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HOW DIGITAL SKILLS AND TECHNOLOGY ADAPTATION SHAPE FEMALE GRADUATES' CAREER READINESS IN INDUSTRY 4.0?

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ABSTRACT

This study examines the effects of digital skills, technology adaptation, and ICT anxiety on the digital career readiness of female fresh graduates in Indonesia, with problem-solving skills as a mediating variable. Using a quantitative cross-sectional survey, data were collected from 205 respondents through an online questionnaire and analyzed with PLS-SEM using SmartPLS 4. The findings show that digital skills and technology adaptation positively and significantly influence problem-solving skills, while ICT anxiety has a significant negative effect. Problem-solving skills significantly enhance digital communication, collaboration, creativity, and production. Digital skills and technology adaptation also directly improve digital collaboration and creative output, whereas ICT anxiety has no significant direct effect on these outcomes. Mediation analysis indicates that problem-solving skills partially mediate the effects of digital skills and technology adaptation on digital performance, but not ICT anxiety. Overall, the results emphasize the importance of strengthening digital competencies, adaptive technology use, and problem-solving skills to enhance female graduates' career readiness in the Industry 4.0 labor market.

Keywords : Digital Skills; Technology Adaptation; Ict Anxiety; Problem-Solving Skills; Career Readiness

ABSTRAK

Penelitian ini menguji pengaruh keterampilan digital, adaptasi teknologi, dan kecemasan terhadap TIK terhadap kesiapan karier digital lulusan perempuan baru di Indonesia, dengan keterampilan pemecahan masalah sebagai variabel mediasi. Penelitian menggunakan desain survei kuantitatif cross-sectional dengan 205 responden yang dikumpulkan melalui kuesioner online dan dianalisis menggunakan PLS-SEM dengan SmartPLS 4. Hasil menunjukkan bahwa keterampilan digital dan adaptasi teknologi berpengaruh positif dan signifikan terhadap keterampilan pemecahan masalah, sedangkan kecemasan terhadap TIK berpengaruh negatif dan signifikan. Keterampilan pemecahan masalah secara signifikan meningkatkan komunikasi dan kolaborasi digital serta kreativitas dan produksi digital. Keterampilan digital dan adaptasi teknologi juga secara langsung meningkatkan kolaborasi dan output kreatif digital, sementara kecemasan terhadap TIK tidak berpengaruh langsung secara signifikan terhadap kedua aspek tersebut. Analisis mediasi menunjukkan bahwa keterampilan pemecahan masalah memediasi secara parsial pengaruh keterampilan digital dan adaptasi teknologi terhadap kinerja digital, tetapi tidak memediasi pengaruh kecemasan terhadap TIK. Temuan ini menegaskan pentingnya penguatan kompetensi digital, kemampuan adaptasi teknologi, dan keterampilan pemecahan masalah untuk meningkatkan kesiapan karier lulusan perempuan di era Industri 4.0.

Kata Kunci : Keterampilan Digital; Adaptasi Teknologi; Kecemasan ICT; Keterampilan Pemecahan Masalah; Kesiapan Karir

INTRODUCTION

Industry 4.0 is changing the global labor market landscape and increasing the complexity of skills, requiring graduates to master not only technical competencies but also critical thinking, communication, and adaptability to technology (Audrin et al., 2024; Islam, 2022; Succi & Canovi, 2020). These skills are crucial for competitiveness and productivity in the ever-evolving digital job market, and are also the focus of improvements in the design of job readiness in higher education (Eimer & Bohndick, 2023; Tushar & Sooraksa, 2023). However, the gap between industry needs and graduate readiness is still evident, reflected in findings on the skills gap and mismatch between the competencies demanded by companies and those offered by graduates (Audrin et al., 2024; Succi & Canovi, 2020). As a result, many graduates still struggle to apply their academic knowledge in the workplace and face barriers in work readiness that affect their transition into the workforce (Herbert et al., 2020). At the macro level, skills mismatch is also linked to unemployment dynamics, highlighting the urgency of curriculum adjustments and strengthening learning experiences relevant to industry (Goulart et al., 2022; Liu et al., 2016).

Women play an important role in Indonesia's digital economy, despite facing various challenges, such as gender gaps in access to technology and training, as well as social stereotypes (Kisti et al., 2025). Nevertheless, government policies and digital training initiatives have effectively increased women's participation, particularly in micro, small, and medium enterprises (MSMEs) and the creative sector (Kisti et al., 2025; Pratama et al., 2025). However, the gap in technology mastery and patriarchal cultural barriers remain major challenges, requiring affirmative policies and digital empowerment to achieve gender equality (Deselia & Hariati Sinaga, 2024; Dewi & Pertiwi, 2025). In addition, digitization has been shown to have a significant positive impact on increasing women's participation in the Indonesian workforce, making it important for policymakers to focus on improving digital literacy and equal access to technology for women (Davani & Sulistyaningrum, 2023).

Empirical data shows gender inequality in the Indonesian labor market, reflected in the female labor force participation rate of 56.42%, which lags far behind that of men at 84.66%, and the female open unemployment rate of 4.92%, which slightly exceeds that of men at 4.90% (BPS, 2024b, 2024c). In 2019, the labor force participation rate for women aged 15 to 64 was around 56% compared to 84% for men (Meilianti et al., 2022). BPS data from February 2019 also shows 83.18% for men and 55.50% for women (Sasongko et al., 2020). In the long term, the female participation rate has tended to remain at around 51% for two decades, even though education and economic structures have changed (Cameron et al., 2019).

Despite labor market transformation and rapid technology adoption, the gender gap in Indonesia remains unresolved, limiting women's participation and job quality (Halim et al., 2023; Kusumawardhani et al., 2023). On the demand side, a significant shortage of digital talent persists, with 87% of companies reporting difficulties in recruiting adequately skilled workers (Mc Kinsey & Coompany, 2020). and projections indicating that demand for digital competencies continues to outpace supply through 2025 and even 2030 (Gayatri, 2022; Mahusin & Prilliadi, 2025; Striestska Ilnia et al., 2021). In addition, policy projections up to 2030 estimate a large-scale deficit of skilled ICT workers, indicating that the acceleration of digitalization does not automatically reduce the gap without strengthening workforce capabilities (Mahusin & Prilliadi, 2025; Striestska Ilnia et al., 2021). Furthermore, uneven internet expansion across regions and among women underscores the need for targeted interventions to ensure digitalization effectively reduces existing disparities (Kusumawardhani et al., 2023).

Gender gaps in ICT access and skills remain evident in Indonesia, where men outperform women in ICT skills (81.94% vs. 76.09%) and internet usage (60.40% vs. 54.70%) (BPS, 2024a; Waluyo, 2023). Digital literacy scores also show a slight male advantage (3.56 vs. 3.52), including in higher education contexts (Long et al., 2023; Wisnubroto, 2023). Similar patterns appear globally, with men reporting higher basic digital skills and internet use in the European Union and worldwide, while women in lower-middle-income countries are significantly less likely to access mobile internet (GSMA, 2024; Van Kessel, 2022; Zavazava, 2023). Meta-analytic evidence further confirms a consistent male advantage in ICT literacy, including digital competence and self-efficacy (Gnambs, 2025; Hossain et al., 2023). However, the gap varies by skill type, as men tend to excel in computational thinking, whereas women perform relatively better in computer and information literacy (Campos et al., 2024).

Previous research highlights that integrating technical and non-technical skills is essential for individual performance and work readiness (Aryasandy et al., 2025; Dogara et al., 2020). Communication, teamwork, and problem-solving remain key determinants of professional success (Al Shayeb, 2013), reinforcing the urgency of strengthening digital skills in an era where technology dominates education and work. Studies show that female graduates' digital competence is strongly associated with digital communication, collaboration, content creation, and problem-solving, particularly through DigComp-based and collaborative online learning approaches (Alibraheim & El-Sayed, 2021; Alnasib, 2023; Jiménez-Cortés et al., 2017; Ogegbo et al., 2022). Higher digital skills also foster confidence in virtual collaboration and innovative performance (Luengo-Aravena et al., 2024; Mena-Guacas et al., 2023; Selfa-Sastre et al., 2022). Consistent with Generation Z's digital fluency, digital skill mastery serves as a

critical foundation for female graduates' career readiness in the Industry 4.0 era (Jaya et al., 2026).

Although extensive research has examined digital skills, technology adaptation, ICT anxiety, problem-solving, and digital performance, these variables are often studied separately. Prior studies tend to focus on technology adoption, collaboration, or digital creativity without integrating psychological, cognitive, and technological factors simultaneously. Consequently, limited understanding exists regarding how digital competence, technological adaptation, and affective factors interact in shaping digital communication and creative performance, particularly among female students and fresh graduates in Indonesia. Therefore, this study investigates the effects of digital skills, anxiety towards ICT, and technology adaptation on digital communication and collaboration as well as digital creativity and production, both directly and through the mediating role of problem-solving skills among female fresh graduates in Indonesia.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) explains technology acceptance through four core constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions (Venkatesh et al., 2003). In this study, Digital Skills and Problem-Solving Skills align with Performance Expectancy, as higher digital competence enhances perceived performance benefits (Van Laar et al., 2017). Effort Expectancy relates to Technology Adaptation and Anxiety toward ICT, reflecting individuals' ease of adapting to new technologies; faster adaptation increases efficiency, whereas ICT anxiety may hinder adaptation and collaboration (Mac Callum, Jeffrey, & Kinshuk, 2014; Suryanto et al., 2022). Social Influence supports Digital Communication and Collaboration through organizational and cultural factors that shape team-based technology use (Garro-Abarca et al., 2021; Lane et al., 2024). Facilitating Conditions, including resource availability, further enable Technology Adaptation and technology use behavior (Rana et al., 2024; Yuan et al., 2023). Drawing on UTAUT, this study examines how Digital Skills, Technology Adaptation, Anxiety toward ICT, and Problem-Solving Skills influence Digital Communication and Collaboration as well as Digital Creativity and Production within supportive organizational contexts.

The Relationship between Digital Skills (DS), Technology Adaptation (TAD), Anxiety Towards ICT (ATI), and Problem Solving Skills (PSS)

The 21st-century competency framework positions DS at its core, emphasizing information literacy, communication, collaboration, and critical thinking in the meaningful use

of ICT. Strengthening DS is consistently associated with improved PSS (Van Laar, 2017; van Laar, 2019), reflecting the close functional link between digital mastery and higher-order cognitive performance. Evidence across educational levels supports this relationship: in higher education, digital competence enhances collaborative problem-solving processes and outcomes in online tasks (Luengo-Aravena et al., 2024), while in schools it correlates positively with learning autonomy and problem-solving attitudes (Blanc et al., 2025). In the Indonesian context, mastery of productivity tools, digital information management, and collaborative communication is linked to greater readiness to address workplace problems, reinforcing the role of DS in fostering PSS during the transition to work (Kertiasih et al., 2024).

This effect is strengthened by technology adaptation, as technology acceptance theory suggests that perceived ease, usefulness, and readiness to try new technologies promote adoption and expand opportunities to practice ICT-based problem solving (Mac Callum, Jeffrey, & Kinshuk, 2014). In online learning contexts, adaptability enhances continued platform use through improved perceptions of ease and usefulness, increasing exposure to authentic tasks that require planning, monitoring, and evaluation of digital solutions (Li et al., 2023). From a psychopedagogical perspective, learning adaptability supports self-regulated learning through motivation and self-management, which are central to goal setting, strategy selection, and reflection in problem solving (Tian & Zheng, 2024). Similarly, higher technological readiness encourages experimentation with new tools and strategies, enriching digital problem-solving capacity. In Indonesian educational and organizational settings, this readiness facilitates digital integration, reduces adoption barriers, and accelerates iterative, data-driven collaborative problem solving (Dimo et al., 2024; Suryanto et al., 2022).

Conversely, anxiety toward ICT weakens this pathway by triggering avoidance behaviors and reducing the quality of learning experiences, thereby limiting opportunities to practice digital problem-solving strategies (Hayat et al., 2024). Technological pressure in online learning is associated with decreased learning quality, which disrupts analytical thinking and self-regulation processes essential for problem formulation, alternative generation, and evaluation (Saleem et al., 2024). From a technology adoption perspective, anxiety hinders intention and system use, leading individuals to avoid exploring features or testing new strategies that support problem-solving development (Mac Callum, Jeffrey, & Kinshuk, 2014). In higher education, ICT anxiety often higher among those with lower digital competence creates discomfort in handling complex digital tasks and reduces problem-solving effectiveness, partly through diminished self-efficacy and less adaptive metacognitive regulation (Alahakoon & Somaratne, 2020; Prakoso et al., 2025).

H1: Digital Skilss has a positive effect on Problem Solving Skills.

H2: Technology Adaptation has a positive effect on Problem Solving Skills.

H3: Anxiety Towards ICT has a negative effect on Problem Solving Skills.

The Relationship between Problem Solving Skills (PSS), Digital Communication and Collaboration (DCC), and Digital Creativity and Production (DCP)

Problem-Solving Skills refer to the ability to identify problems, explore alternatives, and design digital-based solutions to address work challenges effectively (Montecalvo et al., 2024). Within higher education digital competence frameworks, Digital Communication and Collaboration is recognized as a multidimensional construct encompassing digital interaction, collaboration, information management, and content creation (Demirkol et al., 2025). Strengthening PSS in academic and applied tasks supports the effective use of digital tools, facilitating the transfer of problem-solving abilities into collaborative communication practices and contributing to creative digital outputs (J. Wang et al., 2025). Empirical evidence from computer-based collaborative studies confirms that PSS are positively associated with coordination, information exchange, and team process quality in digital environments (Andrews-Todd et al., 2023; Jiang et al., 2023; Sun et al., 2022). The validated multidimensional structure of DCC further indicates that interaction, cooperation, and information management serve as key channels through which PSS is translated into effective digital collaborative behavior (Demirkol et al., 2025; J. Wang et al., 2025).

The link between PSS and Digital Content Production is supported by meta-analytic evidence showing that problem-solving-oriented pedagogy enhances creativity particularly flexibility and originality which underpins effective digital content creation (Rapti & Sapounidis, 2024; Zhan et al., 2024). Problem-based designs in AR/VR and smart learning environments further stimulate idea exploration and originality in digital outputs, with immersive technologies demonstrating positive effects on creativity (Chang et al., 2022; Lin et al., 2023; Y. Wang et al., 2024). In computer-supported collaborative learning, integrating collaborative problem solving with creative tasks such as digital storytelling and design thinking improves planning, iteration, and product refinement (Bilici & Yilmaz, 2024; Selfa-Sastre et al., 2022; J. Wang et al., 2025). Emerging collaborative environments, including generative intelligence tools, as well as adaptive intelligent tutoring systems, further enhance reasoning, team creativity, and problem-solving performance, reinforcing the pathway from PSS to digital content production (Huang et al., 2025; Lin et al., 2023; X. Wei et al., 2025)

H4: Problem Solving Skills has a positive effect on Digital Communication and Collaboration.

H5: Problem Solving Skills has a positive effect on Digital Creativity and Production.

The Relationship between Digital Skills (DS), Technology Adaptation (TAD), Anxiety Towards ICT (ATI), and Digital Communication and Collaboration (DCC)

Digital skills are positively associated with communication strategies in technology-based environments, enhancing effective digital interaction (Zhao & Ko, 2024). Within digital competency frameworks, communication and collaboration are core dimensions supported by technical skills, information management, and applied digital literacy, positioning digital skill mastery as the foundation of collaborative behavior (Van Laar, 2017). Recent evidence indicates that stronger digital skills improve online interaction and coordination through better information flow management, active discussion participation, and joint content production in remote learning and work settings (Bach & Thiel, 2024; Deschênes et al., 2024; Mena-Guacas et al., 2023). These capabilities align with higher-quality DCC, reflected in message clarity, appropriate channel selection, and effective task coordination (Deschênes et al., 2024; Zhao & Ko, 2024).

Technology adaptation, reflected in readiness, habitual use, and comfort with digital tools, is associated with more purposeful and efficient coordination, smoother information exchange, and stronger team synergy in hybrid and fully online environments (Lane et al., 2024; L. Wei & Nga, 2024). Individuals who are more adaptive to technology tend to exhibit better metacognitive control and self-regulation when utilizing platform features, which enhances discussion effectiveness, shared documentation, and collaborative decision-making (Gita et al., 2025; Hashmi et al., 2025; Mena-Guacas et al., 2023). Greater familiarity and trust in technology also reduce technical and social barriers, fostering more cohesive and productive digital interactions. Furthermore, effective ICT orchestration can lower communication anxiety and increase willingness to engage in digital communication, thereby reinforcing the quality of DCC (Russell et al., 2024; Zhao & Ko, 2024).

Previous research indicates that anxiety toward ICT reduces the quality of collaborative communication in digital environments. Anxious students report lower engagement and coordination in online collaborative projects (Hilliard et al., 2020), while in virtual teams, communication apprehension and technological anxiety disrupt interaction dynamics and may trigger organizational dissent (Rahmani et al., 2023). From a technology adoption perspective, anxiety suppresses perceived ease and usefulness, thereby inhibiting effective technology use for communication (Mac Callum, Jeffrey, & Kinshuk, 2014). In online learning, technostress is associated with reduced learning quality, affecting responsiveness, role clarity, and coordination (Saleem et al., 2024). Even in synchronous settings such as video conferencing, anxiety promotes avoidance and lowers communication confidence, resulting in less productive digital interactions (Russell et al., 2024).

H6: Digital Skills has a positive effect on Digital Communication and Collaboration.

H7: Technology Adaptation has a positive effect on Digital Communication and Collaboration.

H8: Anxiety Towards ICT has a negative effect on Digital Communication and Collaboration.

The Relationship between Digital Skills (DS), Technology Adaptation (TAD), Anxiety Towards ICT (ATI), and Digital Creativity and Production (DCP)

Digital content creation is embedded within digital skills and the DigComp framework, which positions technical competence and information management as foundations for producing digital artifacts (Gutiérrez-Santiuste et al., 2023). Validation studies of Digital Communication and Collaboration further confirm that communicative capacity and content creation skills support collaborative production practices (Demirkol et al., 2025). In platform-based learning and work environments, mastery of digital skills enhances multimodal literacy, fluency in authoring tools, and coordination of collaborative processes, thereby improving the quality and originality of Digital Content Production in academic and professional contexts that require continuous content creation (Cojocariu & Boghian, 2024; Pikhart et al., 2024; Y. Wang et al., 2024).

Technology adaptation encompassing readiness, habitual use, and comfort with technology is associated with intensive adoption of creative application ecosystems, expanded tool utilization, and more efficient digital workflows that enhance solution exploration, productivity, and output quality (Anh et al., 2024; D. Wang & Shao, 2024). In platform-based learning and work contexts, adaptive tool use improves process performance and collaborative orchestration (Contrino et al., 2024). Research on digital creativity further links digital skills, multimodal literacy, and fluency in authoring tools with greater originality and production quality (Cojocariu & Boghian, 2024). At both individual and organizational levels, digital readiness predicts sustained technology adoption, thereby supporting long-term consistency in digital content creation (Michelotto & Joia, 2024; Pingali et al., 2023).

Conversely, anxiety toward ICT reduces willingness to experiment, cognitive flexibility, and creative confidence, thereby weakening Digital Content Production performance, particularly under evaluation pressure (Bullock Muir et al., 2024; Sanjeeva Kumar, 2024). In online collaboration, anxiety lowers engagement and disrupts coordination, diminishing both process quality and output outcomes (Hilliard et al., 2020; Prokofieva et al., 2024; Saleem et al., 2024). Evidence from PLS-SEM studies on Indonesian graduates indicates that indirect pathways through collaborative processes better explain digital productivity and output quality than some direct cognitive effects (Kholifah et al., 2025). Consistently, adaptive platform use enhances learning and coordination, whereas technostress is negatively associated with performance (Contrino et al., 2024; Liang et al., 2024).

H9: Digital Skills has a positive effect on Digital Creativity and Production.

H10: Technology Adaptation has a positive effect on Digital Creativity and Production.

H11: Anxiety Towards ICT has a negative effect on Digital Creativity and Production.

The Relationship between Digital Communication and Collaboration (DCC) and Digital Creativity and Production (DCP)

In the context of technology-based learning and collaboration activities, Digital Communication and Collaboration serves as a bridge to Digital Creativity and Production: in a large-scale PLS-SEM study of vocational graduates, DCC acts as a mediator that channels the influence of initial variables to creative-productive outputs (Kholifah et al., 2025). Strong digital collaboration practices, ranging from idea exchange and joint knowledge construction to content editing, are consistently associated with more mature ideas and artifacts (McLachlan & Tippett, 2024; Selfa-Sastre et al., 2022). Collaborative authoring interventions such as digital storytelling also increase the originality and quality of results (Bilici & Yilmaz, 2024), while the use of modern collaborative tools, including those powered by generative AI, has been shown to encourage collaborative problem solving and team creativity performance, which then leads to better digital content production (X. Wei et al., 2025).

H12: Digital Communication and Collaboration has a positive effect on Digital Creativity and Production.

The role of Problem Solving Skills (DCP) as a mediator of Digital Skills (DS), Technology Adaptation (TAD), Anxiety Towards ICT (ATI), and Digital Communication and Collaboration (DCC)

Strengthening Problem-Solving Skills (PSS) through problem-based learning and digital tool use is positively associated with digital performance, positioning PSS as a channel through which Digital Skills, Technology Adaptation, and Anxiety toward ICT influence the quality of Digital Communication and Collaboration (DCC), particularly in terms of message clarity, coordination, and digital task management (Demirkol et al., 2025; L. Wei & Nga, 2024). Digital Skills provide the technical foundation, information management capacity, and collaborative literacy that enhance problem formulation and solution strategies, thereby improving PSS and fostering more effective digital communication behaviors (Blanc et al., 2025; Van Laar et al., 2017). Evidence from computer-based collaborative tasks further confirms that stronger PSS is associated with higher-quality communication and team coordination in digital settings, supporting its mediating role between Digital Skills and DCC in higher education and online learning contexts (Andrews-Todd et al., 2023; Blanc et al., 2025; Jiang et al., 2023).

From the Technology Adaptation perspective, readiness, familiarity, and comfort with technology enhance efficacy and self-regulated learning when using collaborative features, which in turn strengthen knowledge coordination and digital collaboration quality, supporting improvements in Digital Communication and Collaboration (She et al., 2023). Consistent with

technology acceptance theory, reduced affective and cognitive barriers through adaptation facilitate smoother problem-solving and collaborative communication behaviors (Mac Callum, Jeffrey, & Kinshuk, 2014). Empirical evidence shows that adaptive platform adoption improves learning outcomes and team process orchestration (Contrino et al., 2024), while higher digital competence and readiness are associated with more effective collaborative attitudes and practices (Mena-Guacas et al., 2023). Validation studies in higher education further confirm communication and collaboration as key channels through which problem-solving skills manifest in digital interaction, and computer-based task research links collaborative problem-solving quality with stronger team coordination and outcomes, reinforcing the pathway from Technology Adaptation through PSS to DCC (Andrews-Todd et al., 2023; Tzafilkou et al., 2022).

In the relationship from ATI to DCC, anxiety about technology drains attentional resources, reduces self-efficacy, and inhibits strategy exploration, thereby weakening the PSS needed to communicate and collaborate effectively on digital platforms (Mac Callum, Jeffrey, & Kinshuk, 2014). Recent findings also show that strengthening PSS can mitigate the negative affective impact on participation and role clarity in digital environments, so that the influence of ATI is channeled through problem-solving abilities towards more adaptive collaborative behavior (Kholifah et al., 2025; Selfa-Sastre et al., 2022). In various populations of learners and workers, anxiety towards ICT correlates with a decline in the quality of interactions, self-confidence in collaboration, and coordination strategies consistent with the mediation mechanism through PSS (Andrews-Todd et al., 2023; Saleem et al., 2024).

H13: Problem Solving Skills mediates the influence of Digital Skills on DCC.

H14: Problem Solving Skills mediates the effect of Technology Adaptation on DCC.

H15: Problem Solving Skills mediates the effect of Anxiety Towards ICT on DCC.

The role of Problem Solving Skills (PSS) as a mediator of Digital Skills (DS), Technology Adaptation (TAD), Anxiety Towards ICT (ATI), and Digital Creativity and Production (DCP)

The mediating role of Problem-Solving Skills (PSS) is theoretically grounded, as digital creativity and production depend on the ability to transform challenges into operational solutions through tool selection, procedural design, and outcome evaluation (Kholifah et al., 2025; Selfa-Sastre et al., 2022). In the pathway from Digital Skills to Digital Creativity and Production, mastery of applications, information management, and platform-based collaboration expands opportunities for exploration and iterative solution development; however, output quality and originality increase when these competencies are activated through problem formulation, strategy selection, and prototype testing as core components of PSS (Andrews-

Todd et al., 2023; Y. Wang et al., 2024). Evidence from digital ecosystems further shows that strengthening collaborative problem-solving through design thinking and advanced digital tools enhances team creativity and product outcomes (Luengo-Aravena et al., 2024; X. Wei et al., 2025). When the direct effect of Digital Skills on Digital Content Production is less consistent, the indirect pathway through PSS becomes critical, as problem-solving processes drive the planning, monitoring, and reflection required for producing original and functional digital outputs (Kholifah et al., 2025; Selfa-Sastre et al., 2022).

In the pathway from Technology Adaptation to Digital Content Production (DCP), readiness to adopt and utilize new technologies promotes active use, feature experimentation, and strategic exploration, enriching problem-solving experiences and channeling adaptation into creative output through the strengthening of PSS as a process competency (Donelan & Kear, 2018; Suryanto et al., 2022). Higher adaptation is also associated with self-regulated learning and sustained platform engagement, which reinforce the problem-solving cycle and result in more refined digital artifacts, supporting the mediating role of PSS between TAD and DCP (Li et al., 2023; Selfa-Sastre et al., 2022; Y. Wang et al., 2024). Conversely, Anxiety toward ICT reduces willingness to explore, suppresses efficacy, and encourages avoidance of complex digital tasks, thereby disrupting the problem-solving processes required for creative production and positioning PSS as the primary channel through which negative psychological effects translate into weaker digital outputs (Hilliard et al., 2020; Russell et al., 2024; Zhao & Ko, 2024).

In line with this, when anxiety decreases, problem-solving strategies tend to be more adaptive and have an impact on increasing the originality, novelty, and utility of digital outputs, confirming PSS as a mediator that explains how ATI variations translate into DCP variations (Demirkol et al., 2025; Russell et al., 2024; Zhao & Ko, 2024). In addition to direct mediation towards DCP, several studies also describe a chain pattern where PSS improves the clarity of communication and digital work coordination, which then increases the quality of collaboration and condenses the production iteration cycle, thus opening up the possibility of sequential mediation of PSS through Digital Communication and Collaboration before culminating in better and more ready-to-use DCP (Donelan & Kear, 2018; Kholifah et al., 2025; Selfa-Sastre et al., 2022).

H16: Problem Solving Skills mediates the effect of Digital Skills on Digital Creativity and Production.

H17: Problem Solving Skills mediates the effect of Technology Adaptation on Digital Creativity and Production.

H18: Problem Solving Skills mediates the effect of Anxiety Towards ICT on Digital Creativity and Production.

RESERCH METHOD

Method is a method of work that can be used to obtain something. While the research method can be interpreted as a work procedure in the research process, both in searching for data or disclosing existing phenomena (Zulkarnaen, W., et al., 2020). In line with multivariate analysis for testing causal relationships, this study adopts an explanatory research design with a causal approach. The model examines both direct and indirect effects through the mediating role of problem-solving skills, linking digital skills, technology adaptation, and anxiety toward ICT to digital communication and collaboration as well as digital creativity and production among Indonesian female fresh graduates. Data were collected using a cross-sectional survey and analyzed using variance-based structural equation modeling (PLS-SEM) with SmartPLS 4 (Hair et al., 2022).

The study population comprised female fresh graduates in Indonesia. A purposive sampling technique was employed to ensure that respondents met specific research criteria, namely being female fresh graduates aged over 17 years and prepared to enter the labor market. These criteria were selected to capture individuals in the transition phase from education to work, which is highly relevant to the construct of career readiness. However, the use of non-probability sampling implies limited generalizability of the findings beyond the sampled population. A total of 205 valid responses were obtained. Referring to the 10-times rule in PLS-SEM, the sample size exceeds ten times the maximum number of structural paths directed at a latent construct in the model, which in this study is 18 paths, indicating adequacy for estimating a moderately complex structural model and ensuring sufficient statistical power (Hair et al., 2022).

Data collection was conducted using a five-point Likert scale online questionnaire distributed through various social media platforms, including Instagram, TikTok, Twitter/X, Facebook, WhatsApp, and Telegram. This cross-platform approach is consistent with recent studies targeting digitally active populations. All procedures adhered to research ethics principles, including informed consent, voluntary participation, anonymity, and data confidentiality (Dillman et al., 2014; Oates et al., 2021).

The research instruments refer to validated scales. DS were measured using an instrument based on the DigComp framework (Kertiasih et al., 2024), TAD using a technology adoption readiness instrument (Mac Callum, Jeffrey, & Na, 2014; Suryanto et al., 2022), ATI was measured using a technology anxiety scale (Alahakoon & Somaratne, 2020), and PSS were measured using a technology-based problem-solving instrument (Montecalvo et al., 2024). The

outcome variables of DCC and DCP were measured using instruments that had been validated in the context of higher education and the digital environment (Demirkol et al., 2025; Zhao & Ko, 2024).

Data analysis was conducted systematically using PLS-SEM in two main stages. First, the measurement model (outer model) was evaluated through reliability and validity assessments, including Cronbach's Alpha and Composite Reliability (≥ 0.70), Average Variance Extracted (≥ 0.50), outer loadings (≥ 0.70), and discriminant validity using Fornell–Larcker and HTMT criteria. Second, the structural model (inner model) was assessed by examining path coefficients, their significance (t-values and p-values obtained through bootstrapping), coefficient of determination (R^2), and effect size (f^2). In addition, multicollinearity and potential common method bias were assessed using the full collinearity VIF criterion (< 5.0) (Hair et al., 2022).

RESULT AND DISCUSSION

Respondent Characteristics

This study involved 205 female fresh graduate respondents, predominantly aged 22 years old (77 people or 41.46%), followed by those aged 21 years old (68 people or 30.73%) and 23 years old (39 people or 16.59%), with the majority falling within the 21–22 age range. Based on graduation year, most were 2025 graduates, numbering 132 (64.39%), followed by 2024 (22.93%) and 2023 (12.68%), indicating a predominance of recent graduates. In terms of domicile, most respondents came from West Java (26.34%), East Java (22.93%), and DKI Jakarta (15.12%), so that overall, the sample characteristics were dominated by fresh graduates in their early 20s, 2025 graduates, and those residing in the Java region, especially West Java.

Measurement Model

Validity and Reliability Tests

Before testing the structural model, the measurement model was examined to determine whether every construct satisfied validity and reliability criteria. Convergent validity is assessed using the outer loading and AVE coefficient, with standard of the outer loading > 0.70 and AVE > 0.50 respectively. In the meantime, construct reliability is assessed by CA and CR at ≥ 0.70 (Hair et al., 2022).

The test results show that all 48 statement items have outer loading values above 0.70, so all indicators are declared valid in reflecting their respective latent constructs. The AVE values for all variables, namely Digital Skills, Technology Adaptation, Anxiety Towards ICT, Problem Solving Skills, Digital Communication and Collaboration, and Digital Creativity and Production, were above 0.50. These findings indicate that each construct was able to explain

more than 50% of the variance in its indicators, thus meeting the criteria for convergent validity (Hair et al., 2022).

In addition, the reliability test results show that all constructs have CA and CR values above 0.70. These values indicate a high level of internal consistency and stability of the instrument in measuring the research constructs. Thus, the measurement model in this study meets all the outer model evaluation criteria and is declared feasible to proceed to structural model testing.

Discriminant validity was evaluated using the Fornell–Larcker criteria and the HTMT. Based on the Fornell–Larcker criteria, the square root of the AVE value for all constructs was greater than the correlation between constructs, thus indicating that discriminant validity was fulfilled. Furthermore, the HTMT test was conducted as a more rigorous approach to identify potential overlap between latent constructs. The test results showed that the HTMT values between ATI and DCC were 0.556, ATI and DCP were 0.528, ATI and DS were 0.578, ATI and PSS were 0.565, and ATI and TAD were 0.592. The HTMT values between DCC and DCP were 0.774, between DCC and DS were 0.776, between DCC and PSS were 0.799, and between DCC and TAD were 0.761. Furthermore, the HTMT values between DCP and DS were 0.750, between DCP and PSS were 0.766, and between DCP and TAD were 0.742. The HTMT values between DS and PSS were 0.768, between DS and TAD were 0.766, and between PSS and TAD were 0.769. Since every HTMT score is below the cautious cutoff point of 0.90, it can be said that the measurement model used in this investigation satisfies the requirements for discriminant validity (Hair et al., 2022; Henseler et al., 2015).

Structural Model

The viability of the model and the strength of the connections between latent constructs were assessed using the structural model. The SRMR and NFI were used to test the model's viability, while the VIF was used to assess the possibility of multicollinearity. Furthermore, the R^2 value is used to assess the model's explanatory power, and the f^2 quantifies the contribution of each structural path.

According to the test results, the model has a reasonable degree of conformance with actual data because the SRMR value of 0.035 is below the 0.08 limit. An adequate model fit is shown by the NFI value of 0.872. Since all VIF values fall between 1.570 and 3.212, which is still below the 5.0 threshold, multicollinearity testing indicates that the study model does not have a multicollinearity issue.

The R-square values indicate that PSS (R^2 = 0.680), DCC (R^2 = 0.662), and DCP (R^2 = 0.640) are in the moderate category. This indicates that the exogenous components in the model

provide a strong explanation for the variation in these three endogenous variables. As a result, the model can adequately forecast how variables will relate to one another.

Furthermore, the results of the effect size (f^2) evaluation show that the influence of DS on PSS ($f^2 = 0.202$), TAD on PSS ($f^2 = 0.169$), and PSS on DCC ($f^2 = 0.157$) are in the moderate category. Meanwhile, other structural paths are in the small category. These findings indicate that although most relationships have a relatively small contribution, there are several paths that have a substantive influence in explaining the mechanisms of digital performance.

Hypothesis Testing and Discussion

Hypothesis testing was conducted using PLS-SEM to analyze the direct and indirect effects between variables. The significance of structural relationships was determined based on the criteria of t-statistic > 1.96 and p-value < 0.05 (Hair et al., 2022). Based on these criteria, this study tested 18 hypotheses proposed in the research model.

The analysis's findings indicate that DS significantly and favorably affect PSS ($\beta = 0.412$; $t = 3.373$; $p = 0.001$). This result demonstrates that the primary cognitive basis for the development of PSS in female graduates is mastery of DS. People who have strong DS are more equipped to handle the demands of the digital workplace because they can comprehend work requirements, manage information, and make wise judgments. This finding is consistent with the 21st-century DS framework, which places digital literacy and information management as prerequisites for higher-order thinking (van Laar, 2019), and is supported by empirical studies showing that digital competence correlates with improved collaborative problem solving in higher education and work transitions (Blanc et al., 2025; Luengo-Aravena et al., 2024). From a UTAUT perspective, this relationship reflects performance expectancy (Venkatesh et al., 2003).

Additionally, it has been demonstrated that TAD significantly and favorably affects PSS ($\beta = 0.377$; $t = 3.134$; $p = 0.002$). This demonstrates how problem-solving efficacy is strengthened by preparedness and adaptability in the face of technological change. In a changing digital environment, TAD allows users to experiment with new features, continuously learn new tools, and modify their approaches to problem-solving. These results are consistent with studies that demonstrate how technological preparedness and learning flexibility enhance the caliber of problem solving in online learning and digital workplaces (Li et al., 2023; Mac Callum, Jeffrey, & Kinshuk, 2014; Suryanto et al., 2022). This link is associated with enabling conditions and effort expectancy within the UTAUT framework (Venkatesh et al., 2003; Yuan et al., 2023).

On the other hand, ATI significantly and negatively affected PSS ($\beta = -0.098$; $t = 2.057$; $p = 0.040$). This suggests that apprehension about technology serves as an affective barrier in the process of solving digital problems. Technology anxiety can lower self-efficacy, increase avoidance behavior, and restrict cognitive exploration when coming up with answers, according

to the research on technostress (Alahakoon & Somaratne, 2020; Saleem et al., 2024). Research in the context of higher education also shows that ICT anxiety correlates with a decrease in self-regulation and metacognitive strategies that are crucial in technology-based problem solving (Hayat et al., 2024; Prakoso et al., 2025). From the UTAUT perspective, ATI represents an affective barrier in the effort expectancy dimension (Mac Callum, Jeffrey, & Kinshuk, 2014).

Furthermore, PSS has a positive and significant effect on DCC (β = 0.370; t = 3.127; p = 0.002) and DCP (β = 0.243; t = 2.271; p = 0.023). These findings confirm that PSS are a core cognitive capability in supporting the effectiveness of DCC. Individuals with good PSS tend to be better at coordinating teamwork, integrating ideas, and producing value-added digital artifacts. Empirical evidence shows that collaborative problem solving is strongly associated with the quality of communication and digital knowledge exchange (Andrews-Todd et al., 2023; Jiang et al., 2023; Sun et al., 2022), as well as enhancing creativity and the quality of digital production (Rapti & Sapounidis, 2024; Y. Wang et al., 2024).

On the direct path, DS significantly influenced DCC (β = 0.293; t = 2.600; p = 0.009) and DCP (β = 0.211; t = 2.143; p = 0.032), while TAD also significantly affects DCC (β = 0.206; t = 2.012; p = 0.044) and DCP (β = 0.170; t = 2.356; p = 0.019). These results indicate that technological mastery and adaptability readiness are the main determinants of advanced digital performance. These findings are consistent with studies that place digital competence and adaptability as the foundation of communication, collaboration, and digital content production (Demirkol et al., 2025; Mena-Guacas et al., 2023; Zhao & Ko, 2024), and reinforce the role of social influence and facilitating conditions in UTAUT (Venkatesh et al., 2003). Conversely, ATI does not significantly affect DCC (β = -0.048; p = 0.129) or DCP (β = -0.020; p = 0.479), indicating that technology anxiety does not directly reduce digital performance when technical capabilities have been established (Demirkol et al., 2025; Russell et al., 2024).

PSS partially mediates the link between DS and TAD on DCC and DCP, according to mediation analysis (Hair et al., 2022). Because both direct and indirect pathways are important, there is partial mediation. This indicates that technological competence and adaptation function through two different mechanisms: directly and through enhanced problem-solving skills. On the other hand, ATI's path on DCC and DCP showed no mediation, indicating a trend of no mediation. According to these results, technology anxiety is a more significant affective element that shapes attitudes and experiences related to technology usage, but it is not powerful enough to disrupt fundamental cognitive processes after PSS has emerged (Prakoso et al., 2025; Salanova et al., 2013).

Overall, this study fills a research gap by showing that digital competence and TAD not only influence technology acceptance but also translate into advanced digital performance

through cognitive mechanisms. By integrating UTAUT and the 21st-century DS framework, this study positions PSS as a central mediator and shows that ATI is not a direct inhibitor of digital performance, but rather an affective factor whose influence depends on individual cognitive capabilities.

CONCLUSION

The results of the study show that Digital Skills and Technology Adaptation significantly improve the Problem Solving Skills of female graduates in Indonesia, which in turn has an impact on improving Digital Communication and Collaboration as well as Digital Creativity and Production, with Problem Solving Skills acting as a partial mediator between technological competence and advanced digital performance. DS and TAD also have a direct positive influence on digital performance, indicating the existence of direct and indirect influence paths, while ATI is proven to reduce PSS but does not directly affect digital output. Theoretically, this study expands the UTAUT framework by integrating a 21st-century DS perspective and positioning PSS as the primary cognitive mechanism in explaining digital performance. Practically, these findings emphasize the importance for universities to not only focus on technology mastery but also on strengthening digital-based problem-solving abilities through problem-based learning and digital collaborative projects. Although the model has moderate explanatory power and the mediation that occurs is partial, further research is recommended to add variables such as digital self-efficacy and resilience in order to produce a more comprehensive understanding of digital work readiness in the era of technological transformation.

Ethical Approval

Ethical approval for this study was obtained from Tanjungpura University, Indonesia (Ethical Clearance Number: 8913/UN22.2/TU.00/2025). All participants provided informed consent prior to data collection.

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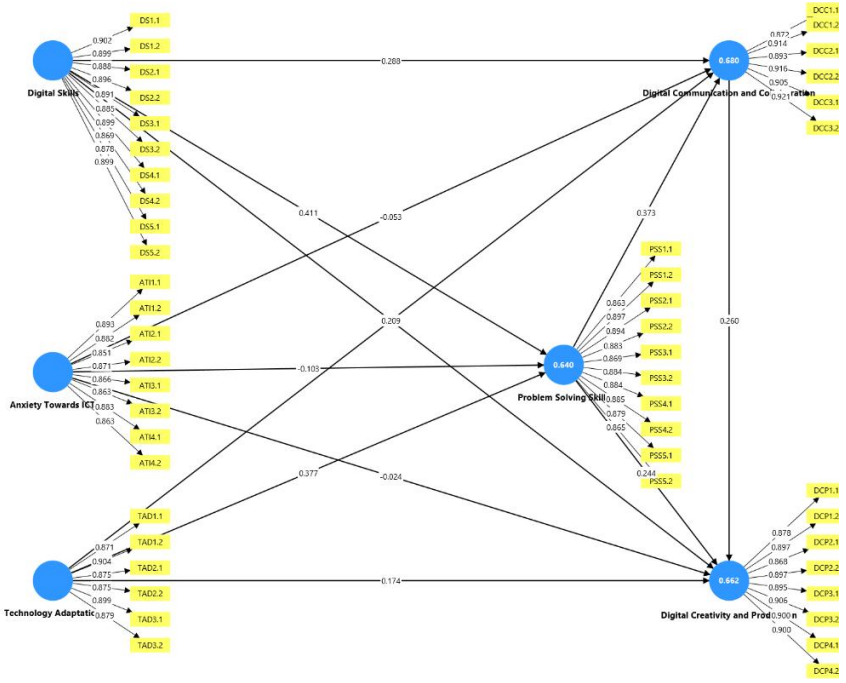
PICTURE AND TABLE



Pict 1. Conceptual Research Model

Table 1. Respondent Characteristics

Category	Item	Frequency (N=205)	Percent (%)
Age	20	6	2.44
	21	68	30.73
	22	77	41.46
	23	39	16.59
	24	12	6.34
	25	3	1.46
Gradution Year	2023	26	12.68
	2024	47	22.93
	2025	132	64.39
Domicile	Aceh	3	1.46
	Sumatra Utara	3	1.46
	Sumatra Barat	4	1.95
	Riau	4	1.95
	Jambi	2	0.98
	Sumatra Selatan	2	0.98
	Lampung	4	1.95
	DKI Jakarta	31	15.12
	Jawa Barat	54	26.34
	Jawa Tengah	27	13.17
	DI Yogyakarta	6	2.93
	Jawa Timur	47	22.93
	Banten	21	10.24
	Kalimantan Barat	14	6.83
	Kalimantan Tengah	1	0.49
	Kalimantan Selatan	2	0.98
	Kalimantan Timur	2	0.98
	Sulawesi Selatan	3	1.46
	Sulawesi Tenggara	2	0.98
	Bali	3	1.46
	Nusa Tenggara Barat	1	0.49
	Kepulauan Riau	9	4.39

	Maluku	1	0.49
Total	23	205	100%

Table 2. Validity and Reliability Test Results

Construct	Measure items	Validity Test			Reliability Test		
		LF	AVE	Decision	CA	CR	Decision
Digital Skills	DS1.1	0.902	0.793	Valid	0.971	0.971	Reliabel
	DS1.2	0.889		Valid			
	DS2.1	0.888		Valid			
	DS2.2	0.896		Valid			
	DS3.1	0.891		Valid			
	DS3.2	0.885		Valid			
	DS4.1	0.899		Valid			
	DS4.2	0.869		Valid			
	DS5.1	0.878		Valid			
	DS5.2	0.899		Valid			
Technology Adaptation	TAD1.1	0.871	0.781	Valid	0.944	0.945	Reliabel
	TAD1.2	0.904		Valid			
	TAD2.1	0.875		Valid			
	TAD2.2	0.875		Valid			
	TAD3.1	0.899		Valid			
	TAD3.2	0.879		Valid			
Anxiety Towards ICT	ATI1.1	0.893	0.760	Valid	0.955	0.957	Reliabel
	ATI1.2	0.882		Valid			
	ATI2.1	0.851		Valid			
	ATI2.2	0.871		Valid			
	ATI3.1	0.866		Valid			
	ATI3.2	0.836		Valid			
	ATI4.1	0.883		Valid			
	ATI4.2	0.863		Valid			
Problem Solving Skills	PSS1.1	0.863	0.775	Valid	0.968	0.968	Reliabel
	PSS1.2	0.897		Valid			
	PSS2.1	0.894		Valid			
	PSS2.2	0.883		Valid			
	PSS3.1	0.869		Valid			
	PSS3.2	0.884		Valid			
	PSS4.1	0.884		Valid			
	PSS4.2	0.885		Valid			
	PSS5.1	0.879		Valid			
	PSS5.2	0.865		Valid			
Digital Communication and Collaboration	DCC1.1	0.872	0.817	Valid	0.955	0.955	Reliabel
	DCC1.2	0.914		Valid			
	DCC2.1	0.893		Valid			
	DCC2.2	0.916		Valid			
	DCC3.1	0.905		Valid			
	DCC3.2	0.921		Valid			
Digital Creativity and Production	DCP1.1	0.878	0.797	Valid	0.964	0.964	Reliabel
	DCP1.2	0.897		Valid			
	DCP2.1	0.868		Valid			
	DCP2.2	0.897		Valid			
	DCP3.1	0.895		Valid			
	DCP3.2	0.906		Valid			
	DCP4.1	0.900		Valid			
	DCP4.2	0.900		Valid			

Table 3. Fornel Lacker

	ATI	DCC	DCP	DS	PSS	TAD
ATI	0.872					
DCC	-0.534	0.904				
DCP	-0.511	0.743	0.893			
DS	-0.559	0.748	0.727	0.891		
PSS	-0.544	0.769	0.741	0.745	0.880	
TAD	-0.563	0.723	0.709	0.734	0.736	0.884

Table 4. Structural Model Assesment Results

Measure	Path	Value	Interpretation
SRMR		0,035	Accepted
NFI		0,872	Good
VIF	*DS* → PSS	2.322	No Multicollinearity
	DS → DCC	2.791	No Multicollinearity
	DS → DCP	3.050	No Multicollinearity
	TAD → PSS	2.339	No Multicollinearity
	TAD → DCC	2.734	No Multicollinearity
	TAD → DCP	2.868	No Multicollinearity
	ATI → PSS	1.570	No Multicollinearity
	ATI → DCC	1.599	No Multicollinearity
	ATI → DCP	1.608	No Multicollinearity
	PSS → DCC	2.775	No Multicollinearity
	PSS → DCP	3.212	No Multicollinearity
	DCC → DCP	3.128	No Multicollinearity
R-square	*PSS*	0.680	Moderate
	DCC	0.662	Moderate
	DCP	0.640	Moderate
F-square	*DS* → PSS	0.202	Moderate
	DS → DCC	0.093	Small
	DS → DCP	0.043	Small
	TAD → PSS	0.169	Moderate
	TAD → DCC	0.049	Small
	TAD → DCP	0.031	Small
	ATI → PSS	0.019	Small
	ATI → DCC	0.005	Small
	ATI → DCP	0.001	Small
	PSS → DCC	0.157	Moderate
	PSS → DCP	0.055	Small
	DCC → DCP	0.064	Small