

Research Article

The Interplay of Soft Skills, Digital Literacy, and Self-Efficacy in Shaping Work Readiness: A Structural Equation Modeling Study of Vocational High School Students

Anas Arfandi ^{a,*} • Musdalifah ^b • Sudjani ^c • Abdul Haris Setiawan ^d

^aDepartment of Civil Engineering and Planning, Universitas Negeri Makassar, Makassar, Indonesia | ^bDepartment of Technology and Vocational Education, Postgraduate Program, Universitas Negeri Makassar, Makassar, Indonesia | ^cDepartment of Civil Engineering Education, Universitas Pendidikan Indonesia, Bandung, Indonesia | ^dDepartment of Construction Engineering Education, Universitas Sebelas Maret, Surakarta, Indonesia

ABSTRACT

Work readiness in vocational education is associated with transferable competencies and students' confidence in applying them in technology-rich workplaces. This study examined the direct and indirect associations among soft skills, digital literacy, self-efficacy, and work readiness among vocational students who had participated in MOOC-based upskilling. A cross-sectional, non-experimental survey involved 225 students from 22 vocational high schools in 16 districts and cities in South Sulawesi, Indonesia. All constructs were measured using a 5-point Likert scale, and CB-SEM was conducted in AMOS using maximum likelihood estimation. The structural model demonstrated excellent overall fit. Soft skills were positively associated with self-efficacy ($\beta = 0.574$, $p < 0.001$) and work readiness ($\beta = 0.652$, $p = 0.034$). In contrast, digital literacy was positively associated with self-efficacy ($\beta = 0.274$, $p = 0.002$) and work readiness ($\beta = 0.663$, $p < 0.001$). Self-efficacy showed the strongest direct association with work readiness ($\beta = 0.778$, $p = 0.018$). Significant indirect associations through self-efficacy were found for soft skills ($\beta = 0.447$, $p = 0.034$) and digital literacy ($\beta = 0.213$, $p < 0.001$), while their direct associations remained significant, indicating partial statistical mediation. These findings suggest that soft skills, digital literacy, and self-efficacy are complementary factors associated with work readiness. The results highlight self-efficacy as an important statistical pathway linking the two competency domains to work readiness. However, because all variables were measured concurrently, the findings should be interpreted as theory-consistent associations rather than evidence of causal direction or temporal mediation.

KEYWORDS competency framework • digital literacy • employability outcomes • lifelong learning • learning engagement • MOOC-based training • vocational education and training

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*CORRESPONDENCE

 Anas Arfandi  anas.arfandi@unm.ac.id  Department of Civil Engineering and Planning, Faculty of Engineering, Universitas Negeri Makassar, Jalan Mallengkeri Raya, Parang Tambung, Makassar, South Sulawesi, 90224, Indonesia  <https://orcid.org/0000-0002-2513-6786>



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1. INTRODUCTION

Work readiness is crucial for graduates' transition from education to employment because it shapes both their ability to obtain jobs and to adapt to workplace demands. Recent employer evidence continues to underscore those soft skills, especially communication and critical thinking/problem-solving. Teamwork is prioritized in recruitment: NACE's Job Outlook 2025 reports that 96.1% of employers rate critical thinking and communication as "very" or "extremely" important career-readiness competencies for new graduates, and it also lists problem-solving, teamwork, and written communication among the most sought-after resume attributes [1]. In parallel, the World Economic Forum highlights that rapid technological and labor-market shifts are increasing the value of human-centered capabilities such as resilience/flexibility and leadership/social influence alongside technology-related skills [2]. Beyond interpersonal competencies, digital literacy is now a core component of work readiness because digitally competent individuals can use new technologies more efficiently and adaptively [3].

Self-efficacy—people's belief in their capacity to succeed in specific situations—also plays a pivotal role in work contexts, influencing persistence, willingness to take on complex tasks, and career behaviors such as decision-making, performance, and satisfaction [4]–[6]. To cultivate workforce-ready graduates, educational institutions increasingly leverage MOOCs as flexible, scalable learning environments that broaden access across geographic and financial constraints. MOOCs have been argued to support not only technical learning but also transferable competencies (e.g., time management and communication) and strengthen self-regulation by enabling learners to manage pace and outcomes [7]–[10], making them a relevant platform for upskilling in a fast-changing labor market.

Despite increased awareness of work-readiness, many graduates struggle to meet employers' expectations. This challenge worsens with rapid technological advancements that demand ongoing upskilling, especially in digital literacy. However, many educational programs inadequately emphasize the development of soft skills or fully prepare students for the complexities of modern workplaces. Furthermore, the shift to online learning and MOOCs brings opportunities and challenges for higher education. While MOOCs provide broad access, concerns grow about their effectiveness in developing practical skills like teamwork, communication, and problem-solving. Consequently, students may gain technical knowledge but lack essential personal and interpersonal skills for workplace success. This gap between education and industry hinders employability.

A considerable body of research highlights the importance of soft skills, digital literacy, and self-efficacy in work readiness. Robles [11] emphasized that employers often prioritize soft skills such as communication,

teamwork, and adaptability over technical expertise. Goleman [12] further argued that emotional intelligence, particularly self-awareness and interpersonal skills, plays a crucial role in career success, especially in leadership and collaborative settings. Luthans & Youssef-Morgan [13] expanded on this by highlighting psychological capital, which includes hope, optimism, and resilience, as critical to overcoming workplace challenges. On the other hand, digital literacy is equally essential in modern work environments. Students with higher digital competence are better equipped to navigate the increasingly digital workspace, where technological proficiency is paramount [14], [15]. Helsper [16] argued that digital literacy goes beyond basic skills, including the ability to ethically use and evaluate digital tools, which is becoming indispensable in today's interconnected world. Additionally, Bandura's [17] self-efficacy theory suggests that individuals who believe in their ability to succeed are more likely to persist and adapt to new challenges. Self-regulated learning, a key aspect of self-efficacy, enables individuals to manage their academic and professional tasks effectively [18]–[20].

Rapid digital transformation and changing labor market demands require holistic work readiness, encompassing not only technical and digital competencies but also social-emotional capacities such as communication, collaboration, and adaptability [2], [21]–[23]. In vocational education and training (VET) systems in developing countries, this challenge is further intensified by persistent skills mismatches and limited alignment between educational outcomes and industry needs [24]. Consequently, understanding how multiple competencies jointly contribute to students' work readiness has become a critical research priority.

Although prior studies have consistently highlighted the importance of soft skills, digital literacy, and self-efficacy as predictors of work readiness, a significant research gap remains. The existing literature largely examines these constructs in isolation, resulting in limited empirical evidence on their relative and combined effects within a single, coherent analytical framework. For example, while digital literacy has been linked to employability outcomes, less is known about how its impact may depend on complementary soft skills such as communication and adaptability, or how self-efficacy functions as a psychological resource that enables students to translate digital and interpersonal competencies into effective work-related performance [25]–[29].

This gap is particularly evident in research focusing on vocational high school students in developing countries, where learning processes are practice-oriented, competency-specific, and closely aligned with occupational standards. Empirical findings derived primarily from higher education or general student populations may not adequately capture the distinct developmental pathways of vocational learners, whose

readiness for work is shaped by hands-on training and early exposure to industry practices [30], [31]. As a result, there is still insufficient evidence explaining how soft skills, digital literacy, and self-efficacy interact structurally to influence work readiness among vocational students.

Building on the limitations identified in previous research, this study proposes an integrated structural model to investigate the simultaneous relationships between soft skills, digital literacy, and work readiness, with self-efficacy positioned as a central psychological mediator or facilitating factor. By focusing on vocational high school students in a specific technical program and regional context, this study provides context-sensitive empirical evidence for the vocational education literature. The findings are expected to inform competency-oriented curriculum design and targeted educational interventions to strengthen holistic workforce preparation in vocational education systems.

This study is significant both theoretically and practically. It aims to enhance understanding of how competencies like soft skills, digital literacy, and self-efficacy influence work readiness. By examining these relationships, the study provides a holistic view of the determinants of work readiness. In practice, the findings could inform educational strategies for online learning environments such as MOOCs, which are crucial in modern education. Understanding their role in fostering work-readiness enables institutions to tailor curricula to labor-market demands. Furthermore, insights from this research can guide policymakers in creating programs that improve students' employability, equipping them with essential technical and personal competencies for career success.

While much has been written about the individual components of work readiness, such as soft skills, digital literacy, and self-efficacy, there remains a lack of comprehensive studies that explore the interactions among these factors and their collective impact on work readiness. Existing research often treats these variables in isolation, which overlooks their potential interactions. Furthermore, while MOOCs and other online platforms have gained prominence in higher education, there is limited empirical research on how effectively they develop work-readiness, particularly in soft skills and self-efficacy. Many studies on MOOCs focus on knowledge acquisition rather than on the development of broader competencies. This research aims to fill these gaps by examining how MOOCs can contribute to holistic work-readiness development, with an emphasis on integrating soft skills, digital literacy, and self-efficacy.

This study aims to examine the structural relationships among soft skills, digital literacy, self-efficacy, and work readiness among vocational high school students. Specifically, the study examines: (1) the associations of soft skills and digital literacy with self-efficacy; (2) the associations of soft skills, digital literacy,

and self-efficacy with work readiness; and (3) the indirect associations of soft skills and digital literacy with work readiness through self-efficacy. The findings are expected to provide practical insights for vocational high schools in designing curricula that better support students' transition into the labor market.

2. LITERATURE REVIEW

2.1. Theoretical Foundation: Social Cognitive Theory

Social Cognitive Theory (SCT) explains human functioning through reciprocal interactions among personal factors, behavior, and environmental conditions [32]. Within SCT, self-efficacy refers to individuals' beliefs in their capability to organize and perform the actions required to achieve desired outcomes [17], [33]. These beliefs influence goal setting, effort, persistence, learning, and responses to failure [20], [34]. Self-efficacy develops through mastery experiences, vicarious learning, social persuasion, and physiological or emotional states [33]. Successful task completion experiences are particularly important because they strengthen individuals' confidence in managing similar demands. In career contexts, competencies do not automatically produce adaptive outcomes; their influence partly depends on individuals' confidence in applying them to career and workplace tasks [35].

Human Capital Theory complements SCT by suggesting that investments in knowledge and skills improve productivity and employability [36], [37]. However, SCT explains why individuals with similar competencies may demonstrate different levels of initiative and readiness. In this study, soft skills and digital literacy represent capability resources, self-efficacy represents the psychological mechanism that activates these resources, and work readiness represents the expected outcome.

The study focuses on vocational high school students who have participated in MOOC-based training. MOOC participation requires digital interaction, independent learning, task completion, and self-regulation. However, because MOOC participation defines the sample rather than functioning as a study variable, it is treated as the contextual boundary of the proposed model.

2.2. Soft Skills, Self-Efficacy, and Work Readiness

Soft skills are transferable interpersonal and self-management competencies, including communication, teamwork, adaptability, problem-solving, responsibility, and emotional regulation. These competencies are increasingly valued because workplaces require employees who can collaborate, manage change, and solve problems in addition to possessing technical abilities [2], [11], [38], [39].

From an SCT perspective, soft skills strengthen self-efficacy by creating opportunities for successful

communication, collaboration, problem-solving, and adaptation. These activities provide mastery experiences, feedback, social persuasion, and opportunities to observe competent peers [33]. Romanova [40] found that integrating employability skills into vocational education was associated with more positive student evaluations of their social and self-learning abilities. Aryani et al. [41] found that soft skills positively influenced students' psychological capital, with perceived mastery of soft skills functioning particularly as a source of efficacy among high school and university students.

Nevertheless, most previous studies have involved university students or graduates rather than vocational high school students. Vocational students may have less workplace experience and fewer opportunities to apply their competencies in authentic employment settings. Therefore, examining this relationship among vocational students participating in MOOC-based training extends the existing evidence.

H1: Soft skills are positively associated with self-efficacy.

Previous studies generally support a positive association between soft skills and work-related outcomes. However, the relationship may not always operate entirely through a direct pathway. Aryani et al. [41] found that soft skills enhanced psychological capital, which, in turn, increased career engagement, particularly among high school and university students. Similarly, Suyitno et al. [27] showed that work-based learning did not directly predict vocational students' employability skills. In contrast, self-efficacy directly contributed to employability and strengthened the effect of work-based learning. These findings suggest that competencies and learning experiences may translate into greater work readiness when students have sufficient confidence to apply them.

H2: Soft skills are positively associated with work readiness.

2.3. Digital Literacy, Self-Efficacy and Work Readiness

Digital literacy refers to the ability to access, evaluate, create, manage, and communicate information safely, critically, and responsibly through digital technologies. It includes information literacy, digital communication, content creation, safety, and technology-related problem-solving [42].

The increasing use of automation, artificial intelligence, digital platforms, and data-based systems has made digital literacy important for employment and continuous learning [43]. From an SCT perspective, successful use of digital tools provides mastery experiences that strengthen students' confidence in managing technology-mediated tasks.

Getenet et al. [44] found that digital literacy significantly contributed to students' self-efficacy and online learning engagement. This mechanism is relevant

to vocational students participating in MOOCs because they must independently navigate platforms, complete online assignments, communicate digitally, and solve technical problems. However, frequent technology use does not always indicate critical or occupationally relevant competence. The strength of the relationship may depend on task complexity, technical support, and the alignment between training technologies and workplace demands.

H3: Digital literacy is positively associated with self-efficacy.

Digital literacy may also directly improve work-readiness by enabling students to search for information, prepare digital documents, communicate through online platforms, learn new software, and adapt to technological change. Caroline et al. [45] concluded that digital literacy is associated with employability-related outcomes, although differences in definitions, measurements, and occupational contexts produce varying findings.

General familiarity with technology may not be sufficient when students lack practical or occupation-specific digital competence. Nevertheless, in the context of MOOC-based training, digital literacy is particularly relevant because it supports independent learning, digital collaboration, and adaptation to technology-mediated workplace processes.

H4: Digital literacy is positively associated with work readiness.

2.4. Self-Efficacy and Work Readiness

Self-efficacy influences whether students initiate career-related activities, accept challenging tasks, persist after failure, and adapt to unfamiliar workplace demands [5]. Students with stronger self-efficacy are more likely to seek information, practice new skills, respond constructively to feedback, and persist in solving problems. These behaviors are central to work readiness.

Tentama et al. [46] found that self-efficacy significantly predicted work readiness among vocational high school students, although it explained only 11.2% of the variance. Evidence from a related domain was reported by Zhou et al. [47], who found that career decision-making self-efficacy positively predicted employability among higher vocational students. Together, these findings suggest that efficacy beliefs are important for employment preparation, although work readiness is also shaped by competencies, workplace exposure, social support, and access to career information.

H5: Self-efficacy is positively associated with work readiness.

2.5. The Mediating Role of Self-Efficacy

SCT distinguishes between possessing competencies and believing that those competencies can be applied successfully. Capability resources influence behavior, in part, through self-efficacy, as individuals are more likely to use and sustain their skills when they believe they can perform effectively [35]. Soft skills can strengthen self-efficacy by fostering successful experiences in communication, teamwork, emotional regulation, and problem-solving. Stronger efficacy beliefs may subsequently encourage students to approach workplace tasks proactively, persist through difficulties, and respond constructively to feedback. Supporting this mechanism, Wujema et al. [48] found that self-efficacy mediated the relationships between CareerEDGE resources, including generic skills and emotional intelligence and undergraduate employability.

However, evidence regarding this mediating mechanism is not entirely consistent. Li et al. [49] found that self-efficacy neither directly predicted employability nor independently mediated the relationship between achievement motivation and employability. However, it contributed through a sequential pathway involving academic performance. These differing findings indicate that the mediating role of self-efficacy may depend on the competencies examined, the additional mechanisms included in the model, students' educational contexts, and the operationalization of employability or work readiness.

H6a: Self-efficacy mediates the positive association between soft skills and work readiness.

Digital literacy may similarly strengthen self-efficacy by providing successful experiences in using digital platforms, managing information, communicating online, and solving technology-related problems. These efficacy beliefs may subsequently promote independent learning, persistence, and adaptation to digital workplace demands.

Although direct evidence examining digital literacy, self-efficacy, and work readiness within one mediation model remains limited, previous studies support each part of the proposed pathway. Digital literacy has been associated with self-efficacy [44], linked to employability-related outcomes [41], and shown to predict work readiness among vocational students [46]. The proposed mediation, therefore, addresses an important empirical gap in research on vocational and MOOC-based learning.

H6b: Self-efficacy mediates the positive association between digital literacy and work readiness.

Figure 1 presents the proposed conceptual model, including the direct associations of soft skills and digital literacy with self-efficacy and work readiness, the

association between self-efficacy and work readiness, and the two indirect relationships through self-efficacy.

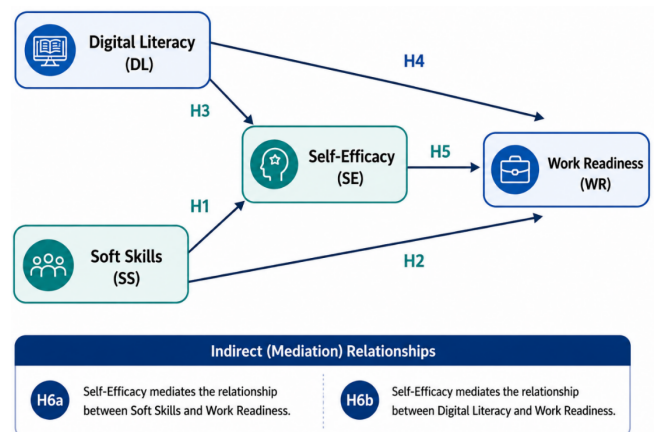


Figure 1. Conceptual model and hypothesized relationships

3. MATERIALS AND METHODS

3.1. Research Design

This study employed a quantitative, analytical cross-sectional survey design to examine the structural relationships among soft skills, digital literacy, self-efficacy, and work readiness among vocational high school students who had participated in MOOC-based training. Data were collected once between January and March 2025 using a structured self-report questionnaire. SEM was used to estimate the direct and indirect relationships among the latent variables [50].

Guided by Social Cognitive Theory [51], soft skills and digital literacy were specified as exogenous variables, work readiness as the endogenous variable, and self-efficacy as the mediator. The model examined the direct effects of soft skills and digital literacy on self-efficacy and work readiness, as well as their indirect effects on work readiness through self-efficacy. MOOC participation defined the sample context rather than serving as an intervention or model variable. Because all variables were measured concurrently without manipulation, the estimated paths represent theory-consistent associations rather than causal effects, and the mediation findings should be interpreted cautiously [52].

3.2. Sample Size & Data Collection

The accessible population consisted of 537 Construction and Housing Engineering students from 22 vocational high schools across 16 districts and cities in South Sulawesi who had participated in MOOC training. A target of 225 respondents was set using the Raosoft calculator as a practical recruitment reference. However, because purposive sampling was applied, the confidence level and margin of error were not interpreted as evidence of statistical precision, representativeness, or population-level generalizability. Sample adequacy was assessed

primarily using SEM guidelines. Hair et al. [53] recommend 5–10 respondents per indicator, while Kline [50] suggests that a sample size of at least 200 is generally adequate for SEM. Thus, the final sample of 225 respondents was considered sufficient for model estimation. Eligible participants were active students who had completed MOOC training and agreed to participate. Data were collected from January to March 2025 through Google Forms distributed via official school channels and face-to-face administration for students with limited internet access. A total of 225 complete questionnaires were included in the analysis.

3.3. Measurement and Instrument Development

This study measured four latent constructs: self-efficacy, soft skills, digital literacy, and work readiness using a 20-item structured questionnaire (Table 1). All items were adapted from established scales and competency frameworks, then contextualized to reflect the study population and setting. Higher scores indicate higher levels of the measured construct.

3.3.1. Item adaptation and content specification

Self-efficacy items were adapted from the General Self-Efficacy Scale (GSE), which conceptualizes efficacy beliefs as an individual's perceived capability to handle difficult demands and cope with unexpected events [18]. Soft skills items were developed to reflect core 21st-century competencies (communication, collaboration, critical thinking/problem solving, and adaptability), aligning with the P21 Framework and career-readiness competency descriptions used in graduate employability contexts [54]. Digital literacy items were adapted from the DigComp 2.2 framework and prior conceptualizations of digital literacy that emphasize information evaluation, safety/privacy, content creation, and technical problem-solving [42]. Work-readiness items were anchored in the Work Readiness Scale (WRS) conceptual model (e.g., work competence, social intelligence, organizational acumen, and personal work characteristics) and in the broader work-readiness literature [55].

Table 1. Constructs, item codes, operational indicators, and source frameworks used in the questionnaire

Construct	Item Codes	No. of Items	Indicators Measured	Sources
Self-Efficacy	SE.1–SE.5	5	Confidence in solving complex problems, achieving goals, handling unexpected situations, remaining calm under difficulty, and managing unexpected events	[18], [56]
Soft Skills	SS.1–SS.5	5	Communication, teamwork, problem-solving, adaptability, and time management	[54], [57]
Digital Literacy	DL.1–DL.5	5	Use of productivity applications, evaluation of online information, personal data protection, digital content creation, and basic technical troubleshooting	[42], [57], [58]
Work Readiness	WR.1–WR.5	5	Responsibility, professional ethics, workplace communication and negotiation, understanding of industry standards, and application of academic knowledge	[55], [57]

Note. Detailed information on the wording of each questionnaire item, response format, construct assignment, and source of adaptation is presented in Supplementary Table S1.

All constructs were measured using five-point response formats. Specifically, self-efficacy used a 5-point scale from 1 (Strongly Not Confident) to 5 (Strongly Confident), work readiness used a 5-point scale from 1 (Strongly Not Ready) to 5 (Strongly Ready), and soft skills and digital literacy used a 5-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.3.2. Expert Review, Pilot Testing and Reliability–Validity Assessment

Before pilot testing, the questionnaire was reviewed by three vocational education experts to evaluate the relevance, clarity, and suitability of each item for its intended construct. Based on their feedback, several items were revised to reduce ambiguity and improve contextual appropriateness. The revised questionnaire was then pilot-tested on 30 students who were not included in the main study.

The pilot test showed strong internal consistency, with Cronbach's alpha values of 0.89 for Self-Efficacy,

0.91 for Soft Skills, 0.91 for Digital Literacy, and 0.92 for Work Readiness. All values exceeded the recommended threshold of 0.70 [59]. In the main sample, reliability and construct validity, including convergent and discriminant validity, were reassessed before testing the structural model and research hypotheses [60].

3.4. Data Analysis

Data were analyzed using CB-SEM in AMOS with maximum likelihood estimation. The measurement model was evaluated using standardized factor loadings, Cronbach's alpha, composite reliability (C.R.), and average variance extracted (AVE). Standardized factor loadings of at least 0.60, reliability coefficients of at least 0.70, and AVE values of at least 0.50 were considered acceptable [60], [61]. The structural model was subsequently evaluated using the normed chi-square (CMIN/DF), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), goodness-of-fit index (GFI), comparative fit index (CFI),

Tucker–Lewis index (TLI), and parsimonious normed fit index (PNFI). Model fit was considered acceptable when CMIN/DF was below 2.00, RMSEA and SRMR were below 0.08, GFI, CFI, and TLI exceeded 0.90, and PNFI exceeded 0.50 [62]–[64]. Direct effects were assessed using standardized path coefficients, critical ratios, and p values, with statistical significance set at $p < 0.05$. The mediating role of self-efficacy was determined by examining the significance of the indirect effects. Partial mediation was concluded when both the indirect effect through self-efficacy and the corresponding direct effect on work readiness remained statistically significant [50], [65].

4. RESULTS

4.1. Characteristics of Respondents

The respondents in this study are 225 students enrolled in the Construction and Housing Engineering program from 22 vocational high schools across 16 districts and cities in South Sulawesi Province. The following table presents a breakdown of the demographic and participation characteristics of the respondents, including gender, internet access, reasons for taking MOOCs, and the skills gained through the training.

Table 2 presents the participants' demographic characteristics and MOOC-related responses. Of the 225 respondents, 170 students (75.56%) were male, and 55

(24.44%) were female. A total of 134 students (59.56%) accessed the internet using personal devices, while 91 students (40.44%) used school facilities. The most frequently reported reason for participating in MOOCs was to enhance work-related skills (67.56%), followed by broadening general knowledge (20.00%) and obtaining a certificate (12.44%). Regarding the competency category that respondents perceived as being gained from MOOC participation, 43.56% selected soft skills, 36.00% selected digital literacy, and 20.44% selected self-efficacy.

4.2. Reliability and Convergent Validity

To evaluate the adequacy of the reflective measurement model, this study examined indicator reliability, internal consistency reliability, and convergent validity. Indicator reliability was assessed using standardized factor loading, whereas internal consistency was evaluated through Cronbach's alpha and composite reliability (C.R.). Convergent validity was assessed using the average variance extracted (AVE). Consistent with widely used guidelines, factor loading of at least 0.60 is generally acceptable (particularly for applied research and early-stage scale development), C.R. values of 0.70 or higher indicate adequate internal consistency, and AVE values of 0.50 or higher provide evidence of convergent validity [50], [53]. Table 3 shows the measurement properties for all constructs.

Table 2. Participant and MOOC-participation characteristics of the analytical sample (N=225)

Category	Item	Frequency	Percentage
Gender	Male	170	75.56%
	Female	55	24.44%
Access Internet	Personal device	134	59.56%
	School facilities	91	40.44%
Reasons for Taking MOOCs	To enhance work skills	152	67.56%
	To obtain a certificate	28	12.44%
	To broaden general knowledge	45	20.00%
Skills Gained from MOOCs	Soft Skills	98	43.56%
	Digital Literacy	81	36.00%
	Self-Efficacy	46	20.44%

Table 3. Standardized factor loadings, internal consistency reliability, and convergent validity of the measurement model

Variables	Item	Standardized Loading Factor	C.R.	AVE	Cronbach's Alpha
Self-Efficacy	SE.1	0.745	0.838	0.511	0.837
	SE.2	0.652			
	SE.3	0.752			
	SE.4	0.627			
	SE.5	0.785			
Soft Skills	SS.1	0.722	0.840	0.515	0.838
	SS.2	0.685			

Variables	Item	Standardized Loading Factor	C.R.	AVE	Cronbach's Alpha
Digital Literacy	SS.3	0.853	0.865	0.565	0.862
	SS.4	0.653			
	SS.5	0.658			
	DL.1	0.781			
	DL.2	0.863			
	DL.3	0.648			
	DL.4	0.785			
Work Readiness	DL.5	0.658	0.866	0.568	0.863
	WR.1	0.866			
	WR.2	0.768			
	WR.3	0.639			
	WR.4	0.827			
	WR.5	0.638			

Table 4. Fit indices for the final structural equation model

Fit Index	Observed Value	Recommended Cut-Off	Assessment	References
CMIN/DF	1.248	< 2.00	Good Fit	[62], [66]
RMSEA	0.001	< 0.08	Excellent Fit	[63], [67]
SRMR	0.005	< 0.08	Excellent Fit	[63]
GFI	0.921	> 0.90	Good Fit	[62]
CFI	0.996	> 0.90	Excellent Fit	[62], [63]
TLI	0.989	> 0.90	Excellent Fit	[62], [68]
PNFI	0.762	> 0.50	Good Parsimony	[63], [64]

Table 3 shows that all indicators exhibit acceptable standardized loadings (0.627–0.866), suggesting that each item contributes substantively to its respective construct. Internal consistency is also well supported, with Cronbach's alpha values ranging from 0.837 to 0.863 and composite reliability (C.R.) values from 0.838 to 0.866, both exceeding commonly accepted thresholds. Convergent validity is supported by AVE values above 0.50 for all constructs (0.511–0.568), indicating that each construct, on average, accounts for more than half of its indicators' variance. The findings indicate that the measurement model meets the standards for indicator reliability, internal consistency, and convergent validity, thereby supporting the instrument's suitability for subsequent structural model evaluation.

4.3. Model Fit Assessment (Goodness-of-Fit)

Evaluation model fit indices are widely recommended as a minimum standard for evaluating the adequacy of CB-SEM. To ensure a comprehensive assessment, this study reports multiple fit indicators capturing different dimensions of model fit, including the normed chi-square (CMIN/DF), absolute fit (RMSEA, SRMR, GFI), incremental fit (CFI, TLI), and parsimonious fit (PNFI).

Table 4 presents statistics indicating that the proposed model fits the data well. The normed chi-square

value (CMIN/DF = 1.248) is below the recommended threshold (< 2.000), suggesting an acceptable level of overall discrepancy between the model and the observed data. The absolute fit indices also demonstrate excellent fit, with RMSEA = 0.001 and SRMR = 0.005, both well below the cut-off (< 0.080), and GFI = 0.921, exceeding the recommended minimum (> 0.900). In terms of comparative (incremental) fit, CFI = 0.996 and TLI = 0.989 surpass the recommended threshold (> 0.900), indicating great improvement over the baseline model. The parsimonious fit index PNFI = 0.762 is above the criterion (> 0.500), suggesting that the model achieves good fit while maintaining parsimony. These results provide convergent evidence that the model demonstrates an adequate-to-excellent fit and is suitable for subsequent hypothesis testing.

4.4. Evaluation of Hypothesis

Structural equation model showing positive standardized associations from soft skills to self-efficacy and work readiness, from digital literacy to self-efficacy and work readiness, and from self-efficacy to work readiness. The model also presents the observed indicators, latent constructs, measurement errors, and standardized path coefficients. The results of the hypothesis tests are shown in Figure 2 and Tables 5–6.

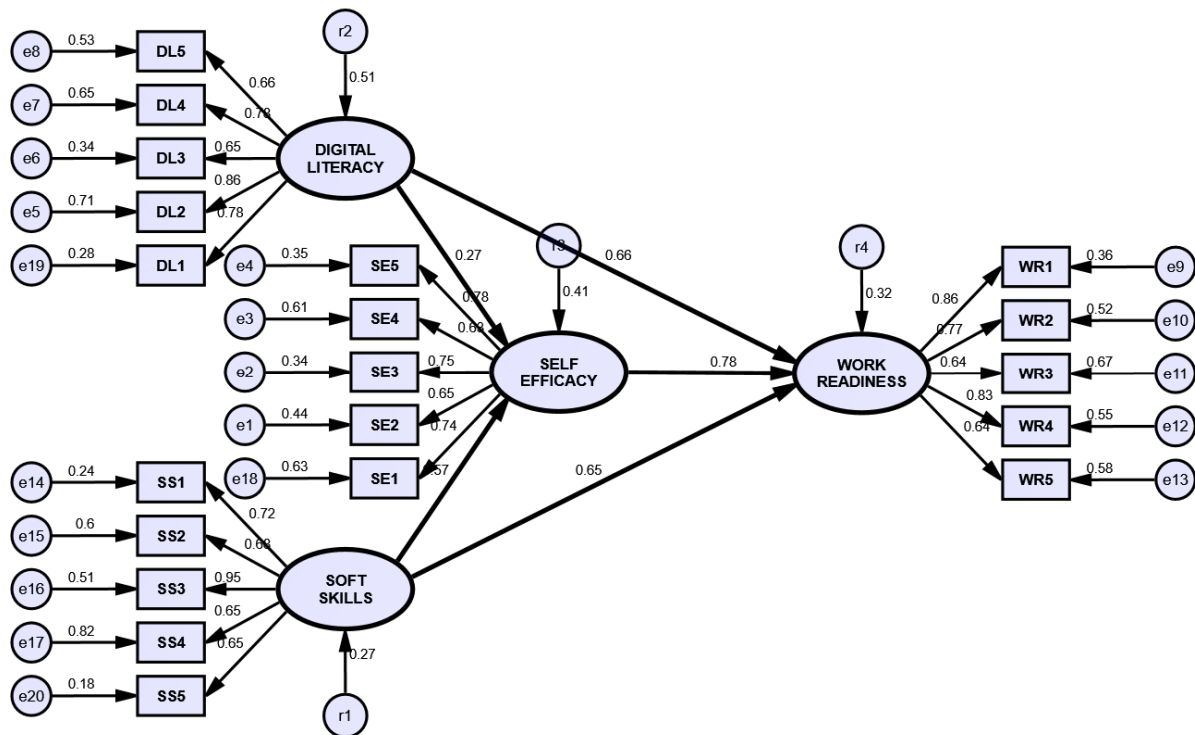


Figure 2. Results of the structural equation modeling analysis (Output AMOS)

Table 5. Standardized direct structural associations and hypothesis-testing results

Path	Standardized Coefficient (β)	C.R.	p-value	Results
SS → SE	0.574	3.151	0.002*	(H1) Supported
SS → WR	0.652	2.298	0.022*	(H2) Supported
DL → SE	0.274	2.479	0.013*	(H3) Supported
DL → WR	0.663	5.814	<0.001**	(H4) Supported
SE → WR	0.778	2.390	0.017*	(H5) Supported

Note: *p<0.05, **p<0.001

Table 6. Estimates of the indirect associations through self-efficacy

Path	Path a	Path b	Standardized Coefficient (β)	p-value	Results
SS → SE → WR	0.574	0.778	0.447	0.034*	(H6a) Supported
DL → SE → WR	0.274	0.778	0.213	<0.001**	(H6b) Supported

Note: *p<0.05, **p<0.001.

Table 5 presents the results of the direct-path analysis. Soft skills were positively associated with self-efficacy ($\beta = 0.574, p = 0.002$) and work readiness ($\beta = 0.652, p = 0.022$). Digital literacy was also positively associated with self-efficacy ($\beta = 0.274, p = 0.013$) and work readiness ($\beta = 0.663, p < 0.001$), while self-efficacy was positively associated with work readiness ($\beta = 0.778, p = 0.017$). Accordingly, H1, H2, H3, H4, and H5 were supported.

Table 6 presents the indirect-effect analysis. The indirect association between soft skills and work readiness through self-efficacy was positive and statistically significant ($\beta = 0.447, p = 0.034$), supporting H6a. The indirect association between digital literacy and work readiness through self-efficacy was also positive and

statistically significant ($\beta = 0.213, p < 0.001$), supporting H6b. Because the corresponding direct associations of soft skills and digital literacy with work readiness remained statistically significant, the results were classified as partial mediation.

5. DISCUSSION

The findings indicate positive associations among soft skills, digital literacy, self-efficacy, and work readiness, consistent with Social Cognitive Theory, which emphasizes the joint role of personal capabilities and efficacy beliefs in shaping adaptive behavior [32]. The

stronger relationship between soft skills and self-efficacy may reflect the fact that efficacy beliefs develop through mastery experiences, vicarious learning, and social persuasion, which are more directly fostered through communication, teamwork, initiative, and self-management than through tool-based competencies [19], [69]. Digital competence is often domain- and task-specific. It may not readily generalize to broader confidence in managing novel or uncertain work demands, particularly when self-efficacy is measured as generalized coping rather than technology-specific confidence [70], [71]. Unequal access to meaningful digital practice and uneven exposure across digital literacy dimensions may further weaken its translation into stable efficacy beliefs [72]–[74]. However, because all variables were measured concurrently, these relationships should be interpreted as theory-consistent associations rather than causal or temporal pathways, as cross-sectional mediation estimates may differ from the actual longitudinal process [52]. Thus, the model supports the plausibility of an SCT-informed competency-belief mechanism but does not establish the direction of causality.

Soft skills showed a moderate-to-strong positive association with self-efficacy ($\beta = 0.574$, $p < 0.001$). This result is consistent with previous findings that perceived mastery of communication, collaboration, adaptability, and problem-solving is associated with stronger psychological resources and career engagement among students [41]. It also aligns with broader labor-market evidence indicating that social and interpersonal capabilities have become increasingly important in work settings characterized by coordination, task interdependence, and continuous adjustment [75], [76]. Students who perceive themselves as capable of communicating clearly, contributing to teams, managing time, and resolving problems may have accumulated more successful interpersonal and task-management experiences. Within SCT, such experiences can serve as mastery experiences and sources of social feedback, leading to stronger efficacy beliefs.

However, the relationship should not be interpreted as unidirectional. Students with stronger general confidence may be more willing to participate in group activities, communicate their ideas, assume responsibility, and persist when interpersonal problems occur. They may consequently assess their soft skills more positively. Thus, self-efficacy may support the development or positive appraisal of soft skills just as soft skills may contribute to efficacy beliefs. This reciprocal interpretation is consistent with the broader agentic principle of SCT, in which personal beliefs, behavior, and environmental experiences continuously influence one another [32].

The positive association between soft skills and work readiness ($\beta = 0.652$, $p = 0.034$) supports the view that employability extends beyond occupation-specific technical knowledge. Research comparing student and employer perspectives has shown that communication,

teamwork, flexibility, problem-solving, and responsibility are among the competencies considered essential for successful transitions into employment [77]. The present findings extend this evidence to vocational high school students preparing for employment in construction and housing engineering.

In this occupational context, soft skills have concrete operational relevance. Construction work requires individuals to coordinate interdependent activities, clarify task responsibilities, communicate schedule changes, report hazards, follow and communicate safety procedures, negotiate solutions, and respond to unexpected site conditions. Studies of construction education and management have similarly identified communication, teamwork, leadership, decision-making, problem-solving, and coordination as central competencies for construction graduates and project personnel [78], [79]. Communication failures in this environment may affect not only productivity but also work quality and safety. The association observed in this study may therefore reflect students' perceptions that they can participate effectively in socially and organizationally complex workplace processes.

Digital literacy was positively associated with self-efficacy ($\beta = 0.274$, $p = 0.002$), though the relationship was weaker than that between soft skills and self-efficacy. This finding is consistent with previous evidence showing that students' digital literacy is related to their confidence and engagement in technology-mediated learning [44], [80]. Successful experiences in navigating online platforms, evaluating information, creating digital content, and solving basic technical problems may provide mastery experiences that support confidence in handling digitally mediated tasks.

The smaller coefficient may nevertheless indicate a degree of domain specificity. The self-efficacy construct used in this study captures relatively general confidence in solving complex problems, achieving goals, managing difficulties, and handling unexpected situations. By contrast, the digital-literacy indicators assess more specific capabilities, such as using productivity applications, evaluating online information, protecting personal data, producing digital content, and troubleshooting basic technical problems. Workplace research distinguishes between possessing particular digital skills and having the broader competence to select, combine, and adapt digital technologies to changing occupational tasks [81], [82]. Students may therefore feel capable of using certain applications without automatically developing generalized confidence in dealing with unfamiliar workplace pressures.

Digital literacy showed a strong direct association with work readiness ($\beta = 0.663$, $p < 0.001$), comparable to the effect of soft skills ($\beta = 0.652$, $p < 0.05$). This pattern indicates that vocational employability depends on dual competencies: functioning effectively in social and organizational contexts and performing productively

within technology-mediated work processes [55], [83], [84]. In construction and housing-related work, digital literacy supports document management, spreadsheet calculations, online communication, technical information searches, digital reporting, collaborative platforms, and design applications. Its importance is reinforced by the increasing use of building information modeling, mobile technologies, cloud collaboration, automated data collection, and integrated digital workflows in the construction sector [85], [86]. Thus, students with stronger digital literacy may be better prepared to work accurately, collaborate effectively, and adapt to contemporary workplace technologies.

The similarly strong direct associations of soft skills and digital literacy with work readiness indicate that these competencies should not be treated as competing explanations. Rather, the results are consistent with a complementary or “dual-competence” interpretation. Digital capabilities may enable students to complete technology-supported tasks accurately and efficiently. In contrast, soft skills may enable them to coordinate those tasks with supervisors, colleagues, clients, and other occupational groups. A student may know how to produce a digital document or operate design software but still experience difficulty communicating its contents, responding to feedback, or coordinating revisions. Conversely, strong communication and teamwork may not be sufficient when workplace activities require digital documentation, data processing, or technology-supported decision-making. Work readiness in construction-related occupations may therefore depend on integrating technological capability with interpersonal and self-management competence.

Self-efficacy showed the strongest direct association with work readiness ($\beta = 0.778$, $p = 0.018$), suggesting that students' beliefs in their ability to perform effectively may play a central role in translating competence into work readiness. This finding is consistent with evidence that self-efficacy influences task engagement, effort, persistence, employment readiness, and work-related performance [33], [46], [87]. During the school-to-work transition, students are required to apply their knowledge in unfamiliar environments, complete tasks under supervision, respond constructively to feedback, and persist when their initial performance is inadequate. In such situations, self-efficacy functions as a proximal motivational and self-regulatory mechanism that shapes goal setting, effort allocation, resilience, and adaptive responses to workplace demands [5], [6], [47]. Previous studies also associate stronger efficacy beliefs with more active job-search behavior, greater persistence during employment transitions, and more favorable employment outcomes [88]–[91]. Therefore. However, students may possess relevant technical and interpersonal competencies; these competencies are more likely to be expressed as work readiness when students are confident that they can mobilize them, regulate their performance,

and cope with pressure, uncertainty, and setbacks in real workplace situations [19].

Nevertheless, the coefficient's size requires cautious interpretation. Both self-efficacy and work readiness were assessed through positively worded self-evaluations. Students who generally perceive themselves as competent, optimistic, or capable may provide consistently favorable answers across both scales. In addition, work-readiness items relating to responsibility, professional communication, application of knowledge, and understanding of workplace standards are conceptually close to perceptions of being able to manage difficult tasks. The strong coefficient may therefore reflect both a substantive relationship and some degree of conceptual or method-related overlap. It should not be taken to mean that efficacy beliefs alone determine readiness for employment.

The significant indirect associations through self-efficacy for soft skills ($\beta = 0.447$, $p = 0.034$) and digital literacy ($\beta = 0.213$, $p < 0.001$) are statistically compatible with the SCT proposition that competencies are associated with adaptive outcomes partly through beliefs in one's ability to apply them successfully. The stronger indirect association for soft skills reflects its stronger relationship with self-efficacy. It is consistent with evidence that self-efficacy can function as an intermediary between employability resources and perceived employability [48]. Thus, soft skills may support work readiness by strengthening students' confidence in managing workplace challenges, interpersonal demands, and uncertainty. In contrast, digital literacy may contribute through both efficacy-related mechanisms and direct instrumental advantages in technology-rich workplaces. This dual pathway aligns with employability frameworks emphasizing the combined role of competence and efficacy beliefs in translating learning into performance-related readiness [83], [92].

At the same time, the findings should not be presented as proof of psychological mediation. A statistically significant indirect effect in cross-sectional data does not demonstrate that soft skills or digital literacy developed first, subsequently increased self-efficacy, and ultimately produced greater work readiness. An equally plausible sequence is that students who already feel ready for employment develop stronger efficacy beliefs and evaluate their competencies more favorably. Reciprocal reinforcement is also possible: Successful competency use may strengthen efficacy beliefs, while stronger efficacy may encourage further practice and competency development. The mediation findings should therefore be described as indirect statistical associations consistent with, but not sufficient to confirm, the proposed SCT mechanism.

The present study contributes to previous research by integrating interpersonal competence, digital capability, efficacy beliefs, and work readiness into a single structural model. Earlier employability research

has often examined these resources separately or focused on university students and graduates. The current results indicate that the same broad competency domains are already relevant among vocational high school students preparing for relatively direct entry into occupation-specific employment.

The construction and housing engineering context is important because readiness in this field cannot be reduced to classroom knowledge or the ability to operate a single technical application. Construction projects involve changing site conditions, multiple occupational groups, safety requirements, documentation procedures, deadlines, and digitally supported workflows. The findings, therefore, extend general employability research by showing that students' perceived readiness is associated with both their capacity to work with others and their capacity to manage technology-mediated information and tasks.

The results also suggest that self-efficacy may help explain why students with apparently similar technical learning opportunities report different levels of work readiness. Students may possess basic competencies but remain hesitant to apply them in unfamiliar or demanding situations. Conversely, efficacy beliefs unsupported by adequate occupational competence may lead to confidence that is not reflected in actual performance. The theoretical contribution of the model is therefore not that confidence can replace competence, but that competence and confidence may need to develop together. This interpretation is more consistent with SCT than treating self-efficacy as an isolated personal trait.

Several alternative explanations need to be considered before drawing substantive conclusions from the relatively high path coefficients. First, reverse causality is plausible. Students who already perceive themselves as prepared for work may interpret their prior learning experiences more favorably and, consequently, report higher levels of soft skills, digital literacy, and self-efficacy. Because no construct was measured before or after another, the present data cannot distinguish whether competencies are associated with later work readiness, whether work readiness is associated with later competency appraisal, or whether both processes occur reciprocally.

Second, the simultaneous use of self-report questionnaires with similar response scales creates a risk of common-method variance. Consistency motives, acquiescence, social desirability, and similarities in item wording may produce covariance attributable partly to the measurement procedure rather than entirely to the theoretical constructs. Podsakoff et al. [93] explained that common measurement sources, common scale formats, and respondents' implicit theories can systematically inflate or alter relationships among organizational and behavioral variables. In this study, students may have inferred that communication ability, digital competence, confidence, and work readiness were all desirable

attributes and answered the items consistently in a favorable direction. The excellent model fit does not eliminate this possibility, because a model can reproduce the observed covariance structure even when part of it arises from a shared measurement method.

Third, social-desirability processes may be particularly relevant, given that the respondents were students who participated via school communication channels. Even where confidentiality was communicated, students may have believed that reporting high competence and readiness reflected expected or socially approved behavior. Future studies should therefore consider including a social-desirability measure, balancing positively and negatively worded items where psychometrically appropriate, separating the measurement of predictors and outcomes, or obtaining assessments from teachers, internship supervisors, and performance-based tasks.

Fourth, participation in MOOC-based training introduces a potential self-selection explanation. Students who participate in online courses may already differ from nonparticipants in motivation, persistence, digital access, prior competence, and willingness to learn independently. Research on MOOC learning has demonstrated considerable variation in learners' motivation and self-regulation, with these characteristics shaping how participants engage with course materials [94]–[96]. Broader analyses of MOOC participation have also shown that open online courses frequently attract learners who already possess educational and motivational advantages [97], [98]. Accordingly, the findings should not be interpreted as evidence that MOOC participation produced the observed levels of soft skills, digital literacy, self-efficacy, or work readiness. MOOC participation defines the context of the sample, but it was not measured as an intervention, exposure level, or explanatory variable.

Fifth, several omitted variables may account for part of the observed associations. Internship and work-based learning experiences may expose students to authentic communication, safety practices, task coordination, workplace technology, and supervisor feedback. Such exposure could simultaneously strengthen perceived soft skills, digital literacy, self-efficacy, and work readiness. Research on work-integrated learning indicates that employability-skill development depends substantially on the quality of workplace tasks, supervision, reflection, and opportunities to assume meaningful responsibility [99]. The model did not measure the duration, quality, or type of students' internship experience, making it impossible to separate the associations of the focal constructs from the influence of prior workplace exposure.

Academic achievement may be another common antecedent. Students with stronger academic performance may have greater mastery of technical content, more positive teacher feedback, and greater confidence in applying their knowledge. School quality,

teacher competence, digital infrastructure, industry partnerships, socioeconomic resources, and access to personal devices may likewise shape all four constructs. For example, students in schools with stronger industry collaboration may receive more realistic workplace assignments and feedback. In contrast, students with reliable digital access may have more opportunities to practice digital tasks independently. The structural coefficients may therefore partly reflect differences in educational opportunity rather than relationships operating solely at the individual level.

The data's nested structure also warrants consideration. Students were recruited from 22 schools across 16 districts or cities. Students within the same school may share teachers, learning facilities, curriculum implementation, school leadership, industry partnerships, and local labor-market conditions. Their responses may consequently be more similar than responses from students attending different schools. A single-level SEM does not explicitly separate student-level relationships from school-level influences. Future studies with sufficient numbers of schools should consider multilevel SEM or cluster-robust estimation to evaluate whether the proposed relationships remain stable after accounting for school-level variation.

6. RESEARCH LIMITATIONS & ALTERNATIVE EXPLANATIONS

Several limitations and alternative explanations should be considered when interpreting these findings. First, the cross-sectional design does not establish temporal order or causality. Accordingly, the significant direct and indirect effects should be interpreted as statistical associations consistent with Social Cognitive Theory rather than as evidence that soft skills and digital literacy increase self-efficacy and, subsequently, produce work readiness [51], [52]. Reverse or reciprocal relationships remain plausible, as students who already perceive themselves as work-ready may report stronger self-efficacy and evaluate their competencies more positively.

Second, all constructs were measured simultaneously using self-report questionnaires with similar response formats. Common-method variance, acquiescence, social desirability, and conceptual overlap, particularly between self-efficacy and work readiness, may therefore have inflated some relationships [93]. The strong coefficients may reflect both substantive associations and respondents' tendency to evaluate desirable personal attributes consistently.

Third, participation in MOOC-based training may introduce self-selection bias. MOOC participants may already differ in motivation, persistence, self-regulation, digital access, and prior competence [94]–[98]. Because MOOC participation was not tested as an intervention or explanatory variable, the findings should not be

interpreted as evidence that MOOCs caused higher soft skills, digital literacy, self-efficacy, or work readiness.

Fourth, unmeasured factors, including academic achievement, internship experience, socioeconomic resources, school quality, teacher competence, digital infrastructure, and industry partnerships, may partly explain the observed associations. Work-integrated learning, for example, may simultaneously strengthen students' competencies, confidence, and work readiness through authentic tasks, supervision, and workplace feedback [99].

Students were nested within 22 schools across 16 districts and cities, but the analysis did not account explicitly for school-level variation. Students within the same school may share learning facilities, teachers, curriculum implementation, industry partnerships, and local labor-market conditions. Future studies should therefore use longitudinal or experimental designs, multiple data sources, performance-based assessments, and multilevel or cluster-robust analyses to test temporal relationships and reduce potential measurement and contextual biases.

7. IMPLICATIONS AND FUTURE RESEARCH

7.1. Theoretical Implications

The findings provide qualified support for integrating SCT with competency-based approaches to work readiness. Soft skills and digital literacy represent perceived capability resources, while self-efficacy reflects students' confidence in applying those capabilities under difficult or unexpected conditions. The significant direct and indirect associations suggest that competencies contribute to work readiness both instrumentally and through efficacy beliefs. However, these results indicate theory-consistent relationships rather than confirmed causal mechanisms.

The weaker association between digital literacy and self-efficacy may partly reflect differences in the specificity of the constructs. Digital literacy was measured through specific technology-related activities, whereas self-efficacy reflected broader confidence in managing challenges. Future studies should therefore distinguish general, occupational, computer, and construction-task self-efficacy. The partial mediation also indicates that self-efficacy is not the only explanatory mechanism. Career adaptability, vocational identity, learning engagement, occupational commitment, and workplace exposure may provide additional pathways linking competencies to work readiness.

7.2. Practical Implications

Vocational schools should integrate soft skills, digital literacy, and self-efficacy within authentic, occupation-specific learning activities. Construction-related projects could require students to coordinate roles, communicate safety information, solve project problems, negotiate

decisions, respond to changing specifications, and document their work. Digital learning should similarly move beyond basic application use toward managing project documents, processing data in spreadsheets, using collaborative platforms, producing digital drawings, and evaluating technical information.

Self-efficacy can be strengthened through challenging but achievable tasks, repeated practice, feedback, peer modeling, and opportunities for revision. However, confidence development should remain connected to observable competence through practical demonstrations, project rubrics, structured observations, and assessments from teachers or industry supervisors. Partnerships with construction companies may further improve authenticity and provide more credible evidence of readiness than self-report alone. These recommendations remain provisional and require evaluation through longitudinal or intervention studies.

7.3. Directions for Future Research

Future research should use longitudinal designs to clarify temporal ordering by measuring competencies before training or internships, self-efficacy during or after these experiences, and work readiness at a later stage. Cross-lagged or longitudinal mediation models could also examine reverse and reciprocal relationships.

Studies should combine self-reports with performance tasks, teacher assessments, internship supervisor ratings, academic records, and workplace behavior indicators. Future models should additionally control for internship experience, academic achievement, socioeconomic resources, school infrastructure, teacher support, industry partnerships, and MOOC engagement. Comparing MOOC participants with similar nonparticipants and measuring completion, interaction, assessment performance, and time on task would help determine whether the observed relationships reflect MOOC experiences, broader student characteristics, or differences in learning quality.

8. CONCLUSION

This study tested an SEM model in which soft skills and digital literacy were positioned as predictors of work readiness, both directly and indirectly through self-efficacy as a mediator. The model demonstrated an acceptable level of fit, and the hypothesis tests showed that soft skills and digital literacy had positive and significant effects on work readiness; both also had positive and significant effects on self-efficacy, while self-efficacy itself had a positive and significant effect on work readiness. These results indicate that vocational students' work-readiness is shaped by the integration of interpersonal competencies, digital capabilities, and confidence in meeting workplace demands.

The study's primary contribution is strengthening the understanding of work readiness in the digital era by providing empirical evidence for the synergistic roles of soft skills, digital literacy, and self-efficacy in vocational education. However, the findings are limited by the cross-sectional design, the geographically restricted sample in South Sulawesi, and potential bias from self-reported measures; future research is encouraged to adopt longitudinal designs, incorporate in-depth qualitative approaches, and conduct comparative studies across regions or learning models. In terms of implications, vocational institutions should design learning experiences that systematically develop soft skills and digital literacy while fostering self-efficacy, as discussed in the study.

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CONFLICTS OF INTEREST

The authors declare that no conflicts of interest are associated with this study. All aspects of the research were conducted with the utmost integrity and transparency.

DATA AVAILABILITY

The datasets utilized and analyzed during this research are available from the corresponding author upon reasonable request.

ETHICAL STATEMENTS

Not applicable. This study did not involve any human participants or animals, and no personal or sensitive data were collected, used, or analyzed at any stage of the research.

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REFERENCES

- [1] National Association of Colleges and Employers (NACE), "Job Outlook 2025," 2025. <https://www.naceweb.org/mynace/job-outlook>
- [2] World Economic Forum, "The Future of Jobs Report 2025," World Economic Forum, 2025. <https://www.weforum.org/reports/the-future-of-jobs-report-2025/>
- [3] A. J. A. M. Van Deursen and J. A. G. M. Van Dijk, Digital skills: Unlocking the information society. Springer, 2014.
- [4] A. Bandura, Self-Efficacy: The Exercise of Control. New York: W. H. Freeman and Company, 1997.
- [5] R. W. Lent and S. D. Brown, "Social cognitive model of career self-management: Toward a unifying view of adaptive career behavior across the life span," J. Couns.

- Psychol., vol. 60, no. 4, pp. 557–568, 2013, <https://doi.org/10.1037/a0033446>
- [6] R. W. Lent, S. D. Brown, and G. Hackett, “Contextual supports and barriers to career choice: A social cognitive analysis,” *J. Couns. Psychol.*, vol. 47, no. 1, pp. 36–49, 2000, <https://doi.org/10.1037/0022-0167.47.1.36>
- [7] A. A. Al-Imarah and R. Shields, “MOOCs, disruptive innovation and the future of higher education: A conceptual analysis,” *Innov. Educ. Teach. Int.*, vol. 56, no. 3, pp. 258–269, 2019, <https://doi.org/10.1080/14703297.2018.1443828>
- [8] K. O’Connor, “MOOCs, institutional policy and change dynamics in higher education,” *High. Educ.*, vol. 68, no. 5, pp. 623–635, 2014, <https://doi.org/10.1007/s10734-014-9735-z>
- [9] T. R. Liyanagunawardena, S. A. Williams, and A. A. Adams, “The Impact and Reach of MOOCs: A Developing Countries’ Perspective,” *eLearning Pap.*, vol. 33, pp. 1–8, 2013.
- [10] L. Yuan and S. Powell, “In-depth MOOCs and disruptive innovation : Implications for,” *eLearning Pap.*, vol. 33, no. May, pp. 1–8, 2013, [Online]. Available: <http://www.openeducationeuropa.eu/en/article/MOOCs-and-disruptive-innovation:-Implications-for-higher-education>
- [11] M. M. Robles, “Executive Perceptions of the Top 10 Soft Skills Needed in Today’s Workplace,” *Bus. Commun. Q.*, vol. 75, no. 4, pp. 453–465, 2012, <https://doi.org/10.1177/1080569912460400>
- [12] D. P. Goleman, *Emotional intelligence: Why it can matter more than IQ*. New York: Bantam Books, 1995.
- [13] F. Luthans and C. M. Youssef-Morgan, “Psychological capital: An evidence-based positive approach,” *Annu. Rev. Organ. Psychol. Organ. Behav.*, vol. 4, no. 1, pp. 339–366, 2017. <https://doi.org/10.1146/annurev-orgpsych-032516-113324>
- [14] A. J. A. M. van Deursen and J. A. G. M. van Dijk, “The first-level digital divide shifts from inequalities in physical access to inequalities in material access,” *New Media Soc.*, vol. 21, no. 2, pp. 354–375, 2019, <https://doi.org/10.1177/1461444818797082>
- [15] R. J. Baron, “Digital literacy,” *Int. Encycl. media Lit.*, pp. 1–6, 2019.
- [16] E. J. Helsper, “The Social Relativity of Digital Exclusion: Applying Relative Deprivation Theory to Digital Inequalities,” *Commun. Theory*, vol. 27, no. 3, pp. 223–242, 2017, <https://doi.org/10.1111/comt.12110>
- [17] A. Bandura, “Self-efficacy: toward a unifying theory of behavioral change,” *Psychol. Rev.*, vol. 84, no. 2, p. 191, 1977. [https://doi.org/10.1016/0146-6402\(78\)90002-4](https://doi.org/10.1016/0146-6402(78)90002-4)
- [18] R. Schwarzer and M. Jerusalem, “Generalized Self-efficacy Scale,” In: J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user’s portfolio. Causal and control beliefs*, 1995. <https://measure-wellbeing.org/measures-bank/gse/>
- [19] B. J. Zimmerman, “Self-Efficacy: An Essential Motive to Learn,” *Contemp. Educ. Psychol.*, vol. 25, no. 1, pp. 82–91, 2000, <https://doi.org/10.1006/ceps.1999.1016>
- [20] D. H. Schunk and M. K. DiBenedetto, “Self-efficacy theory in education,” in *Handbook of Motivation at School: Second Edition*, Routledge, 2016, pp. 34–54. <https://doi.org/10.4324/9781315773384>
- [21] UNESCO, *UNESCO strategy 2022-2029*. Paris: UNESCO, 2022. [Online]. Available: https://unevoc.unesco.org/pub/unesco_strategy_for_tv_et_2022-2029.pdf
- [22] L. Li, “Reskilling and Upskilling the Future-ready Workforce for Industry 4.0 and Beyond,” *Inf. Syst. Front.*, vol. 26, no. 5, pp. 1697–1712, 2024, <https://doi.org/10.1007/s10796-022-10308-y>
- [23] W. M. Lim, “The workforce revolution: Reimagining work, workers, and workplaces for the future,” *Global Business and Organizational Excellence*, vol. 42, no. 4. Wiley Online Library, pp. 5–10, 2023. <https://doi.org/10.1002/joe.22218>
- [24] I. & U. J. S. World Bank, “Improve technical and vocational education and training (TVET) to meet skills and labour mismatch.” 2023. <https://www.ilo.org/resource/news/improve-technical-and-vocational-education-and-training-tvet-meet-skills>
- [25] D. Gamage, I. Perera, and S. Fernando, “MOOCs lack interactivity and collaborativeness: Evaluating MOOC platforms,” *Int. J. Eng. Pedagog.*, vol. 10, no. 2, pp. 94–111, 2020, <https://doi.org/10.3991/ijep.v10i2.11886>
- [26] M. D. P. García-Chitiva, P. Vázquez-Villegas, and J. C. Correa, “Collaborative Skills Developed in Collaborative Online International Learning as a Multivariate Research Subject,” *Int. J. Eng. Pedagog.*, vol. 15, no. 2, pp. 74–92, 2025, <https://doi.org/10.3991/ijep.v15i2.51561>
- [27] S. Suyitno et al., “The Effect of Work-Based Learning on Employability Skills: The Role of Self-Efficacy and Vocational Identity,” *Eur. J. Educ. Res.*, vol. 14, no. 1, pp. 309–321, 2025, <https://doi.org/10.12973/euler.14.1.309>
- [28] I. A. Susantyo, L. Yuldinawati, and M. A. Sugiat, “Analyzing Digital Utility App Adoption: A UTAUT Approach on PLN Mobile with Technological Literacy as a Moderator,” *Adv. Sustain. Sci. Eng. Technol.*, vol. 8, no. 1, 2026, <https://doi.org/10.26877/asset.v8i1.2367>
- [29] M. R. Che Abdul Rahman, U. A. A. Rauf, and S. Sinniah, “Oil Palm Smallholders Entrepreneurs and Financial Literacy: Technology Adoption,” *J. Appl. Eng. Technol. Sci.*, vol. 6, no. 1, pp. 656–667, 2024, <https://doi.org/10.37385/jaets.v6i1.6168>
- [30] N. Kholifah et al., “Unlocking workforce readiness through digital employability skills in vocational education Graduates: A PLS-SEM analysis based on human capital Theory,” *Soc. Sci. Humanit. Open*, vol. 11, p. 101625, 2025. <https://doi.org/10.1016/j.ssaho.2025.10162>
- [31] D. R. Swaramarinda, B. Bin Isa, D. Puruwita, R. Faslah, K. D. Arfiando Sebayang, and M. A. Adha, “Preparing vocational students for the digital economy: Exploring the role of digital literacy, entrepreneurial agility, and digital entrepreneurship education,” *Soc. Sci. Humanit. Open*, vol. 12, p. 101926, 2025, <https://doi.org/10.1016/j.ssaho.2025.101926>
- [32] A. Bandura, “Social cognitive theory: An agentic perspective,” *Annu. Rev. Psychol.*, vol. 52, no. 1, pp. 1–26, 2001, <https://doi.org/10.1146/annurev.psych.52.1.1>
- [33] A. Bandura and S. Wessels, *Self-efficacy*. Cambridge University Press Cambridge, 1997.
- [34] D. H. Schunk and M. K. DiBenedetto, “Self-efficacy and human motivation,” in *Advances in Motivation Science*, vol. 8, Elsevier, 2021, pp. 153–179. <https://doi.org/10.1016/bs.adms.2020.10.001>

- [35] S. D. Brown and R. W. Lent, *Career Development and Counseling: Putting Theory and Research to Work*, vol. 53, no. 9. John Wiley & Sons, 2013.
- [36] C. Goldin, "Human Capital Human Capital," *Soc. Econ.*, vol. 2, no. 1, pp. 235–287, 2016, [Online]. Available: https://link.springer.com/chapter/10.1007/978-1-349-19806-1_19
- [37] G. S. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, 3rd ed. Chicago: University of Chicago press, 1993. <https://doi.org/10.7208/chicago/9780226041223.001.0001>
- [38] J. World Economic Forum, "The future of jobs report 2020," Retrieved from Geneva, 2020.
- [39] H. Tushar and N. Sooraksa, "Global employability skills in the 21st century workplace: A semi-systematic literature review," *Heliyon*, vol. 9, no. 11, 2023, <https://doi.org/10.1016/j.heliyon.2023.e21023>
- [40] O. Romanova, "Embedding employability skills into vocational education and training: What works best for students' self-evaluation and aspirations?," *J. Teach. Learn. Grad. Employab.*, vol. 13, no. 1, pp. 20–36, 2022, <https://doi.org/10.21153/jtlge2022vol13no1art1488>
- [41] F. Aryani, H. Wirawan, A. Saman, S. Samad, and M. Jufri, "From high school to workplace: investigating the effects of soft skills on career engagement through the role of psychological capital in different age groups," *Educ. Train.*, vol. 63, no. 9, pp. 1326–1345, 2021, <https://doi.org/10.1108/ET-03-2021-0087>
- [42] R. Vuorikari, S. Kluzer, and Y. Punie, *DigComp 2.2: The Digital Competence Framework for Citizens*. Luxembourg, 2022. <https://doi.org/10.2760/115376JRC128415>
- [43] European Commission: Directorate-General for Research and Innovation, "Industry 5.0: Towards a sustainable, human-centric and resilient European industry," Publications Office of the European Union, 2021. [Online]. Available: <https://data.europa.eu/doi/10.2777/308407>
- [44] S. Getenet, R. Cantle, P. Redmond, and P. Albion, "Students' digital technology attitude, literacy and self-efficacy and their effect on online learning engagement," *Int. J. Educ. Technol. High. Educ.*, vol. 21, no. 1, p. 3, 2024, <https://doi.org/10.1186/s41239-023-00437-y>
- [45] A. Caroline, M. J. H. Coun, A. Gunawan, and J. Stoffers, "A systematic literature review on digital literacy, employability, and innovative work behavior: emphasizing the contextual approaches in HRM research," *Front. Psychol.*, vol. 15, p. 1448555, 2024, <https://doi.org/10.3389/fpsyg.2024.1448555>
- [46] F. Tentama, N. Merdiaty, and S. Subardjo, "Self-efficacy and work readiness among vocational high school students," *J. Educ. Learn.*, vol. 13, no. 2, pp. 277–281, 2019, <https://doi.org/10.11591/edulearn.v13i2.12677>
- [47] D. Zhou, Z. Peng, and H. Zhou, "The influence of career decision-making self-efficacy on employability of higher vocational students: mediated by emotional intelligence," in *Frontiers in Education*, 2023, vol. 8, p. 1274430. <https://doi.org/10.3389/feduc.2023.1274430>
- [48] B. K. Wujema, R. M. Rasdi, Z. Zaremohzzabieh, and S. Ahrari, "The Role of Self-Efficacy as a Mediating Variable in CareerEDGE Employability Model: The Context of Undergraduate Employability in the North-East Region of Nigeria," *Sustain.*, vol. 14, no. 8, p. 4660, 2022, <https://doi.org/10.3390/su14084660>
- [49] X. Li, R. Pu, and N. Phakdeephrot, "The influence of achievement motivation on college students' employability: A chain mediation analysis of self-efficacy and academic performance," *Front. Psychol.*, vol. 13, p. 972910, 2022, <https://doi.org/10.3389/fpsyg.2022.972910>
- [50] R. B. Kline, *Principles and practice of structural equation modeling*. Guilford publications, 2023.
- [51] A. Bandura, "Social Foundations of Thought and Action," *Heal. Psychol. Read.*, vol. 1986, no. 23–28, pp. 94–106, 2012, <https://doi.org/10.4135/9781446221129.n6>
- [52] S. E. Maxwell and D. A. Cole, "Bias in cross-sectional analyses of longitudinal mediation," *Psychol. Methods*, vol. 12, no. 1, pp. 23–44, 2007, <https://doi.org/10.1037/1082-989X.12.1.23>
- [53] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, and R. L. Tatham, *Multivariate Data Analysis*, 8th ed. Edinburgh Gate, Harlow: Pearson Education Limited, 2019.
- [54] Battelle for Kids, *Framework for 21st Century Learning Definitions*. 2019. [Online]. Available: http://static.battelleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf
- [55] C. L. Caballero, A. Walker, and M. Fuller-Tyszkiewicz, "The Work Readiness Scale (WRS): Developing a measure to assess work readiness in college graduates," *J. Teach. Learn. Grad. Employab.*, vol. 2, no. 1, pp. 41–54, 2011, <https://doi.org/10.21153/jtlge2011vol2no1art552>
- [56] U. Scholz, B. G. Doña, S. Sud, and R. Schwarzer, "Is general self-efficacy a universal construct? Psychometric findings from 25 countries," *Eur. J. Psychol. Assess.*, vol. 18, no. 3, pp. 242–251, 2002, <https://doi.org/https://doi.org/10.1027/1015-5759.18.3.242>
- [57] National Association of Colleges and Employers (NACE), "Competencies for a Career-Ready Workforce," 2024, [Online]. Available: <https://www.naceweb.org/docs/default-source/default-document-library/2024/resources/nace-career-readiness-competencies-revised-apr-2024.pdf>
- [58] W. Ng, "Can we teach digital natives digital literacy?," *Comput. Educ.*, vol. 59, no. 3, pp. 1065–1078, 2012, <https://doi.org/10.1016/j.compedu.2012.04.016>
- [59] I. Hussey, T. Alsalti, F. Bosco, M. Elson, and R. Arslan, "An Aberrant Abundance of Cronbach's Alpha Values at .70," *Adv. Methods Pract. Psychol. Sci.*, vol. 8, no. 1, p. 25152459241287124, 2025, <https://doi.org/10.1177/25152459241287123>
- [60] G. W. Cheung, H. D. Cooper-Thomas, R. S. Lau, and L. C. Wang, "Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations," *Asia Pacific J. Manag.*, vol. 41, no. 2, pp. 745–783, 2024, <https://doi.org/10.1007/s10490-023-09871-y>
- [61] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, "Multivariate data analysis," 2019.
- [62] R. E. Schumacker and R. G. Lomax, *A Beginner's Guide to Structural Equation Modeling*, 3rd ed. Mahwah, NJ: Lawrence Erlbaum Associates, 2015. <https://doi.org/10.4324/9781315749105>
- [63] L. T. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria

- versus new alternatives,” *Struct. Equ. Model.*, vol. 6, no. 1, pp. 1–55, 1999,
<https://doi.org/10.1080/10705519909540118>
- [64] H. W. Marsh, K. T. Hau, and Z. Wen, “In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler’s (1999) findings,” *Struct. Equ. Model.*, vol. 11, no. 3, pp. 320–341, 2004,
https://doi.org/10.1207/s15328007sem1103_2
- [65] R. B. Kline, *Principles and practice of structural equation modeling*, 4th ed. New York, United States: Guilford publications, 2015.
- [66] E. Carmines and J. Mclver, “Analyzing models with unobserved variables: Analysis of covariance structures,” in *Social measurement: Current issues*, G. W. Bohr., vol. 80, Beverly Hills: Sage Publications, 1981, pp. 65–115.
- [67] F. Chen, P. J. Curran, K. A. Bollen, J. Kirby, and P. Paxton, “An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models,” *Sociol. Methods Res.*, vol. 36, no. 4, pp. 462–494, 2008,
<https://doi.org/10.1177/0049124108314720>
- [68] M. C. Hill and C. R. Tiedeman, “Evaluating Model Fit,” in *Effective Groundwater Model Calibration*, Thousand Oaks, CA: SAGE Publications, 2007, pp. 93–123.
<https://doi.org/10.1002/9780470041086.ch6>
- [69] E. L. Usher and F. Pajares, “Sources of Self-Efficacy in school: Critical review of the literature and future directions,” *Rev. Educ. Res.*, vol. 78, no. 4, pp. 751–796, 2008,
<https://doi.org/10.3102/0034654308321456>
- [70] D. R. Compeau and C. A. Higgins, “Computer self-efficacy: Development of a measure and initial test,” *MIS Q. Manag. Inf. Syst.*, vol. 19, no. 2, pp. 189–210, 1995,
<https://doi.org/10.2307/249688>
- [71] M. J. J. Roll and D. Ifenthaler, “Multidisciplinary digital competencies of pre-service vocational teachers,” *Empir. Res. Vocat. Educ. Train.*, vol. 13, no. 1, p. 7, 2021,
<https://doi.org/10.1186/s40461-021-00112-4>
- [72] J. A. G. M. van Dijk, “Digital divide research, achievements and shortcomings,” *Poetics*, vol. 34, no. 4–5, pp. 221–235, 2006,
<https://doi.org/10.1016/j.poetic.2006.05.004>
- [73] E. van Laar, A. J. A. M. van Deursen, J. A. G. M. van Dijk, and J. de Haan, “The relation between 21st-century skills and digital skills: A systematic literature review,” *Comput. Human Behav.*, vol. 72, pp. 577–588, 2017,
<https://doi.org/10.1016/j.chb.2017.03.010>
- [74] N. Yelland, *Technology and social inclusion: Rethinking the digital divide*. MIT press, 2013.
<https://doi.org/10.1017/CBO9781107300910.004>
- [75] D. J. Deming, “The growing importance of social skills in the labor market,” *Q. J. Econ.*, vol. 132, no. 4, pp. 1593–1640, 2017,
<https://doi.org/10.1093/qje/qjx022>
- [76] D. Deming and L. B. Kahn, “Skill requirements across firms and labor markets: Evidence from job postings for professionals,” *J. Labor Econ.*, vol. 36, no. S1, pp. S337–S369, 2018,
<https://doi.org/10.1086/694106>
- [77] C. Succi and M. Canovi, “Soft skills to enhance graduate employability: comparing students and employers’ perceptions,” *Stud. High. Educ.*, vol. 45, no. 9, pp. 1834–1847, 2020.
<https://doi.org/10.1080/03075079.2019.1585420>
- [78] C. Ahn, S. H. Lee, F. Peña-Mora, and S. Abourizk, “Toward environmentally sustainable construction processes: The U.S. and Canada’s perspective on energy consumption and GHG/CAP emissions,” *Sustainability*, vol. 2, no. 1, pp. 354–370, 2010,
<https://doi.org/10.3390/su2010354>
- [79] A. R. J. Dainty and R. J. Brooke, “Towards improved construction waste minimisation: a need for improved supply chain integration?,” *Struct. Surv.*, vol. 22, no. 1, pp. 20–29, 2004,
<https://doi.org/10.1108/02630800410533285>
- [80] H. J. Kim, A. J. Hong, and H. D. Song, “The roles of academic engagement and digital readiness in students’ achievements in university e-learning environments,” *Int. J. Educ. Technol. High. Educ.*, vol. 16, no. 1, pp. 1–18, 2019,
<https://doi.org/10.1186/s41239-019-0152-3>
- [81] M. Oberländer, A. Beinicke, and T. Bipp, “Digital competencies: A review of the literature and applications in the workplace,” *Comput. Educ.*, vol. 146, p. 103752, 2020,
<https://doi.org/10.1016/j.compedu.2019.103752>
- [82] B. Audrin, C. Audrin, and X. Salamin, “Digital skills at work – Conceptual development and empirical validation of a measurement scale,” *Technol. Forecast. Soc. Change*, vol. 202, p. 123279, 2024,
<https://doi.org/10.1016/j.techfore.2024.123279>
- [83] L. D. Pool and P. Sewell, “The key to employability: Developing a practical model of graduate employability,” *Educ. Train.*, vol. 49, no. 4, pp. 277–289, 2007,
<https://doi.org/10.1108/00400910710754435>
- [84] M. Fugate, A. J. Kinicki, and B. E. Ashforth, “Employability: A psycho-social construct, its dimensions, and applications,” *J. Vocat. Behav.*, vol. 65, no. 1, pp. 14–38, 2004.
<https://doi.org/10.1016/j.jvb.2003.10.005>
- [85] T. D. Oesterreich and F. Teuteberg, “Understanding the implications of digitisation and automation in the context of Industry 4.0: A triangulation approach and elements of a research agenda for the construction industry,” *Comput. Ind.*, vol. 83, pp. 121–139, 2016,
<https://doi.org/10.1016/j.compind.2016.09.006>
- [86] M. Kozlovska, D. Klosova, and Z. Strukova, “Impact of industry 4.0 platform on the formation of construction 4.0 concept: A literature review,” *Sustain.*, vol. 13, no. 5, pp. 1–15, 2021,
<https://doi.org/10.3390/su13052683>
- [87] A. D. Stajkovic and F. Luthans, “Self-efficacy and work-related performance: A meta-analysis,” *Psychol. Bull.*, vol. 124, no. 2, p. 240, 1998,
<https://doi.org/10.1037/0033-2909.124.2.240>
- [88] R. W. Lent, S. D. Brown, and G. Hackett, “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance,” *J. Vocat. Behav.*, vol. 45, no. 1, pp. 79–122, 1994,
<https://doi.org/10.1006/jvbe.1994.1027>
- [89] G. Petruzzello, M. G. Mariani, D. Guglielmi, B. I. J. M. van der Heijden, J. P. de Jong, and R. Chiesa, “The role of teaching staff in fostering perceived employability of university students,” *Stud. High. Educ.*, vol. 48, no. 1, pp. 20–36, 2023,
<https://doi.org/10.1080/03075079.2022.2105830>
- [90] L. M. Moynihan, M. V. Roehling, M. A. LePine, and W. R. Boswell, “A longitudinal study of the relationships among job search self-efficacy, job interviews, and employment outcomes,” *J. Bus. Psychol.*, vol. 18, no. 2, pp. 207–233, 2003,
<https://doi.org/10.1023/A:1027349115277>
- [91] R. Kanfer, C. R. Wanberg, and T. M. Kantrowitz, “Job search and employment: A personality–motivational

- analysis and meta-analytic review.," J. Appl. Psychol., vol. 86, no. 5, pp. 837–855, 2001, <https://doi.org/10.1037/0021-9010.86.5.837>
- [92] P. Knight and M. Yorke, Learning, curriculum and employability in higher education. London: Routledge Falmer, 2003. <https://doi.org/10.4324/9780203465271>
- [93] P. M. Podsakoff, S. B. MacKenzie, J. Y. Lee, and N. P. Podsakoff, "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," J. Appl. Psychol., vol. 88, no. 5, pp. 879–903, 2003, <https://doi.org/10.1037/0021-9010.88.5.879>
- [94] A. Littlejohn, N. Hood, C. Milligan, and P. Mustain, "Learning in MOOCs: Motivations and self-regulated learning in MOOCs," Internet High. Educ., vol. 29, pp. 40–48, 2016, <https://doi.org/10.1016/j.iheduc.2015.12.003>
- [95] R. S. Jansen, A. van Leeuwen, J. Janssen, R. Conijn, and L. Kester, "Supporting learners' self-regulated learning in Massive Open Online Courses," Comput. Educ., vol. 146, p. 103771, 2020, <https://doi.org/10.1016/j.compedu.2019.103771>
- [96] D. F. O. Onah, E. L. L. Pang, J. E. Sinclair, and J. Uhomoibhi, "An innovative MOOC platform: the implications of self-directed learning abilities to improve motivation in learning and to support self-regulation," Int. J. Inf. Learn. Technol., vol. 38, no. 3, pp. 283–298, 2021, <https://doi.org/10.1108/IJILT-03-2020-0040>
- [97] J. A. Ruipérez-Valiente et al., "Large scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions," Comput. Educ., vol. 180, p. 104426, 2022, <https://doi.org/10.1016/j.compedu.2021.104426>
- [98] J. Reich and J. A. Ruipérez-Valiente, "The MOOC pivot," Science (80-.), vol. 363, no. 6423, pp. 130–131, 2019, <https://doi.org/10.1126/science.aav7958>
- [99] D. Jackson, "Employability skill development in work-integrated learning: Barriers and best practice," Stud. High. Educ., vol. 40, no. 2, pp. 350–367, 2015, <https://doi.org/10.1080/03075079.2013.842221>

SUPPLEMENTARY

Table S1. Questionnaire items, response formats, and source basis for each adapted measure

Construct	Item	Questionnaire items	Sources
Self-Efficacy	SE.1	I am confident in my ability to overcome complex problems if I make a sincere effort.	Adapted from General Self-Efficacy Scale (GSE) item [18].
	SE.2	When facing challenges, I can find ways to achieve my goals.	Adapted from GSE item [18], [56].
	SE.3	I am confident in handling unexpected situations effectively.	Adapted from GSE item "deal efficiently with unexpected events" [18], [56].
	SE.4	I remain calm when encountering difficulties by relying on my own abilities.	Adapted from GSE item [18].
	SE.5	I know how to deal with unexpected events thanks to my experience and skills.	Adapted from GSE item [18], [56].
Soft Skills	SS.1	I can express ideas clearly and persuasively, both verbally and in writing.	Adapted from P21 (Communication) [54] & NACE (Communication) [57].
	SS.2	I work effectively as a team member to achieve shared goals.	Adapted from P21 (Collaboration) [54] & NACE (Teamwork) [57].
	SS.3	I can analyze problems and offer creative solutions.	Adapted from P21 (Critical thinking + Creativity) [54] & NACE (Critical Thinking) [57].
	SS.4	I adapt easily to changing work priorities.	Adapted from P21 (Life & Career skills: flexibility/adaptability) [54] & flexibility indicators on NACE [57].
	SS.5	I manage my time efficiently to complete multiple tasks before deadlines.	Adapted from P21 (Life & Career skills: flexibility/adaptability) [54] & flexibility indicators on NACE [57].
Digital Literacy	DL.1	I am comfortable using productivity applications (Google Docs, Excel, Canva, etc.) to complete tasks.	Adapted from the digital competency domain in DigComp 2.2 (use of digital technology for work/activities) [42]; digital literacy dimension [58].
	DL.2	I evaluate the credibility of online information before using it.	Adapted from DigComp 2.2 – Information & data literacy (evaluating information) [42].
	DL.3	I understand how to protect personal data while engaging in online activities.	Adapted from DigComp 2.2 – Safety (protecting personal data & privacy) [42].

Construct	Item	Questionnaire items	Sources
Work Readiness	DL.4	I can create digital content (infographics, short videos) for professional purposes.	Adapted from DigComp 2.2 – Digital content creation [42]; Digital Literacy Concept [58].
	DL.5	I can troubleshoot simple technical problems with software or hardware without assistance.	Adapted from DigComp 2.2 – Problem solving (solving technical problems) [42].
	WR.1	I am ready to take full responsibility for my first job after graduation.	Adapted from Work Readiness Scale (WRS) (domain <i>personal work characteristics/work competence</i>) [55] & NACE (Professionalism/Work Ethic) [57].
	WR.2	I am aware of the professional ethics expected in the workplace.	Adapted from NACE (Professionalism/Work Ethic: integrity/ethical behavior) [57] & <i>Organizational acumen/awareness</i> concept on WRS [55].
	WR.3	I am confident in communicating and negotiating with cross-functional colleagues.	Adapted from WRS (Social intelligence) [55] & NACE (Communication/Teamwork) [57].
	WR.4	I understand the industry performance standards in my field.	Adapted from WRS (Organizational acumen + work competence) & work readiness [55].
	WR.5	I am ready to apply my academic knowledge in real-world situations.	Adapted from WRS (Work competence) [55].