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Identification, validity, and reliability of the 21st-century workplace skills for on-the-job training practicum

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ABSTRACT

This study aimed to develop and evaluate an instrument for measuring 21st-century workplace skills in on-the-job training (OJT) trainees. A literature review identified 20 key skills, which became the foundation of the instrument. Its validity and reliability were tested through a pilot study involving 20 OJT supervisors, employing methods like the item-level content validity index (I-CVI) and Cronbach's alpha. The results confirmed the instrument's effectiveness, indicating the need for further research with larger and more diverse samples to enhance its applicability. This tool is crucial in improving OJT programs by enabling supervisors to assess and support trainees more effectively. Additionally, it serves as a resource for employers and educators in appraising potential hires and graduates, and assists institutions in refining their curricula.

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1. INTRODUCTION

In recent years, different theories and pedagogies have been realigned toward the total development of students in accordance with 21st-century skills. One of the major adjustments and amendments in the curriculum is including the practicum or on-the-job course. The main objective of the on-the-job training (OJT) program is to strengthen the student's skills, competencies, aptitudes, and proficiencies. Hence, these experiences would play a vital role after graduation. Furthermore, an OJT course or the program will bridge and link the gaps between academia and industry. Despite including training and practicum in the curriculum, improvement is still needed. The labor force has expressed concerns about the students' workplace skills, which has become an emerging worry. Hence, these two sectors or areas operate, plan, and execute practices and usually meet at different levels. With this, educational institutions need to focus on inculcating relevant skills and competencies that students need, thus, making these learners ready to explore new information in this fast-changing world of technology. In order to ensure that the students possess the necessary skills and competencies, there should be a reliable instrument that will assess and measure the said parameters. Taking this into account, the two major criteria for measuring an instrument would be reliability and validity. In relation to this, this study sought to create a tool to measure 21st-century workplace skills and to conduct an initial evaluation to determine the validity and reliability of the instrument.

2. LITERATURE REVIEW

2.1. The value of 21st century skills

21st-century skills refer to a range of core competencies vital for success in today's globally interconnected and digitally advanced environment. These skills include technical and computer proficiency, effective interpersonal and communication abilities, and a strong foundation in critical thinking and problem-solving. They also involve intrapersonal skills such as self-direction, creativity, ethical understanding, self-motivation, adaptability, flexibility, professionalism, global awareness, cultural and gender sensitivity, leadership, responsibility, safety and disaster preparedness, entrepreneurship, financial literacy, specialization, research and fact-checking, training and mentoring, planning, time management, and self-care [1]–[21].

In light of this, individuals in the modern world need these 21st-century talents to navigate the rapidly evolving global environment effectively. These skills enable individuals to be responsible citizens and skilled employees, facilitating continuous adaptation to changing global scenarios [22], [23]. The current educational strategy emphasizes equipping students with these skills, focusing on problem-solving, critical thinking, active learning, and learning to learn. The goal is to develop individuals capable of conducting research, asking questions, reflecting, generating ideas, analyzing, interpreting, finding solutions, and specializing in various fields [24]. Including 21st-century learning abilities in the curriculum is not only beneficial for students but also essential for preparing them for their future roles in society.

2.2. Prior studies related to workplace skills in the 21st century

Research into 21st-century skills has highlighted their importance in the modern workplace. These skills include knowledge creation, practical problem-solving, skillful communication, teamwork, information and communication technology for learning, and self-control. They are increasingly preferred over traditional academic, non-cognitive, and content knowledge, which often have vague definitions and are challenging to observe [8]. Laar *et al*. [1] delved into the factors determining 21st-century skills and digital skills, covering areas like technical, informational, communicational, collaborative, critical-thinking, creative, and problem-solving abilities.

In their mixed-methods study, Sumen and Calisici [25] investigated the 21st-century skills of secondary school students, using a sample of 222 students for quantitative data and selecting 20 students for qualitative analysis. Their findings indicated a high level of these skills among students, with female students demonstrating higher levels than their male counterparts. Turhan and Demirci [26] focused on pre-service teachers, examining their understanding of 21st-century skills and how these align with modern frameworks and curricula. Involving 59 pre-service math teachers and 71 pre-service science teachers, this phenomenological research revealed that teacher candidates possess an awareness of 21st-century skills across various subcategories like cognitive and process skills, communication and collaboration, initiative and self-direction, career skills, and technology knowledge and usage.

These studies collectively enhance our understanding of 21st-century skills in several ways. First, they emphasized the shift from traditional academic skills to more dynamic, practical skills that are crucial in modern, digitized, and globally connected world. Second, these researches highlighted the high level of these skills among young learners, particularly noting gender differences in skill acquisition. Third, the like those on studies on pre-service teachers provide insights into how future educators are being prepared to impart these essential skills, suggesting a growing alignment of educational curricula with the demands of the 21st-century workplace. These research, thus contributes significantly to our comprehension of the nature, acquisition, and application of 21st-century skills, which are critical for success in the modern, rapidly evolving professional environment.

2.3. Overview of validity and reliability tests

Face validity, a subjective assessment, examines how effectively a concept is translated into a measurable tool. It gauges the extent to which an instrument visibly associates with a particular concept, especially in the perception of non-experts like test-takers or legal system representatives. Its main focus is to ensure the instrument looks appropriate and relevant to those who use it. This involves evaluating visual elements such as viability, readability, consistency in style and format, and clarity of language. Face validity is defined as a researcher's subjective assessment regarding an instrument's presentation and relevance [27], [28]. The process includes ensuring that items are pertinent, logical, unambiguous, and easy to understand. In assessing face validity, respondents evaluate the instrument's question interface, sentence structure, grammar, and other essential aspects. This evaluation alerts researchers to potential misunderstandings or misinterpretations, even when assessing valid measurements of conceptual variables. For example, Oktavia *et al*. [29] who assessed the reliability and validity of questionnaires for the Indonesian curriculum K-13 in STEM education. They involved teachers and STEM educators in a focus group discussion to evaluate the instrument's clarity and purpose, emphasizing its face validity.

Content validity, on the other hand, concerns the extent to which an instrument comprehensively measures the construct under study. It's crucial in instrument development due to its psychometric significance and its link to reliability. The method involves ensuring the instrument contains a suitable set of items to evaluate the targeted construct. A common measure in content validity is the content validity index (CVI), including item-level CVI (I-CVI) and scale-level CVI (S-CVI). I-CVI assesses individual item relevance, while S-CVI evaluates the overall scale. A high content validity scale should have I-CVIs of at least 0.78 and S-CVI values of 0.8 and 0.9 as seen in Table 1. For example, Silva *et al*. [30] used the CVI to develop a tool for assessing motivation for weight loss, involving experts from various fields to ensure a comprehensive evaluation. Rodrigues *et al*. [31] used the I-CVI in developing the personalized exercise questionnaire for individuals with osteoporosis, with a panel of 42 experts contributing to its content validity. Turkcu *et al*. [32] utilized a questionnaire seeking expert opinions on its content validity and subsequently revising the instrument based on CVI evaluations. These examples demonstrate the practical application of face and content validity in instrument development, highlighting their significance in ensuring tools are both appropriately presented and comprehensively measure the intended constructs.

Table 1. Experts needed and the acceptable CVI values [33]

Number of experts	Acceptable CVI values
Two experts	At least 0.80
Three to five experts	Should be 1.00
At least six experts	At least 0.83
Six to eight experts	At least 0.83
At least nine experts	At least 0.78

In reliability tests for instruments, the concept of instrument reliability is defined as the ability to consistently represent the construct it is designed to measure, evidenced by providing stable scores across time and during multiple administrations. This consistency requires that all other factors remain unchanged, ensuring that the scores remain stable over time [34]. Additionally, internal consistency is crucial, which refers to the extent to which all parts of the instrument measure the same construct [34], [35].

For an instrument to be deemed reliable, its scores must not only be constant but also consistent across different occasions [35], [36]. A commonly used method to assess this reliability, especially in surveys or indexes, is Cronbach's alpha. This technique is instrumental in evaluating how consistently an instrument measures something, quantifying the reliability of scores and synthesizing data from various components of a questionnaire [37], [38]. The interpretation of Cronbach's alpha values, which range from 0.00 (indicating no reliability) to 1.0 (indicating perfect reliability), plays a vital role in determining the level of reliability in a study. Raof and Musta'amal [39] noted that values close to 1.0 signify a high level of reliability, whereas values closer to 0.00 indicate poor reliability. The reliability of instruments is a key focus area in research, with numerous studies dedicated to examining the reliability of instruments throughout their development and implementation phases [40].

3. METHOD

The initial instrument comprised 20 identified skills and underwent two levels of validation. The first phase involved a simple face validity check. In this stage, three English professors were provided with the list of these 20 skills. They were tasked with validating each skill using pen and paper, focusing on whether the items reflected and were relevant to 21st-century workplace skills. Additionally, they assessed the statements for readability, simplicity, and grammatical accuracy. The experts were also asked to suggest any omissions or provide recommendations on how to improve each statement or the naming of the skills to ensure comprehensive evaluation of the instrument. In contrast, the second part utilized I-CVI. Six experts, each with a background in hiring employees, were specifically asked to evaluate the relevance of various skills in defining 21st-century workplace competencies. Among these experts, four are Human Resource Managers at multinational companies, and two are Placement Officers from universities, each possessing a minimum of five years of experience in hiring. While 20 out of 50 OJT supervisors currently assigned to a state university were selected to be the respondents for the measurement of the reliability of the instrument. Their choice was based on their years of practical experience with student performance and placement of these students in real-world settings, diverse industry insights, and understanding of the alignment between academic training and professional requirements. Their availability and willingness to participate also played a factor in choosing them. This is based on the prior studies, which indicated that, as a rule of thumb, the appropriate sample size should be at least 10% of the projected sample of the actual study. A normality test was also initiated prior to the tests. To measure the internal consistency of each competency found in the

instrument, a Cronbach alpha greater than or equal to 0.70 served as the baseline [41], [42]. The instrument has 5-point coded responses, as seen in Table 2. After the pilot testing, all descriptive statistics were reported (i.e., the normality tests, content validity, and internal consistency coefficients).

4. RESULTS AND DISCUSSION

Table 2 shows the basis and the definition lifted based on the literature review. This study was able to identify 20 specific skills in relation to 21st century workplace skills. The identified skills includes computer [43], interpersonal [44], [45], communication [4], [46], self-direction [13], adaptability [47], creativity [48], flexibility [49], professionalism and ethics [50], [51], global awareness, cultural, and gender sensitivity [52], [53], leadership and responsibility [9], [12], [54], safety and disaster preparedness [55], entrepreneurial and financial literacy [4], [5], [56], technical and specialization [6], research and fact-checking [1], [57], critical thinking and problem-solving [4], [42], [58], training, coaching, and mentoring [42], [59]–[61], planning and time management [4], [62], intrapersonal [63]–[66], emotional intelligence [45], and self-care skills [67]–[69].

Table 3 presents the validity and reliability results of the 20 identified skills. For validity, the analysis indicated that all 20 were valid. For internal consistency reliability, the test's result showed a Cronbach's alpha value of 0.921. This confirms that the internal consistency reliability of the instrument is good and, therefore, ready to use for a larger study.

Table 2. Basis for each identified 21st century workplace skills

Skill	Definition	Basis
Computer skill	The ability to use specific and technical skills and knowledge needed to perform a task.	[43]
Interpersonal skill	The ability to work, collaborate, ask questions, provide and receive feedback, and negotiate, including expressing oneself clearly.	[44], [45]
Communication skill	The ability to effectively convey and receive information, thoughts, feelings, and ideas to and from others clearly and concisely.	[4], [46]
Self-direction skill	The ability to work independently and take the initiative with minimal supervision.	[13]
Adaptability skill	The ability to adapt and adjust to a given situation.	[47]
Creativity skill	The ability to generate original ideas, connect seemingly unrelated concepts, and use imagination to solve problems and create value.	[48]
Flexibility skill	The ability to adapt to changing circumstances and work effectively in different situations and with diverse people while maintaining a positive attitude and openness to new ideas and perspectives.	[49]
Professionalism and ethics skills	The ability to observe, demonstrate and exhibit integrity, professional image and ethical behavior.	[50], [51]
Global awareness, cultural, and gender sensitivity skills	The ability to comprehend, understand, appreciate and respect different cultures and preferences regardless of race, gender, and affiliations.	[52], [53]
Leadership and responsibility skills	The ability to take initiative, lead others, and assume responsibility for one's actions.	[9], [12], [54]
Safety and disaster preparedness skills	The ability to understand and follow safety procedures and protocols in order to minimize the risk of accidents or injuries.	[55]
Entrepreneurial and financial literacy skills	The ability to understand and navigate the economic and business environment.	[4], [5], [56]
Technical and specialization skills	The ability to focus on the specialized occupational concentration on a specific area of expertise and accomplish tasks quickly and efficiently without continuous training.	[6]
Research skills and fact-checking skills	The ability to find, collect, organize, assess, use, or otherwise present information that is pertinent to a given topic.	[1], [57]
Critical thinking and problem-solving skills	The ability to deduce, explain, be open-minded, and solve problems through analysis, interpretation, and inference.	[4], [42], [58]
Training, coaching, and mentoring skills	The ability to successfully increase someone's knowledge or develop a desired skill level for doing a particular job by giving instructions, information, and practice.	[42], [59]–[61]
Planning and time management skills	The ability to prioritize and manage their time effectively in order to complete their tasks on time and meet deadlines.	[4], [62]
Intrapersonal skills	The ability to communicate with oneself, manage emotions, and cope with challenges one may face at different times.	[63]–[66], [70]
Emotional intelligence skills	The ability to recognize, understand, express, regulate, assess, and use emotions in order to positively interact and communicate with others	[45]
Self-care skills	The ability to prioritize and engage in practices and activities that promote physical, emotional, and mental well-being while managing daily life and work demands.	[67]–[69]

Table 3. Content validity and reliability results

21st century workplace skills	Content validity (N=6)			Reliability (N=20)	
	No. of agreement	I-CVI	Interpretation	Mean	SD
Computer skill	6	1	Valid	4.85	0.489
Interpersonal skill	6	1	Valid	4.90	0.447
Communication skill	6	1	Valid	4.90	0.308
Self-direction skill	6	1	Valid	4.85	0.489
Adaptability skill	6	1	Valid	4.95	0.224
Creativity skill	6	1	Valid	4.90	0.308
Flexibility skill	6	1	Valid	4.85	0.366
Professionalism and ethics skills	6	1	Valid	4.80	0.523
Global awareness, cultural, and gender sensitivity skills	6	1	Valid	4.65	0.671
Leadership and responsibility skills	6	1	Valid	4.75	0.639
Safety and disaster preparedness skills	6	1	Valid	4.45	0.826
Entrepreneurial and financial literacy skills	5	0.83	Valid	4.85	0.489
Technical and specialization skills	6	1	Valid	4.70	0.657
Research skills and fact-checking skills	5	0.83	Valid	4.80	0.523
Critical thinking and problem-solving skills	6	1	Valid	4.85	0.489
Training, coaching, and mentoring skills	6	1	Valid	4.85	0.489
Planning and time management skills	6	1	Valid	4.85	0.366
Intrapersonal skills	6	1	Valid	4.85	0.489
Emotional intelligence skills	5	0.83	Valid	4.90	0.447
Self-care skills	5	0.83	Valid	4.90	0.308

5. CONCLUSION

This research has successfully developed and validated an instrument to assess 21st-century workplace skills in OJT programs, a critical step in enhancing educational and practicum training standards. The instrument's initial validation involved two key phases. In the first phase, three English professors conducted a face validity check, scrutinizing the relevance, readability, and grammatical accuracy of the 20 identified skills. They also offered recommendations for improvements. The second phase employed the I-CVI, where six experts with extensive experience in employee hiring assessed the relevance of these skills to 21st-century workplace competencies. Further reliability testing was conducted with 20 experienced OJT supervisors from a state university.

Despite the rigorous validation process, the study acknowledges limitations such as the small sample size and the specific selection of participants. These issues highlight the need for further research with larger and more diverse groups to confirm these findings. Future studies should focus on deepening our understanding of specific 21st-century workplace competencies, exploring their evolution and relevance in various industrial contexts, and examining their long-term impact on career progression and adaptability in the workplace. Addressing these aspects will further validate the instrument and provide invaluable insights for OJT supervisors and apprentices, ultimately contributing to a more skilled and adaptable workforce in the global economy.

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