perceptions. The pragmatic quality and the hedonic quality indicators were found to enhance the linkages of the learning transformation process towards the learners' development of behavior, attitudes, and beliefs that promote their competencies to a higher level.

Keywords: Future Workforce, Digital Innovation, Virtual Reality Technology

[1] College of Aviation Development and Training, Dhurakij Pundit University, Bangkok, Thailand, 10210 *Corresponding author email: vongsa.lao@dpu.ac.th

[2] College of Aviation Development and Training, Dhurakij Pundit University, Bangkok, Thailand, 10210 Email: watana.man@dpu.ac.th

[3] College of Creative Design and Entertainment Technology, Dhurakij Pundit University, Bangkok, Thailand, 10210 Thailand, Email: wilawan.inn@dpu.ac.th

[4] College of Creative Design and Entertainment Technology, Dhurakij Pundit University, Bangkok, Thailand, 10210 Thailand, Email: banyapon.poo@dpu.ac.th

Introduction

In the current era, where globalization and advancements in artificial intelligence are reshaping labor market demands, the rapid development of digital technology necessitates sustained adaptation across all industries, including education (Gudoniene & Rutkauskiene, 2019). New technologies are replacing many tasks traditionally performed by humans, making it essential for educational systems to evolve. Following the Thai government's commitment to driving the nation toward "Thailand 4.0," a value-based economy focused on innovation, technology, and creative thinking, with social and environmental sustainability at its core to ensure that the future workforce can thrive in this dynamic environment. Thailand's education system must undergo significant refinement, particularly at the curriculum level, to prepare students with the necessary skills to sustain life in a rapidly changing world and contribute to transformative change. Despite increased educational opportunities, the overall quality of education in Thailand remains low, as evidenced by the country's poor performance in the 2022 PISA (Programme for International Student Assessment) scores. Thai students achieved their lowest results since first participating in PISA in 2001, underperforming in reading, mathematics, science, and other critical areas. These results highlight the need for a reformed higher education system that aligns with the labor market needs and prepares students for future employment by developing essential competencies.

Moreover, the OECD's "Education at a Glance" report emphasizes the importance of aligning higher education outcomes with labor market demands. Thailand must reform its higher education system to build resilience to global changes and meet the workforce demands outlined in the Thailand 4.0 policy. This research aims to raise awareness among policymakers, researchers, and educators to ensure that Thai higher education systems are future-ready. It involves not only preparing for digital transformation in pedagogy by personalizing learning experiences, improving student engagement, and enhancing essential career skills but also fostering intrinsic motivation in university students. By cultivating genuine interest and curiosity in the content studied, students are more likely to engage deeply in self-directed learning (SDL) and achieve better learning outcomes.

Furthermore, the study emphasizes the need to improve teachers' competencies in managing classroom activities aligned with Education 4.0 principles, including integrating digital tools and innovations, for example, virtual reality augmented reality and mixed reality, to build teaching and learning processes supporting future career readiness and employability. By doing so, Thai graduates will be better equipped with academic knowledge, occupational-specific skills, and attitudes necessary to meet the 21st-century labor market demands, thereby contributing to the nation's stability, prosperity, and sustainability. While much research has focused on improving student learning quality in various contexts, there remains a gap in understanding the relationship between students' perceptions of learning environments, educational innovation in teaching approaches, competency, and learning outcomes.

Research Objectives

1. To specify virtual reality technology's quality characteristics and reinforcement factors in transformative learning of higher education that supports students' learning ability.
2. To understand virtual reality technology's role in shaping attitude and behavior based on pedagogical values through intrinsic motivation that enhances students' learning performance and satisfaction.

Literature review

Innovation Concept

Everette M. Roger, as conceptualized in his study of attitudes and the acceptance of innovations, detailed this in his book Diffusion of Innovations. Innovation refers to new processes, methods, or inventions that have not been previously utilized. Alternatively, it may refer to existing methods or inventions that require modernization through improvements or adaptations. Implementing such innovations is intended to enhance operational efficiency and produce the expected outcomes or behaviors (Rogers, 1983). In educational institutions, innovation arises from

introducing new changes to improve and enhance teaching and learning processes. "Educational Innovation" encompasses inventions, models, methods, or new processes designed and implemented to address educational challenges or improve teaching practices. The primary purpose is to reinforce the efficiency of existing methods, which aligns with Thomas P. Hughes' concept in The Evolution of Large Technological Systems. Hughes describes innovation as introducing new or progressively improved methods, which are expanded through experimentation or application in real-world situations. It leads to changes in values, beliefs, and behaviors that ultimately benefit society (Hughes, 1989). The types of educational innovations specified in the National Education Act B.E. 2542 (1999) categorize educational technology and innovation based on their application across various domains into five types: 1) Curriculum innovation, 2) Instructional innovation, 3) Teaching media innovation, 4) Learning Assessment innovation, and 5) Education Management innovation. This research falls under the category of instructional innovation, which refers to new processes, products, or approaches to learning experience or assessment that deliver new concepts, methods, or processes designed in education that can be applied to address teaching and learning challenges and enhance student learning outcomes more effectively.

Future Workforce

The term "future workforce" denotes the developing talent that educational institutions strive to cultivate, focusing on equipping individuals with the competencies, essential skills, and abilities needed to match the demands of the 21st-century labor market. This preparation involves aligning educational curricula by expanding experiential learning opportunities and providing new learning formats for modern industries' needs. It also emphasizes technical abilities, critical thinking, problem-solving, and access to career-oriented experiences for students that cross the gap between theoretical knowledge and real-world expectations. In the new millennium, the role of universities within the higher education system has grown increasingly complex and challenging. This shift is primarily driven by emerging scientific research to deepen the understanding of how people learn. Such research plays a crucial role in shaping educational

practices and is essential for ensuring and justifying the quality and relevance of higher education in a rapidly evolving global landscape (Mamatha, 2021). Therefore, the future of learning must emphasize awareness of the learning process by bridging the gap between theory and practice and between knowing and doing. It asserts that theory and practice should be integrated to create meaningful and compelling learning experiences. Through practice, individuals engage directly with their experiences, which allows them to develop and apply essential skills such as organizing thoughts, reflecting on actions, solving problems, and making informed decisions. This approach is crucial for cultivating new skills and effectively implementing newly acquired ideas in real-world contexts.

Transformative Learning

Transformative Learning is characterized by a process in which individuals undergo a significant shift in their perspective, influenced by deeply ingrained patterns of thought and interpretation as a guideline to action. This shift often involves re-evaluating existing values and beliefs, leading to a profound change in how they view the world. It comprises habits of mind and meaning perspectives, which lead to a perspective transformation congruent to research studied by Mezirow, J. (1991) in the late 20th century; his research studied a theory of adult learning by making meaning of their experiences that emphasizes how individuals change their perspectives and worldviews. This type of Learning goes beyond simply acquiring new knowledge; it involves a fundamental shift in how students perceive themselves and their surroundings. Jack Mezirow developed the concept focusing on how critical aspects of transformative Learning include:

- Critical Reflection: Learners critically examine their existing beliefs, assumptions, and values, often prompted by a "disorienting dilemma" or a situation that challenges their current worldview.
- Rational Discourse: Engaging in dialogue allows learners to explore different perspectives and question their assumptions.

- Personal Experience: Learners draw on their experiences to reflect and learn, integrating new insights into their worldview.
- Action and Application: The transformative learning process often changes behavior and actions as learners apply their new perspectives to real-world situations.

Intrinsic Motivation

As Ryan et al. (1985) described, intrinsic motivation is driven by internal factors. It arises when individuals engage in activities purely for the enjoyment or fulfillment they derive from them. This motivation is often linked to significant activities that align with one's values, such as personal growth, creativity, and a sense of purpose. Such intrinsic factors lead to greater engagement and satisfaction. Personal satisfaction is a potent motivator, inspiring individuals to feel content and fulfilled. Individuals tend to persist through challenges and setbacks more effectively when intrinsically motivated. This type of motivation often leads to deep immersion and enjoyment in an activity, known as flow, where the focus is on the inherent satisfaction of the task rather than any external rewards. Ryan et al. (2000) further explained that when intrinsically motivated, a person is moved to act for the fun, challenge, or novelty by internal rewards such as personal satisfaction, interest, or task enjoyment rather than because of external products, pressures, or rewards.

Tacit Knowledge

The concept of tacit knowledge was notably introduced and popularized by Michael Polanyi, a Hungarian-British philosopher. Polanyi first articulated the idea of tacit knowledge in his work "Personal Knowledge: Towards a Post-Critical Philosophy," published in 1958, and later in his influential 1966 book "The Tacit Dimension," which refers to knowledge that is personal, context-specific, and often acquired through experience. It is the knowledge that individuals carry in their minds, and it is hard to formalize or communicate because it includes insights, intuitions, and skills often not consciously known by the person holding them. For example, riding a bike or

speaking a language involves tacit knowledge learned through practice rather than explicit instruction.

Self-Efficacy

Self-efficacy pertains to an individual's belief in their capacity to achieve success t in a specific context. The concept was introduced by Albert Bandura, a renowned Canadian-American psychologist and professor at Stanford University. Bandura (1977) described self-efficacy as a person's assessment of their capability to perform actions necessary to manage anticipated challenges when facing difficulties. Do you feel confident in your ability to rise and accomplish your goal, or do you give up in defeat? Do you doubt your abilities to grow and overcome the challenges life presents? These questions reflect the essence of self-efficacy and its impact on personal growth and resilience. Bandura (1999) emphasized that self-efficacy reflects confidence in one's ability to control motivation, behavior, and the social environment. These cognitive self-evaluations influence all aspects of human experience, including the goals individuals pursue, the effort they invest in achieving those goals, and the likelihood of reaching desired levels of behavioral performance, which is congruent with Seligman (1998) mentioned that the state you are in significantly affects how you perceive your self-efficacy. For instance, depression can lower confidence in your abilities, while positive emotions can enhance your perceived skills. Stress and tension are often interpreted as indicators of vulnerability to poor performance, further influencing self-efficacy judgments. The fundamental principle of the self-efficacy theory is that individuals' beliefs in their ability to achieve desired outcomes through their actions play a crucial role that was aligned with Maddux (2002), who stated that self-efficacy determines what goals we pursue, how to accomplish those goals, and how we reflect upon our performance when facing challenges.

Conceptual Framework

After reviewing the concepts related to learning through virtual reality technology, the researcher established a conceptual framework illustrated in Figure 1.

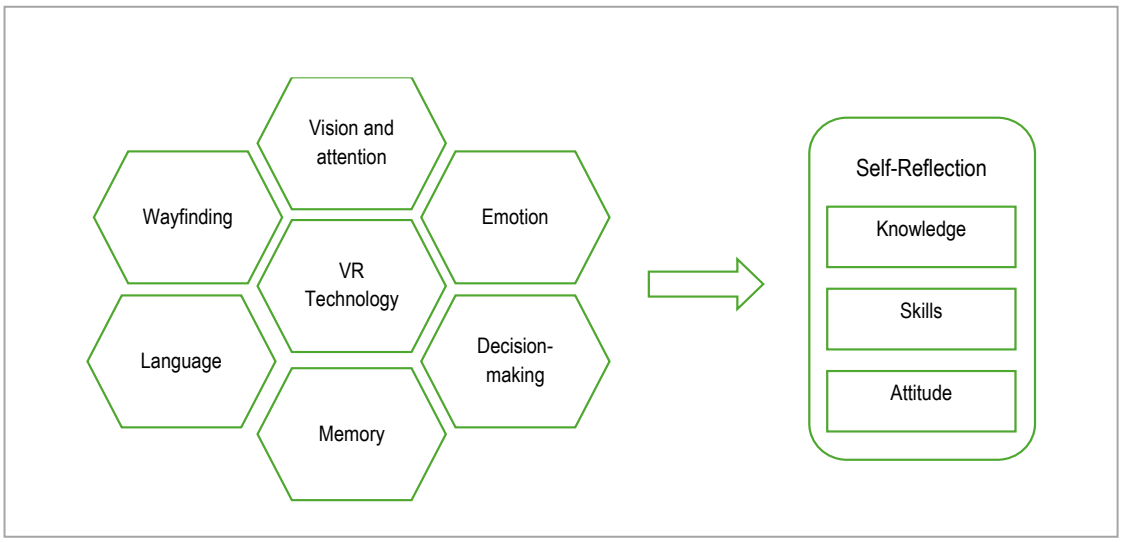

Figure 1: Education transmission model for the 21st century using digital technology.

Methodology

1. Key informants

This qualitative research focused on the effectiveness of virtual experience based on its characteristics and reinforcement factors. It was conducted on all thirty-six Airline Business students of the College of Aviation Development and Training, Dhurakij Pundit University, currently in their second and third years. All thirty-six students were key informants representing the entire population of virtual reality users who registered for the AV339 In-Flight Safety and Emergency Course, which related to pre-flight preparation, including inspection procedures of the emergency and medical equipment. The course also equips the students with the in-flight safety regulations, maintaining flight security, managing potential emergency incidents during flights, evacuating passengers from the aircraft on land and water, and survival strategies in emergencies.

2. Data Collection

2.1 The primary information source was gathered through the three qualitative methods: focus group discussion, deep listening, and observation to describe each key informant's experience with all the thirty-six students in the areas that contributed to the research objectives.

2.2 The secondary data were gathered through content analysis of research studies, utilizing articles in both Thai and English obtained from academic databases such as Scopus, TCI (Thailand Citation Index), and Google Scholar. The analysis examined virtual reality technology in teaching and learning, emphasizing experiential learning through practical, hands-on activities.

3. Data Analysis

The researchers analyzed data through data collection mainly derived from the focus group discussions and behavioral observations by dividing the discussions into three groups, each consisting of twelve key informants. Data collection began by allowing students to express their opinions and feelings through reflective thinking based on their experiences. The researchers guide the discussion using open-ended questions and encourage the group to talk to itself rather than to the researchers. The researcher examined the results and behavioral data by actively engaging with the information through attentive listening and note-taking during the focus group discussions. Observational notes were also recorded while students interacted within the simulated virtual environment and participated in the discussions. This approach allowed the researchers to fully immerse themselves in the context and interpret the details comprehensively before segmenting the findings into components aligned with the research objectives.

Results

Following the intrinsically motivated criteria, researchers explored the students' preferences and engagement based on the specific quality characteristics and favorable reinforcement on the use of virtual reality technology as the learning media to foster the student's learning ability associated with its roles in shaping the students' aspects in both attitude and behavior. It found that experience-based learning helps transform educational content in airline

safety procedures that allow learners to see and interact with it to comprehend the information effectively; when students feel a sense of autonomy in decision-making and competence in their performance, they are more likely to be inherently motivated. The immersive technology helps extend Airline Business students' learning ability to support knowledge (K), skills (S), and attitudes (A), which enhances their learning performance and satisfaction. The study also found that the transition of the learning process required a powerful way to shift the classroom environment in terms of how the students gave meanings and values to what they learned while benefitting from the designed classroom strategy to increase their motivation, engagement, and influences learning ability in three areas as exhibited in Table 1-2 that aligned with the competency achievement of future workforce.

Table 1: The three areas where virtual reality technology influences the students' learning ability

The areas where students' learning ability is influenced	**The quality characteristics**	**The virtual reality technology measures**	**The reinforcement indicators of virtual reality technology**
Stimulation and motivation for learning	Task-Oriented Quality	Effectiveness refers to the virtual experience that delivers simplicity and accuracy to learners.	Pragmatic Indicators - Perspicuity refers to the students' feeling that it is straightforward to get familiar with technology and easy to learn and comprehend.
Promoting understanding during learning	Task-Oriented Quality	Efficiency refers to the time learners take to learn and complete	Pragmatic Indicators - Efficiency refers to the students' feeling that the

		the task in the virtual Environment.	interaction is efficient and fast. - Dependability refers to the user feeling in control of their interaction.
Building confidence in the learning outcomes	Non-Task-Oriented Quality	Satisfaction refers to the learners' feelings about their virtual experience.	Hedonic Indicators - Attractiveness refers to appeal. - Stimulation refers to enjoyment. - Novelty refers to challenging, innovative, and creative.

Table 2: Assessing students' experience metrics on the aspects in the three learning domain areas

The areas where students' learning ability is influenced	**Metrics on how virtual reality technology enhances students' learning achievement**	**Competency**	**Learning Domains**	**Related Sub-domains**
Stimulation and motivation for learning	Attitudinal Aspect - asking students to do self-reports.	Knowledge (K)	Cognitive Domain	- Remember - Understand - Apply - Analyze

	- having a discussion using focus groups.			- Evaluate
Promoting understanding during learning	Behavioral Aspect - observe students' actions regarding task completion and the time needed to complete the task. - having a discussion using focus groups.	Skills (S)	Psychomotor Domain	- Perception - Set - Guide Response - Mechanism - Complex Overt Response
1. Building confidence in the learning outcomes	Attitudinal Aspect - asking students to do self-reports. - having a discussion using focus groups.	Attitude (A)	Affective Domain	- Receiving - Responding - Valuing - Organizing - Characterizing

Furthermore, the analysis of data gathered from group discussions with thirty-six key informants on their experiences of virtual reality (VR) technology to enhance the efficiency of learning has provided the researcher with clarity and understanding of the conditions influencing the perception of VR users through examining learner feedback on behavior, attitudes, and beliefs. The researcher developed knowledge categorized into two quality indicators: 1) practical quality indicators, measured by attractiveness, clarity, efficiency, and reliability, and 2) hedonic quality

indicators, measured by stimulation and novelty. These two quality indicators are interconnected with positive or negative conditions of the learners' experiences. Ideally, virtual reality improves cognitive function and retains students' memory, which involves learning and recalling motor skills. It is the ability to reproduce a particular movement or sequence without conscious thought, acquired through repetition and practice rather than passively obtaining the information through lectures in a physical classroom environment. Immersive technology helps create realistic simulated environments, which offers a new learning method that students previously could not experience. Besides, it supports essential concepts that will make a difference in education (Mills et al., 2019). The researchers found the two interconnected processes in learning are sensation and perception. Sensation is the input mechanism through which learners gather information from their surroundings via sensory receptors, such as vision, hearing, taste, smell, touch, and kinesthetic senses (balance). On the other hand, perception focuses on selecting and interpreting this environmental information. It describes how the brain processes, organizes and interprets sensory inputs. This concept aligns with Dollard and Miller's (1950) learning mechanisms theory, emphasizing the role of drives and habits in learning. The conformity was also aligned with Robert Glaser, a distinguished American educator and educational psychology scholar at the University of Pittsburgh, who made notable contributions to learning and instructional theories. In his research, Training Research and Education, Glaser Ed. (1962) explored the application of testing and technology in education and training, demonstrating how technology adapts to student behavior by integrating knowledge and skills. This approach enhances the learning process by improving behavioral orientation, maximizing knowledge acquisition and retention, and increasing student motivation, collectively enhancing learning abilities. Glaser (1962) also highlighted in Programmed Instruction — A Behavioral View the effectiveness of programmed materials in teaching, which surpassed traditional textbook or lecture-based methods in facilitating student learning. In recent research, this new teaching pedagogy has inspired a positive change that motivates students to acquire the required knowledge and enhances skills during practice in a virtual environment while gaining a unique learning experience (Ngiik et al., 2019). The findings suggest that when applying educational innovations, it is essential to consider those that positively

reinforce the learners' perception while avoiding approaches that could negatively impact learners' attitudes and behavior, as illustrated in tables 3-5, which present the initial analysis of the data collected from students' viewpoints based on the influencing areas that affect students' experience of attitude and behavior.

Table 3: The students' experience in stimulation and motivation for learning

Competency Standard	**Results of the attitudinal aspect according to the student's experience metric**
Knowledge	- Virtual Reality technology helps motivate learning and practicing aviation safety principles according to flight attendants' duties, making it more engaging. - The three-dimensional images in the simulated environment stimulate learners to feel a sense of participation as if they were actually on a real airplane. - Students feel alert and eager to learn continuously in simulated situations. - Students feel that time passes quickly while in the virtual world.

Table 4: The students' experience in promoting understanding during learning

Competency Standard	**Results of the behavioral aspect according to the student's experience metric**
Skills	- Learning and memorization become more manageable for students through tactile sensations from visual observation and bodily movements or organs. - The bodily movements or organs' responsiveness within the virtual environment helps students' brains memorize information more accurately

than traditional learning methods, such as reading from textbooks or listening to lectures.

- The bodily movements or organs' responsiveness within the virtual environment helps the brain retain information longer than just sitting and listening to lectures.
- Virtual interaction within the virtual reality environment promotes perception and mindfulness. It enhances concentration, supporting learners' deeper understanding compared to just sitting and listening to lectures or watching videos in the classroom.
- Simulated emergencies help learners feel safe and alleviate concerns about dangerous situations or the risk of personal injury.
- Simulated emergencies help students learn from their mistakes without worrying about actual accident situations.

Table 5: The students' experience in building confidence in the learning outcomes

Competency Standard	**Results of the attitudinal aspect according to the student's experience metric**
Attitude	- Students agree that the experiences gained from practical training within the virtual reality environment impact their learning outcomes, which align with the objectives of functional competency to improve their aviation safety ability. - Students agree that virtual reality technology will support the effectiveness of their competency in following airlines' safety standard operation procedures even after completing their studies.

- Students strongly agree that virtual reality technology is a suitable learning tool for supporting their professional skills as flight attendants in the area of in-flight safety.

All the key formants agreed that the concept of merging virtual reality with the three components of learning domains: cognitive, affective, and psychomotor, was influential in the classroom that offered undergraduate students real-life simulation-based learning, were appropriately developed interaction in practical activity, which consistent with (Miettinen, Reijo, 2000), who explained that the approach, or movement, has a unique nature as a cognitive enterprise and it can also be seen as a kind of ideology needed to confront the diverse challenges of higher education.

Besides, this research's concept of learning domains is closely associated with the four stages outlined in Bandura's Social Learning Theory: attention, retention, reproduction, and motivation. Bandura (1999) described that new behaviors emerge when learners 1) place value on the activities they observe in others and 2) feel motivated to apply what they have learned to alter their behavior. This idea aligns with the findings of Abele and Spunk (2009) and Raven and Stephenson (2001), which are grounded in Bandura's self-efficacy theory.

Conclusion

Virtual reality technology is considered an educational innovation that aligns with a new way of learning pedagogy and responding to 21st-century changes. Ideally, it is more effective in enhancing cognitive abilities and improving students' memory retention than traditional lecture-based learning in a conventional classroom setting. The technology allows students to choose their active learning experiences and fulfill them with exciting, immersive experiences that support their learning ability and long-term memory. This research applied virtual reality technology to the AV339 In-flight Safety and Emergency Procedures course, revealing factors that enhance students' learning experiences, which emphasize a student-centered approach through active

learning that integrates the physical and virtual worlds and is well-suited for enhancing classroom activities, enhancing learners' perceptions through sensory stimulation within simulated environments. It is an educational innovation that plays a huge role in education. It allows students to experience hands-on learning through virtual interaction and rotating objects at every angle with the VR controllers controlled and operated by the students' hands (Ochoa, 2016) while recalling reflective thinking, enabling students to develop new knowledge, skills, and attitudes to achieve expected learning outcomes from hands-on practice under various simulated in-flight emergency scenarios. Still, virtual reality technology also stimulates cognitive development and fosters positive attitudes toward learning, which is particularly beneficial for subjects perceived as uninteresting. Modern education should thus focus on learning processes that support the development of learners, enabling them to apply acquired knowledge, job-related skills, and career attitudes in practical contexts and put into experiential journeys to achieve their future roles, duties, and responsibilities effectively. However, the adoption of virtual reality technology in education must be considered based on teachers' perceptions of the effectiveness of such educational innovation so that the development of policies to encourage transforming traditional education into a transformative one with digital technology can be recognized and created in favorable of academic environment (Gachago, 2013)

Discussion

Amidst the rapidly evolving global landscape, marked by economic, technological, social, and environmental changes and heightened economic competition, the demand for a highly competent workforce has intensified. Human capital is vital for national development and the primary driver of a country's progress. In response, Thailand's higher education reform policy emphasizes producing and developing a skilled workforce capable of meeting these demands. Higher education institutions must strategically shift their teaching models towards innovative digital learning pedagogy. However, selecting an educational reform strategy driven by digital technology innovation necessitates considering a learning environment that supports three key aspects:

1) Enhancing students' perception through multisensory interaction promotes the development of knowledge, skills, and attitudes aligned with activity objectives.

2) Facilitating long-term memory retention through hands-on practice, unlike traditional lecture-based or video-based sessions.

3) Stimulating reflective thinking by engaging students in experiential learning activities that allow them to reach their highest learning potential.

Experiential learning, rooted in the theories of educational pioneers like David Kolb and John Dewey, emphasizes the importance of learning by doing, a process related to procedural memory, which involves recalling motor skills acquired through repetition and practice. Miettinen (2020) described it as a form of memory, the ability to regenerate a particular movement or sequence without conscious thought acquired through repetition and practice. This type of learning, often called muscle memory, is frequently associated with sports, playing musical instruments, or typing on a keyboard. While experiential learning is gaining popularity among higher education students, this study leverages virtual reality technology to address new educational challenges. Virtual reality offers students immersive experiences, enabling them to engage in virtual interactions and explore the meaning of content beyond passive listening in traditional classrooms. The research identifies two critical benefits of virtual reality experiences for students: first, it facilitates the development of analytical thinking and reflective practice through self-perception, and second, it helps students organize their thoughts by processing information using cognitive functions, integrating new data with their existing knowledge, congruence with findings by Lizzio et al. (2022), which reveal that immersive virtual reality simulations increase students' interest and self-efficacy, enhance their perspectives on the value of what they learn, and improve attitudes toward career aspirations. The research underscores the importance of the classroom environment and learning activities in fostering engagement, motivation, and behavioral changes that align with the desired attributes specific to each profession, thereby meeting future labor market demands. This research has focused on various contexts to improve the quality of student learning. It provides a deeper understanding of how the classroom environment and learning activities are critical in

fostering engagement and motivation that lead to behavioral changes from experiential learning aligned with the desired attributes specific to each profession that meet future labor market demands in alignment with the recent research by Makransky et al. (2020), whose study disclosed that an immersive virtual reality simulation increases students' interest and self-efficacy and helps raise their perspective to value what they learned from the lesson, and improving their attitudes toward career aspirations.

Moreover, the six mind dimensions in the research framework include vision and attention, wayfinding, memory, language, emotion, and decision-making. Focusing on different cognitive processes that shape how students perceive and interact with educational content highlights the need for educators to address these diverse cognitive aspects to create a successful learning experience that enhances learning pedagogy by integrating digital innovation as a learning tool to ensure students' competencies development necessary for future career readiness. Here is an interpretation of what these six minds could represent:

1) **Vision and attention** play vital roles in students' virtual interaction. Attention-related issues include colors, contrasts, sizes of visual scenes, and audible sound features. These elements directly interface with students' virtual interaction, demanding full engagement and attention.

2) **Wayfinding** is a lifeline for self-directed learning (SLD) in the virtual environment. The students can navigate and understand their location, interaction, and response in the simulated environment of Airbus A320 series aircraft.

3) **Language**, in text or non-text form, is not just a means of communication. The bridge conveys messages to students' cognitive knowledge, emphasizing the importance of explicit and straightforward transmission to reduce confusion in the virtual learning environment.

4) **Memory** refers to students' insights and perspectives consciously derived based on concrete knowledge and contextual past experiences. The anticipated responses and

reactions while students perform in the virtual world are automatically accessible and connected to students' cognitive knowledge and learning processes. These all roll to harness students' immediate interaction without conscious awareness while facing the simulated situations.

5) **Decision-making** refers to students' critical thinking, a metaphor for framing and finding ways to solve the quests implied through immediate virtual actions in responses to simulated situations based on students' experience and intuition. After trial and error, the response and reaction bring them into new experiences that shape their beliefs, eventually resulting in behavior change.

6) **Emotion** represents students' overall experience at a deep-seated level, reflecting their learning performance. This affective domain, which arises from the mind and self-reflection, brings together values and meaning to make users feel accomplished with their learning goals while independently controlling their learning experience.

The researcher found that when instructors facilitate hands-on practice, even within a simulated environment, experiential learning yields two primary benefits: it enhances students' analytical thinking and reflective skills through self-awareness, and it aids in organizing thoughts by processing new information in the brain. This process allows students to integrate new knowledge with their existing understanding, leading to a deeper comprehension of the subject matter. The researcher observed that students' immersion in a virtual environment significantly enhances concentration, leading to improved cognitive processes such as thinking, memory, observation, reflection, and decision-making. Additionally, this immersive experience fosters the development of desirable behavioral attributes that align with the objectives and expectations of the learning activities. These findings are consistent with the research by Ngiik et al. (2019), which highlights the transformative impact of technology integration in learning, particularly in enhancing learners' sensory perceptions. This enhancement relates to their emotions, thoughts, beliefs, and physical movements within simulated scenarios, ultimately resulting in behavior that aligns with the learning objectives and outcomes. This approach to fostering new awareness aligns with the

findings of Baume et al. (2018), who conducted a meta-analysis on learning outcomes. Their research indicated that reflective thinking, shaped by integrating learners' beliefs and the meaning derived from experiential learning through hands-on practice, leads to internalizing desirable characteristics. Additionally, this study provides valuable insights for instructors by highlighting the importance of selecting appropriate digital technologies for classroom activities. These technologies should be chosen based on practical effectiveness and sensory quality indicators, contributing to positive reinforcement and facilitating authentic student learning experiences.

Therefore, to ensure that the learning of the future workforce is effectively achieved, students must combine their experiences in virtual environments with simulated scenarios, leading to the development of tacit knowledge. This integration allows them to better understand complex content through virtual interactions that connect their sensory perceptions, emotions, thoughts, and intrinsic motivations, such as work-related skills or analytical thinking. These cognitive and emotional connections, forged through experiential learning, ultimately contribute to creating new knowledge within each student, which is highly beneficial for their future professional endeavors.

Recommendations for applying the research results

The ideas for applying the research reflect the six minds of the student's experience, which refers to the diverse ways that education program designers should bear in mind and consider different aspects of the learners that emphasize the various cognitive processes involved in creating successful experiential learning. Here is an interpretation of what these "Six Factors" Influenced:

1) **The Analytical and Critical Factors** focus on an approach that evaluates data using empirical evidence and reliable indicators. This analysis is not just about understanding the data; it also covers the effective use of information through research and understanding learners' behavior, needs, and problems. Moreover, it will help educators and educational innovation designers appropriately adjust educational innovation design

guidelines that create a profound learning experience and help students understand the content of their studying more.

2) **The Deep and Holistic Comprehension Factor** focuses on attaining profound and comprehensive insights into the learners' minds. It prioritizes understanding students' emotional needs and motivations. It involves stepping into students' shoes to create learning experiences that are practical, functional, and resonate with learners' emotions.

3) **The Strategic Planning Factor** emphasizes the importance of strategic thinking and planning. Consider learning objectives consistent with the learner's experience and learning outcomes to ensure that decisions in designing the learning process support the overall learning goals of the curriculum. Meanwhile, learners benefit from effective design interactions that enhance their experiences and help support their systematic problem-solving skills.

4) **The Innovative and Creative Design Factor** focuses on utilizing creativity and originality in developing and designing learning processes. The primary goal is to introduce new and innovative ideas and solutions that create unique and engaging experiences for learners. Effective design should captivate learners' attention and motivate them to participate fully in learning activities. Additionally, it requires consideration of the use of technology and tools that enhance engagement and improve the overall effectiveness of the learning experience**.**

5) **The Effective Applied Operational Factor** refers to the practical application of knowledge and skills in an operational context to achieve effectiveness. It focuses on usability, ensuring the design is functional, accessible, and easy to use. Before implementing designs, it considers the practicality and constraints that might affect the students' experience.

6) **The Collaborative and Effective Teamwork Factor** focuses on harnessing the collective strength of all stakeholders to achieve shared objectives. Key stakeholders include the

education sector, employers, related organizations, program developers, and students. Each group plays a distinct role in supporting and complementing one another. The education sector is responsible for producing graduates who emphasize cross-disciplinary knowledge integration to develop diverse skills. Employers and organizations define the market's skill needs, while program developers create tools to enhance the learning experience. Students play a crucial role in providing feedback on the learning process. This collaborative effort ensures that student-centered learning approaches are designed systematically and comprehensively.

In simulating a virtual reality environment, the "six minds" represent the cognitive processes on the screen, which are critical in shaping the learning experience that is particularly evident in 3D virtual environments with a 360-degree perspective, where users can perceive images and sounds within the virtual world by wearing VR glasses that stimulate the body's senses, fostering imagination (Schlindwein et al., 2013) and deepening cognitive processes. Such technological tools are essential for enhancing the learning approach needed for the future workforce's transition, where understanding and balancing different perspectives contribute to a more comprehensive and practical learning experience. Meanwhile, it is recommended that all key stakeholders, including the education sector, employers, related organizations, program developers, and students, must collaboratively take into account when adopting research results to highlight six key factors that should guide the design of educational programs that enhance experiential learning.

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