

# From Competencies to Employability: Digital Literacy as a Conversion Mechanism and Psychological Resilience as a Boundary Condition among Graduates in Zhejiang, China

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## ABSTRACT:

Digital transformation has changed how university graduates demonstrate employability. In digitally advanced regional economies, employability is no longer expressed only through disciplinary knowledge, general communication skills, or formal credentials. Graduates are increasingly expected to evaluate information, collaborate through digital platforms, present evidence of their capabilities, and adapt to changing tools and work processes. This study examines how cognitive, social, and behavioural competencies relate to graduate employability in Zhejiang Province, China, and tests whether digital literacy acts as a mediating mechanism and psychological resilience as a boundary condition. A cross-sectional survey was conducted with 521 final-year students from higher education institutions in Zhejiang Province. The questionnaire measured cognitive

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competencies, social competencies, behavioural competencies, digital literacy, psychological resilience, and self-perceived employability. Reliability analysis, exploratory factor analysis, confirmatory factor analysis, direct-effect regression, bootstrap mediation testing, and moderation analysis were used to evaluate the hypotheses. Cognitive, social, and behavioural competencies positively predicted employability, with behavioural competencies showing the strongest direct association. All three competency domains also positively predicted digital literacy. Digital literacy was positively associated with employability and partially mediated the relationships between each foundational competency domain and employability. Psychological resilience significantly moderated the digital literacy-employability relationship: the association was not significant at low resilience but became significant at medium and high resilience. These findings suggest that graduate employability in a digital economy depends not only on foundational competencies but also on the capacity to translate those competencies into digital practice and sustain their use under pressure.

**Keywords:** graduate employability; digital literacy; psychological resilience; higher education; Zhejiang Province; mediation; moderation

**1. Introduction**

Graduate employability has become a central concern for higher education systems as labour markets become more digital, platform-based, and skills-intensive. Universities are increasingly expected to prepare students not only for graduation but for transition into complex working environments where knowledge must be applied through data systems, communication platforms, digital portfolios, and technology-supported collaboration. The debate is no longer whether employability belongs in higher education; it is how employability can be cultivated without reducing higher education to narrow job training (Tight, 2023; Yorke, 2006).

This issue is especially visible in Zhejiang

Province, China. Zhejiang is one of the country's most dynamic digital-economy regions, with strong e-commerce, platform economy, smart manufacturing, and fintech sectors. Employers in such environments do not merely ask whether graduates possess knowledge or generic capabilities. They also ask whether graduates can use digital tools to search, analyse, communicate, collaborate, produce evidence, and adapt. The shift changes the meaning of graduate employability. A student with strong problem-solving skills may still be disadvantaged if those skills cannot be expressed through digital information evaluation or data-supported decision-making. A student with strong social skills may struggle if teamwork increasingly occurs through online platforms. A student with

initiative may not gain full employment advantage if that initiative is not made visible through digital projects, online professional profiles, or evidence-based portfolios.

The present study argues that digital literacy should be understood as a mechanism through which foundational competencies are translated into employability. Digital literacy is often defined as the ability to access, evaluate, create, communicate, and solve problems through digital technologies (Ng, 2012; Vuorikari et al., 2022). In university settings, empirical reviews show that digital literacy is connected to self-efficacy, learning engagement, and the ability to participate in technology-mediated learning environments (Gutiérrez-Ángel et al., 2022). Recent employability research also suggests that digital skills and digital learning are increasingly involved in graduates' work readiness, professional confidence, and digitally mediated learning outcomes (Adegbite, 2024; Kholifah et al., 2025; Liu et al., 2023; Narmaditya et al., 2024). Yet much of the literature still treats digital literacy as a standalone skill or another item in a graduate skills checklist.

This article takes a different view. It positions digital literacy as a mediating construct linking three foundational domains to graduate employability: cognitive competencies, social competencies, and behavioural competencies. Cognitive competencies include critical thinking, analytical reasoning, reflective learning, and problem solving. Social competencies include communication, collaboration, conflict management, and professional relationship building. Behavioural competencies include initiative, self-management, adaptability, persistence, and continuous learning. These domains are valuable, but their value may be constrained in digital work contexts unless graduates can enact them through digital technologies. In other words, digital literacy may function as a translation mechanism rather than

merely as an additional skill.

The study also examines psychological resilience as a boundary condition. Digital skills do not operate in an emotionally neutral environment. Graduates entering the labour market face competition, uncertainty, repeated rejection, rapid technological change, and pressure to learn unfamiliar systems. Resilience, understood as the ability to recover from difficulty and continue functioning under stress, may determine whether digital literacy can be converted into employability confidence (Connor & Davidson, 2003). A graduate may possess digital skills but fail to use them effectively under job-search pressure. Conversely, a resilient graduate may be more able to sustain digital learning, recover from setbacks, and convert digital capability into perceived employability.

This study therefore asks three questions. First, how do cognitive, social, and behavioural competencies relate to graduate employability among final-year students in Zhejiang Province? Second, does digital literacy mediate the relationships between these foundational competencies and graduate employability? Third, does psychological resilience moderate the relationship between digital literacy and graduate employability? By answering these questions, the article contributes to employability research in three ways. It tests a mechanism through which foundational competencies become employability-relevant in a digital labour market; it identifies resilience as a condition that strengthens the usefulness of digital literacy; and it offers evidence from a Chinese regional economy where digital transformation is deeply embedded in graduate transition.

## 2. Literature Review and Hypotheses

### 2.1 Graduate Employability as a Transformational Capability

Graduate employability is a multidimensional concept. Early employability frameworks moved

beyond simple employment outcomes and emphasised graduates' knowledge, skills, self-understanding, career management, and ability to adapt to labour-market conditions (Yorke, 2006). Self-perceived employability research further highlights that employability is not only an external labour-market condition; it also includes the graduate's belief that they can obtain and maintain suitable work (Rothwell & Arnold, 2007). This distinction is important for final-year students, who may not yet have stable employment outcomes but are already forming judgements about their readiness for work.

Perceived employability should not be confused with actual employment. It does not prove salary, job fit, job security, or career success. However, it is a meaningful outcome in studies of graduate transition because students' confidence, perceived preparedness, and sense of market competitiveness can affect job-search behaviour, career exploration, and willingness to engage with employability-building opportunities (Chen et al., 2023; Ma et al., 2024). Employability-building activities, such as work experience, career development, and skills-oriented learning, can support graduates' transition, but participation and benefit depend on students' resources, agency, and institutional context (Jackson et al., 2024).

This study conceptualises employability as a transformational capability. Graduates' foundational competencies matter because they allow students to transform educational experiences into labour-market readiness. The problem is that transformation increasingly occurs through digital channels. A graduate's learning record, internship evidence, collaborative work, job search, and professional networking are often digitally mediated. The study therefore examines how foundational competencies are converted into perceived employability through digital literacy.

## 2.2 Cognitive Competencies and Employability

Cognitive competencies refer to higher-order thinking skills, analytical reasoning, problem solving, reflective learning, and the capacity to apply knowledge in unfamiliar situations. These competencies are important because contemporary work increasingly involves ambiguity and non-routine tasks. Graduates must evaluate information quality, compare alternatives, solve unfamiliar problems, and continue learning after formal education. In Zhejiang's digital economy, cognitive competence also includes the ability to interpret digital information, assess algorithmic outputs, and make decisions in data-rich environments.

Social cognitive theory helps explain why cognitive competencies may affect employability. From this view, individuals' beliefs, actions, and environments interact; students who perceive themselves as capable are more likely to attempt demanding tasks, learn from feedback, and persist in skill development (Bandura, 1986, 1997). Cognitive competence can therefore support employability by increasing students' capacity to understand work demands and respond adaptively. It also provides the intellectual foundation for digital literacy, because digital problem solving requires evaluation, interpretation, and judgement rather than tool use alone.

Hypothesis 1: Cognitive competencies have a positive relationship with graduate employability.

Hypothesis 4: Cognitive competencies have a positive relationship with digital literacy.

## 2.3 Social Competencies in Digitally Mediated Work

Social competencies include teamwork, communication, conflict management, empathy, and professional networking. These abilities have long been treated as employability assets, but their expression has changed. Hybrid work, virtual collaboration, enterprise messaging platforms,

shared documents, video meetings, and online professional communities have shifted part of social performance into digital spaces. In platform-rich economies, graduates must not only communicate well but communicate well through digital channels.

This shift matters for Zhejiang. Many firms rely on digital coordination, online communication, and platform-supported project management. Graduates who can collaborate face-to-face but struggle to manage tone in written communication, coordinate asynchronous work, or build trust in virtual teams may not fully convert social competence into employability. Digital literacy therefore gives social competencies an operational medium. The social graduate becomes more employable when interpersonal strengths can be enacted through online collaboration, professional digital identity, and platform-based teamwork.

Hypothesis 2: Social competencies have a positive relationship with graduate employability.

Hypothesis 5: Social competencies have a positive relationship with digital literacy.

#### **2.4 Behavioural Competencies and Employability Action**

Behavioural competencies include initiative, self-discipline, time management, adaptability, sustained effort, and proactive learning. These characteristics are closely connected to employability because labour-market transition requires action. Students must search for opportunities, prepare documents, complete applications, build portfolios, respond to failure, and continue learning after rejection. Behavioural competencies turn potential into movement.

In digital economies, behavioural competencies are also connected to digital learning. A proactive student is more likely to explore unfamiliar tools; a self-regulated student is more likely to maintain progress in online learning environments; an adaptive student is more likely to update skills as

platforms change. For this reason, behavioural competencies may directly support employability while also strengthening digital literacy. Recent studies of employability and entrepreneurial or work-readiness pathways similarly show that action-oriented variables influence employment-related outcomes through mediating mechanisms such as intention, digital employability skills, or career exploration (Gazi et al., 2024; Kholifah et al., 2025; Ma et al., 2024).

Hypothesis 3: Behavioural competencies have a positive relationship with graduate employability.

Hypothesis 6: Behavioural competencies have a positive relationship with digital literacy.

#### **2.5 Digital Literacy as a Mediating Mechanism**

Digital literacy is a multidimensional capability. It includes technical operation, information evaluation, digital communication, online collaboration, content creation, safety awareness, and problem solving (Ng, 2012; Vuorikari et al., 2022). In higher education, digital literacy is increasingly associated with students' capacity to learn independently, evaluate online information, and engage with digital learning environments (Gutiérrez-Ángel et al., 2022). In employability research, it has been linked to graduates' work readiness and the capacity to benefit from work-integrated learning (Adegbite, 2024; Kholifah et al., 2025).

The key claim of this study is that digital literacy mediates the effect of foundational competencies on employability. Cognitive competencies may shape employability partly because they help students evaluate digital information and solve digitally mediated problems. Social competencies may shape employability partly because they help students communicate and collaborate through digital platforms. Behavioural competencies may shape employability partly because they help students persist in digital learning, construct digital evidence of ability, and adapt to changing



tools.

This view aligns with the broader movement from static employability lists to process models. Rather than asking only what competencies graduates possess, the study asks how those competencies become usable in a particular labour-market context. Digital literacy is treated as a mechanism that transforms foundational competencies into employability-relevant practices. It is therefore expected to predict employability directly and mediate the relationships between cognitive, social, and behavioural competencies and employability.

Hypothesis 7: Digital literacy has a positive relationship with graduate employability.

Hypothesis 8: Digital literacy mediates the relationship between cognitive competencies and graduate employability.

Hypothesis 9: Digital literacy mediates the relationship between social competencies and graduate employability.

Hypothesis 10: Digital literacy mediates the relationship between behavioural competencies and graduate employability.

## 2.6 Psychological Resilience as a Boundary Condition

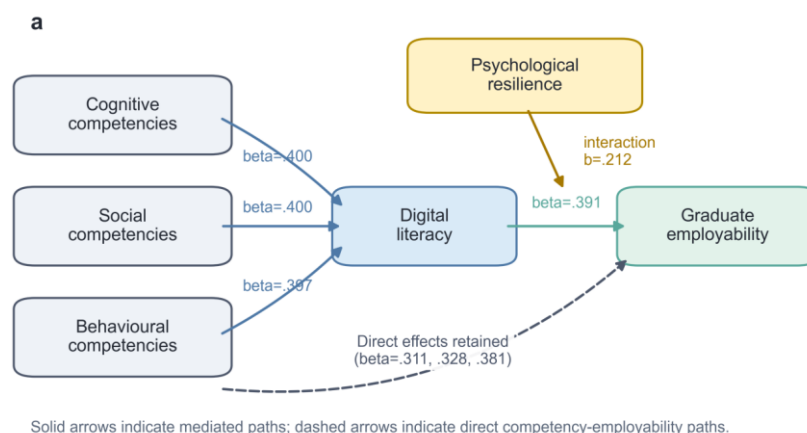
Psychological resilience refers to the capacity to recover from adversity, remain motivated under pressure, and continue functioning despite

setbacks (Connor & Davidson, 2003). For graduates, resilience is not an abstract personality trait; it is tested during job search, internship competition, digital task failure, and early career uncertainty. A student may encounter rejection, unfamiliar software, difficult online collaboration, or pressure to produce evidence of competence. Without resilience, digital literacy may remain a skill that is possessed but not consistently applied.

The moderation logic is therefore straightforward. Digital literacy should be more strongly associated with employability among students with higher resilience because those students are more likely to continue using digital resources under stress. They may also be more willing to learn from failed applications, revise digital portfolios, and persist in online professional networking. Students with lower resilience may be less able to convert digital literacy into confidence or perceived labour-market readiness, especially when digital work environments create pressure rather than support.

Hypothesis 11: Psychological resilience positively moderates the relationship between digital literacy and graduate employability, such that the relationship is stronger when resilience is higher.

The full conceptual model is shown in Figure 1 and guides the direct-effect, mediation, and moderation tests reported below.



**Figure 1 Conceptual model of competencies, digital literacy, resilience, and employability.**

*Note. Solid pathways represent the hypothesised competency and digital-literacy effects. Psychological resilience is modelled as the boundary condition on the digital literacy-employability pathway.*

### 3. Method

#### 3.1 Research Design

The study used a quantitative, non-experimental, cross-sectional survey design. The design was appropriate for testing a theoretically specified model involving multiple latent constructs, direct effects, mediation, and moderation.

Because all variables were measured at one point in time, the analysis tests associations and conditional mechanisms rather than experimental causality. The paper therefore avoids claiming that the variables cause employment outcomes. Its contribution is mechanism testing within a theoretically grounded model.

#### 3.2 Participants and Sampling

The target population was final-year students in higher education institutions in Zhejiang Province, China. Final-year students were selected because they are near the transition from university to work and are likely to have formed judgements about employability, digital readiness, and career-related competencies. The final valid sample included 521 respondents.

The sample was balanced by gender: 272 respondents were male (52.21%) and 249 were female (47.79%). By institution type, 163 students came from public universities (31.29%), 264 from private universities (50.67%), and 94 from vocational or technical colleges (18.04%). By educational level, 165 were diploma students (31.67%), 268 were bachelor's degree students (51.44%), and 88 were postgraduate or above (16.89%).

The largest disciplinary groups were social sciences (32.82%) and business and management (23.22%). Most respondents were actively engaging with employment preparation: 72.55%

reported that they were applying for jobs or attending career fairs.

#### 3.3 Measures

The questionnaire measured six constructs. Cognitive competencies were measured with five items covering critical thinking, problem solving, logical analysis, reflective learning, and application of knowledge in unfamiliar situations. Social competencies were measured with five items covering collaboration, conflict resolution, digital professional communication, professional networking, and adaptation to varied social and cultural work environments.

Behavioural competencies were measured with five items covering initiative, time management, adaptability, self-motivation, and sustained effort toward career goals.

Digital literacy was measured with five items covering effective use of digital tools, evaluation of online information credibility, digital collaboration, adaptation to new digital tools, and use of digital tools for problem solving and decision-making.

Psychological resilience was measured with five items covering calmness under stress, recovery after setbacks, positive outlook under uncertainty, persistence despite difficulty, and confidence in overcoming challenges. Employability was measured with five items covering confidence in securing employment, readiness for digitally driven workplaces, adaptation to changing job requirements, integration of academic knowledge with practical skills, and readiness to contribute in professional environments.

All items used a five-point Likert-type response format. The constructs were operationalised as reflective measures. The questionnaire items were adapted from established scales and adjusted to fit the graduate employability and digital economy context.

Employability items were adapted from Rothwell and Arnold (2007) and Chen et al. (2023), digital

literacy items from Ng (2012) and Vuorikari et al. (2022), and psychological resilience items from Connor and Davidson (2003).

Cognitive, social, and behavioural competency items were developed from the employability competency literature and reviewed for contextual relevance. Minor wording adjustments were made to ensure that the items were understandable to final-year students in Zhejiang Province.

### 3.4 Data Collection and Ethics

Data were collected through an online questionnaire distributed through institutional channels. Participants received an information statement before completing the survey. The statement explained the purpose of the study, the voluntary nature of participation, anonymity, confidentiality, and the right to withdraw before submission.

The extracted dataset did not contain directly identifying information. The survey was treated as an anonymous, non-interventional educational survey with minimal risk to participants under the applicable institutional procedures for educational survey research.

### 3.5 Analytical Strategy

The analysis proceeded in five stages. First, descriptive statistics summarised the sample and the six core variables. Second, reliability was assessed using Cronbach's alpha and corrected item-total correlations. Third, exploratory factor analysis, confirmatory factor analysis, discriminant validity checks, common method bias assessment, and multicollinearity diagnostics were used to evaluate measurement quality.

The Fornell-Larcker criterion was used to evaluate discriminant validity (Fornell & Larcker, 1981), and common method bias was considered in light

of established survey-method concerns (Podsakoff et al., 2003).

Fourth, direct effects were tested using standardised regression coefficients. Fifth, mediation effects were tested using a non-parametric bootstrap procedure with 5,000 resamples, consistent with recommendations for indirect-effect testing (Preacher & Hayes, 2008; Zhao et al., 2010).

Moderation was tested through hierarchical regression with an interaction term between digital literacy and psychological resilience, followed by simple-slope analysis (Aiken & West, 1991).

The interaction was interpreted through conditional effects rather than through the lower-order coefficients alone. The article reports reliability and validity evidence, direct-effect regression, bootstrap mediation, moderation, and supplementary conditional indirect-effect estimates.

## 4. Results

The results are organised so that each table or figure appears immediately after its first substantive citation in the text. Tables report the statistical evidence, whereas figures visualise the study context, measurement quality, construct relationships, and structural effects.

### 4.1 Sample profile and descriptive statistics

Table 1 reports the sample profile. The sample included respondents from public universities, private universities, and vocational or technical colleges, and most respondents were already applying for jobs or attending career fairs. Figure 2 visualises the institutional context, job-search status, and digital-access distribution.



Table 1 Sample profile (N = 521)

| Variable          | Category                                       | n   | %     |
|-------------------|------------------------------------------------|-----|-------|
| Gender            | Male                                           | 272 | 52.21 |
|                   | Female                                         | 249 | 47.79 |
| Institution type  | Public University                              | 163 | 31.29 |
|                   | Private University                             | 264 | 50.67 |
|                   | Vocational/Technical College                   | 94  | 18.04 |
| Education level   | College Diploma                                | 165 | 31.67 |
|                   | Bachelor's Degree                              | 268 | 51.44 |
|                   | Postgraduate and above                         | 88  | 16.89 |
| Field of study    | Engineering and Technology                     | 75  | 14.40 |
|                   | Business and Management                        | 121 | 23.22 |
|                   | Social Sciences                                | 171 | 32.82 |
|                   | Education                                      | 55  | 10.56 |
|                   | Arts and Humanities                            | 70  | 13.44 |
|                   | Natural Sciences                               | 29  | 5.57  |
|                   | Yes                                            | 378 | 72.55 |
|                   | No                                             | 100 | 19.19 |
| Job-search status | Planning to do so within the next three months | 43  | 8.25  |
|                   |                                                |     |       |
| Digital access    | Very Poor                                      | 29  | 5.57  |
|                   | Poor                                           | 64  | 12.28 |
|                   | Fair                                           | 199 | 38.20 |
|                   | Good                                           | 140 | 26.87 |
|                   | Excellent                                      | 89  | 17.08 |

Sample context for the Zhejiang graduate survey

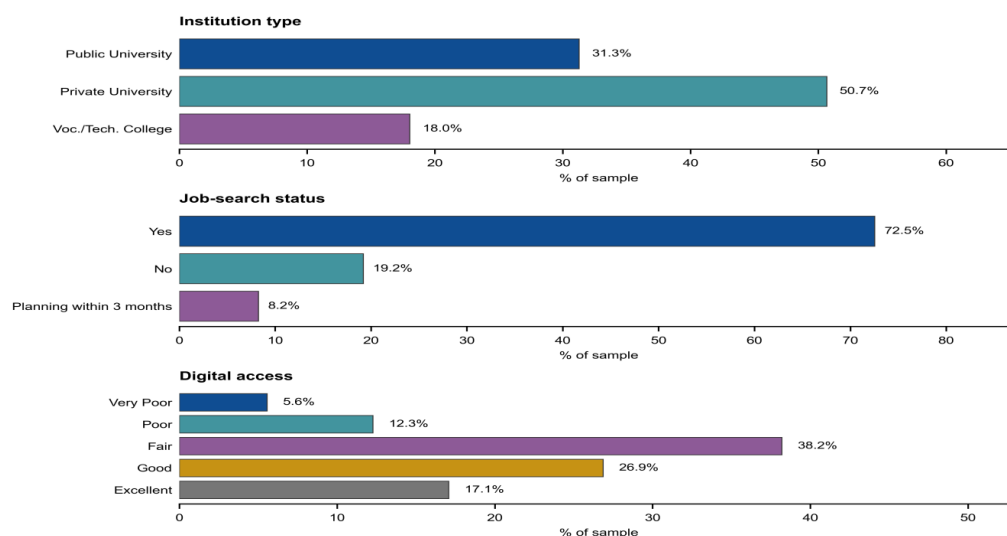


Figure 2 Sample context for the Zhejiang graduate survey.

*Note. Bars show institution type, job-search status, and digital access as percentages of the full sample.*

Table 2 summarises the six core variables. Mean scores for all constructs were above the theoretical midpoint, with social competencies showing the highest mean and psychological resilience showing the lowest mean.

**Table 2 Core variable descriptive statistics**

| Variable                 | N   | Min   | Max   | M     | SD    | Median |
|--------------------------|-----|-------|-------|-------|-------|--------|
| Cognitive competencies   | 521 | 1.000 | 5.000 | 3.693 | 0.979 | 4.000  |
| Social competencies      | 521 | 1.400 | 4.800 | 3.754 | 0.931 | 4.000  |
| Behavioural competencies | 521 | 1.200 | 4.800 | 3.697 | 0.923 | 4.000  |
| Digital literacy         | 521 | 1.200 | 4.800 | 3.666 | 0.980 | 4.000  |
| Psychological resilience | 521 | 1.000 | 4.800 | 3.540 | 1.030 | 4.000  |
| Employability            | 521 | 1.000 | 4.800 | 3.691 | 0.955 | 4.000  |

#### 4.2 Measurement quality and construct validity

Table 3 reports item-level factor loadings, Cronbach's alpha, composite reliability, and AVE.

The wording of the constructs and item domains is described in Section 3.3, and full item wording can be supplied as supplementary material if required by the target journal.

**Table 3 Factor loadings, reliability, and convergent validity**

| Construct                | Item | Loading | Alpha | CR    | AVE   |
|--------------------------|------|---------|-------|-------|-------|
| Cognitive competencies   | CF1  | 0.812   | 0.881 | 0.886 | 0.610 |
|                          | CF2  | 0.760   |       |       |       |
|                          | CF3  | 0.761   |       |       |       |
|                          | CF4  | 0.777   |       |       |       |
|                          | CF5  | 0.793   |       |       |       |
| Social competencies      | SF1  | 0.776   | 0.874 | 0.878 | 0.590 |
|                          | SF2  | 0.792   |       |       |       |
|                          | SF3  | 0.770   |       |       |       |
|                          | SF4  | 0.756   |       |       |       |
|                          | SF5  | 0.745   |       |       |       |
| Behavioural competencies | BF1  | 0.747   | 0.865 | 0.870 | 0.573 |
|                          | BF2  | 0.782   |       |       |       |
|                          | BF3  | 0.786   |       |       |       |
|                          | BF4  | 0.730   |       |       |       |
| Digital                  | BF5  | 0.737   | 0.883 | 0.871 | 0.576 |
|                          | DL1  | 0.774   |       |       |       |

| Construct                   | Item | Loading | Alpha | CR    | AVE   |
|-----------------------------|------|---------|-------|-------|-------|
| literacy                    | DL2  | 0.784   | 0.892 | 0.897 | 0.635 |
|                             | DL3  | 0.777   |       |       |       |
|                             | DL4  | 0.713   |       |       |       |
|                             | DL5  | 0.744   |       |       |       |
|                             | RS1  | 0.813   |       |       |       |
| Psychological<br>resilience | RS2  | 0.831   | 0.867 | 0.875 | 0.584 |
|                             | RS3  | 0.763   |       |       |       |
|                             | RS4  | 0.785   |       |       |       |
|                             | RS5  | 0.792   |       |       |       |
|                             | EC1  | 0.730   |       |       |       |
| Employability               | EC2  | 0.794   | 0.867 | 0.875 | 0.584 |
|                             | EC3  | 0.750   |       |       |       |
|                             | EC4  | 0.772   |       |       |       |
|                             | EC5  | 0.772   |       |       |       |

*Note. Standardized factor loadings were obtained from the measurement model. CR and AVE were calculated based on the reported standardized loadings.*

Additional measurement diagnostics supported the adequacy of the data. The KMO value was 0.928, and Bartlett's test of sphericity was significant ( $\chi^2 = 8310.934$ ,  $df = 435$ ,  $p < 0.001$ ). The confirmatory model showed acceptable fit ( $\chi^2/df = 1.155$ , CFI = 0.992, TLI = 0.992, GFI = 0.946, AGFI = 0.936, RMSEA = 0.017, RMR = 0.040, IFI = 0.993, NFI = 0.947). Harman's

single-factor test indicated that the first unrotated factor explained 31.458% of the variance, below the commonly used 40% threshold; therefore, common method bias was not considered severe, although the self-report design still requires cautious interpretation.

Table 4 reports construct correlations and square roots of AVE. The correlations were positive but moderate, and the diagonal square roots of AVE exceeded the inter-construct correlations.

**Table 4 Descriptive statistics, correlations, and square roots of AVE**

| Construct                | M     | SD    | CC    | SC    | BC    | DL    | PR    | EMP   |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cognitive competencies   | 3.693 | 0.979 | 0.781 |       |       |       |       |       |
| Social competencies      | 3.754 | 0.931 | 0.385 | 0.768 |       |       |       |       |
| Behavioural competencies | 3.697 | 0.923 | 0.390 | 0.418 | 0.757 |       |       |       |
| Digital literacy         | 3.666 | 0.980 | 0.400 | 0.400 | 0.397 | 0.759 |       |       |
| Psychological resilience | 3.540 | 1.030 | 0.254 | 0.285 | 0.257 | 0.449 | 0.797 |       |
| Employability            | 3.691 | 0.955 | 0.311 | 0.328 | 0.381 | 0.391 | 0.374 | 0.764 |

*Note. Diagonal entries are square roots of AVE. Lower-triangle entries are construct correlations.*

Table 5 reports multicollinearity diagnostics. VIF values ranged from 1.341 to 1.569, indicating that

multicollinearity was not a serious threat to the structural estimates.

**Table 5 Multicollinearity diagnostics**

| Variable                 | VIF   | Tolerance |
|--------------------------|-------|-----------|
| Cognitive competencies   | 1.355 | 0.738     |
| Social competencies      | 1.395 | 0.717     |
| Behavioural competencies | 1.427 | 0.701     |
| Digital literacy         | 1.569 | 0.637     |
| Psychological resilience | 1.341 | 0.746     |

### 4.3 Direct effects

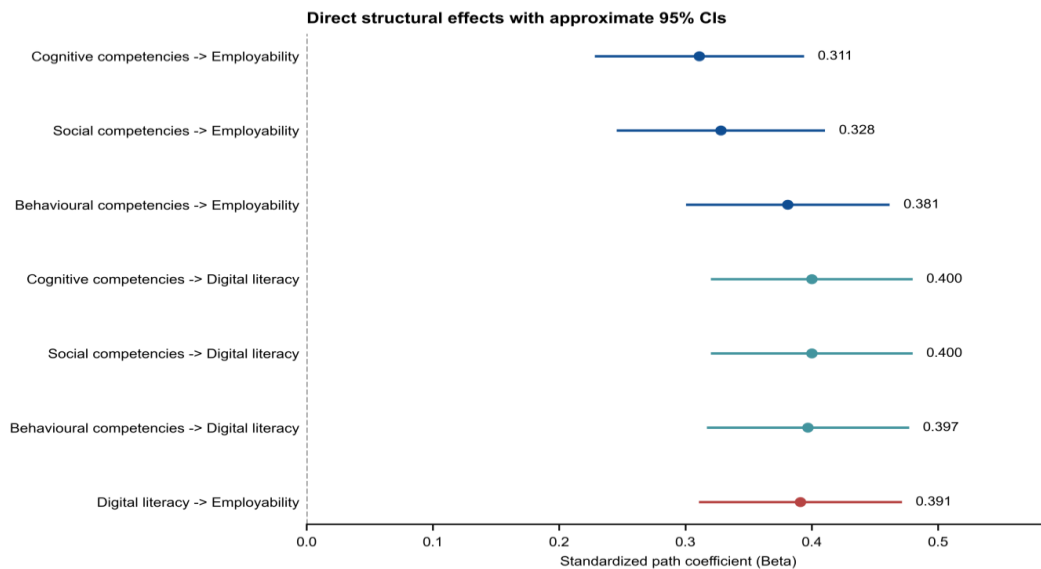
The direct-effect results are reported in Table 6 and visualised in Figure 3. Cognitive, social, and behavioural competencies were positively

associated with employability, and all three foundational competencies were positively associated with digital literacy. Digital literacy also positively predicted employability.

**Table 6 Direct effects and path coefficients**

| Hypothesis | Path                                           | Beta  | SE    | t     | p      | 95% CI         | R <sup>2</sup> |
|------------|------------------------------------------------|-------|-------|-------|--------|----------------|----------------|
| H1         | Cognitive competencies<br>→<br>Employability   | 0.311 | 0.042 | 7.459 | <0.001 | [0.229, 0.393] | 0.097          |
| H2         | Social competencies→<br>Employability          | 0.328 | 0.042 | 7.901 | <0.001 | [0.247, 0.409] | 0.107          |
| H3         | Behavioural competencies<br>→<br>Employability | 0.381 | 0.041 | 9.385 | <0.001 | [0.301, 0.461] | 0.145          |
| H4         | Cognitive competencies→<br>Digital literacy    | 0.400 | 0.040 | 9.951 | <0.001 | [0.321, 0.479] | 0.160          |
| H5         | Social competencies→<br>Digital literacy       | 0.400 | 0.040 | 9.953 | <0.001 | [0.321, 0.479] | 0.160          |
| H6         | Behavioural competencies→<br>Digital literacy  | 0.397 | 0.040 | 9.854 | <0.001 | [0.318, 0.476] | 0.158          |
| H7         | Digital literacy<br>→<br>Employability         | 0.391 | 0.040 | 9.665 | <0.001 | [0.312, 0.470] | 0.153          |

*Note. SEs and 95% CIs are Wald approximations derived from the reported beta and t values because the source analysis output did not contain bootstrap SEs/CIs.*



**Figure 3 Direct structural effects.**

*Note. Points show standardized path coefficients and horizontal lines show approximate 95% confidence intervals derived from the reported beta and t values.*

#### 4.4 Mediating effects of digital literacy

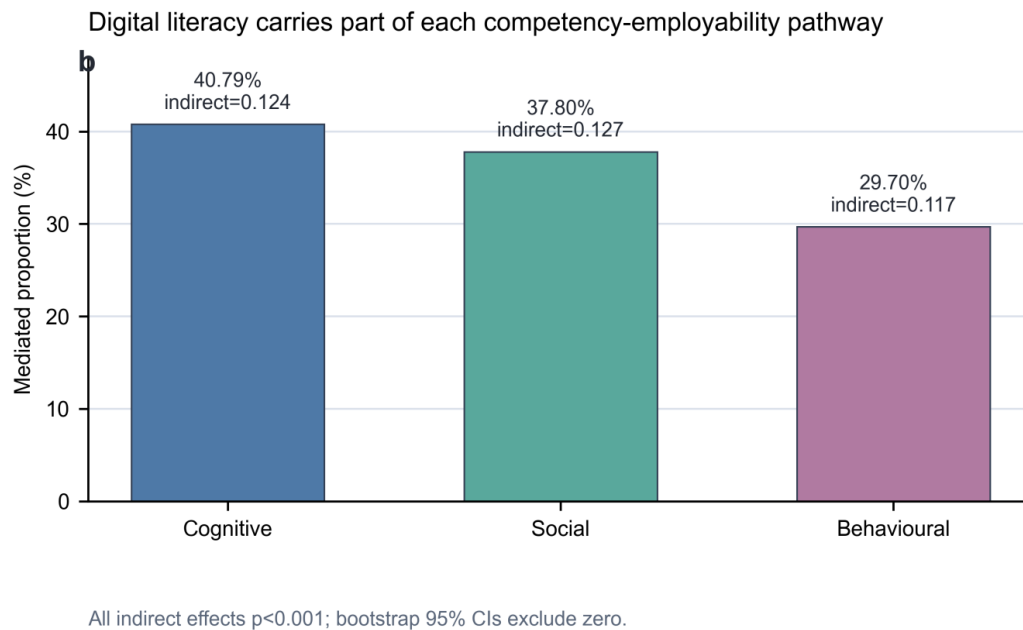
Table 7 reports the bootstrap mediation results, and Figure 4 visualises the mediation proportions. Digital literacy significantly mediated all three

competency-employability pathways, with the largest mediated proportion in the cognitive pathway.

**Table 7 Mediation effects of digital literacy**

| Hypothesis | Path                                                        | Indirect effect | SE    | 95% bootstrap CI | p      | Mediation proportion |
|------------|-------------------------------------------------------------|-----------------|-------|------------------|--------|----------------------|
| H8         | Cognitive competencies → Digital literacy → Employability   | 0.124           | 0.024 | [0.078, 0.172]   | <0.001 | 40.79%               |
| H9         | Social competencies → Digital literacy → Employability      | 0.127           | 0.026 | [0.079, 0.181]   | <0.001 | 37.80%               |
| H10        | Behavioural competencies → Digital literacy → Employability | 0.117           | 0.024 | [0.070, 0.166]   | <0.001 | 29.70%               |





**Figure 4 Mediation effect proportions for the three competency pathways.**

*Note. The figure compares the mediated proportions for cognitive, social, and behavioural competency pathways through digital literacy.*

#### 4.5 Moderating effect of psychological resilience

Table 8 reports the moderation model and simple-slope results, and Figure 5 displays the

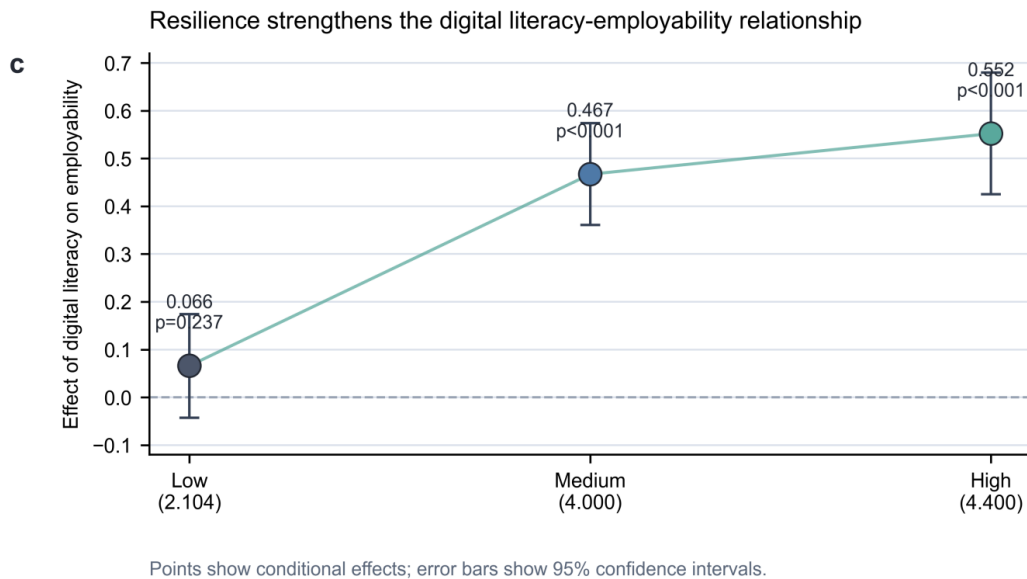
conditional effects. Digital literacy was not significantly related to employability at low resilience but became significant at medium and high resilience.

**Table 8 Moderation and simple-slope results for psychological resilience**

| Term                                        | Effect                                                            | SE    | t      | p      | 95% CI           |
|---------------------------------------------|-------------------------------------------------------------------|-------|--------|--------|------------------|
| Digital literacy                            | -0.380**                                                          | 0.123 | -3.094 | 0.002  | [-0.622, -0.139] |
| Psychological resilience                    | -0.514***                                                         | 0.138 | -3.725 | <0.001 | [-0.786, -0.243] |
| Digital literacy × Psychological resilience | 0.212***                                                          | 0.038 | 5.633  | <0.001 | [0.138, 0.286]   |
| Model summary                               | R = 0.498; R <sup>2</sup> = 0.248; MSE = 0.689; F(3,517) = 56.914 |       |        |        | <0.001           |
| Interaction change                          | Delta R <sup>2</sup> = 0.046; F(1,517) = 31.735                   |       |        |        | <0.001           |
| Simple slope: Low (2.104)                   | 0.066                                                             | 0.055 | 1.184  | 0.237  | [-0.043, 0.174]  |
| Simple slope: Medium (4.000)                | 0.467                                                             | 0.054 | 8.622  | <0.001 | [0.361, 0.574]   |
| Simple slope: High (4.400)                  | 0.552                                                             | 0.065 | 8.508  | <0.001 | [0.425, 0.680]   |

*Note. The interaction term was interpreted through the simple-slope results. In interaction models, lower-order coefficients are*

conditional effects and should not be interpreted independently of the interaction term. Low, medium, and high resilience values follow the observed simple-slope levels reported in the source analysis.



**Figure 5 Conditional effect of digital literacy on employability by resilience level.**

*Note. Lines show the estimated digital literacy-employability relationship at low, medium, and high psychological resilience.*

#### 4.6 Conditional indirect effects

Table 9 reports supplementary conditional indirect-effect estimates implied by the moderated

pathway. The estimates increased from low to high resilience, which is consistent with the simple-slope pattern shown in Figure 5.

**Table 9 Supplementary conditional indirect-effect estimates implied by the moderated pathway**

| Antecedent               | Moderator level | a path | Conditional path | b     | Conditional indirect effect |
|--------------------------|-----------------|--------|------------------|-------|-----------------------------|
| Cognitive competencies   | Low (2.104)     | 0.400  | 0.066            | 0.026 |                             |
|                          | Medium (4.000)  | 0.400  | 0.467            | 0.187 |                             |
|                          | High (4.400)    | 0.400  | 0.552            | 0.221 |                             |
| Social competencies      | Low (2.104)     | 0.400  | 0.066            | 0.026 |                             |
|                          | Medium (4.000)  | 0.400  | 0.467            | 0.187 |                             |
|                          | High (4.400)    | 0.400  | 0.552            | 0.221 |                             |
| Behavioural competencies | Low (2.104)     | 0.397  | 0.066            | 0.026 |                             |
|                          | Medium (4.000)  | 0.397  | 0.467            | 0.185 |                             |
|                          | High (4.400)    | 0.397  | 0.552            | 0.219 |                             |

*Note. These supplementary estimates were calculated by multiplying the a path by the conditional b path. They illustrate the pattern implied by the significant interaction effect and are interpreted alongside the bootstrap mediation tests and simple-slope results.*

#### 5. Discussion

This study examined how cognitive, social, and behavioural competencies were associated with

graduate employability in Zhejiang and whether digital literacy and psychological resilience explained the mechanism and boundary of that association. The overall finding is that

foundational competencies were positively related to employability, digital literacy partly converted these competencies into employability, and psychological resilience strengthened the digital literacy-employability pathway. This pattern responds to employability research that has moved from static lists of graduate attributes toward process models of transition, capability use, and contextual fit (Yorke, 2006; Rothwell & Arnold, 2007; Tight, 2023). The explanation is that graduates in digital labour markets must not only possess competencies but also display them through digital evidence, online collaboration, and sustained job-search behaviour. The theoretical contribution is therefore a conversion model in which employability is produced through the interaction of foundational competencies, digital capability, and psychological resources.

### **5.1 Foundational competencies and employability**

The first major finding is that cognitive, social, and behavioural competencies all showed positive relationships with perceived employability, with behavioural competencies showing the strongest direct association. This suggests that students who report stronger problem solving, communication, initiative, self-management, and adaptability also tend to perceive themselves as more employable.

This finding is consistent with employability frameworks that define employability as a combination of knowledge, skills, self-beliefs, personal attributes, and career-management capacities rather than a simple employment outcome (Yorke, 2006; Rothwell & Arnold, 2007). It also agrees with recent empirical work showing that employability-building activities and perceived career resources contribute to graduate transition outcomes (Jackson et al., 2024; Qostal et al., 2024).

The stronger behavioural pathway may reflect the stage of the respondents. Final-year students and active job seekers evaluate employability through action: preparing applications, managing

interviews, searching online platforms, and adapting to feedback. The result is also compatible with social cognitive theory, because students who believe they can act effectively are more likely to attempt demanding transition tasks and persist after difficulty (Bandura, 1986, 1997).

The theoretical implication is that graduate employability models should treat behavioural activation as a central mechanism rather than as a minor personal trait. Cognitive and social competencies remain important, but they become more visible to students when supported by proactive and self-regulated behaviour during the transition from university to work.

### **5.2 Digital literacy as a conversion mechanism**

The second major finding is that digital literacy partially mediated all three competency-employability relationships. The mediated proportions were especially large for cognitive and social competencies, indicating that thinking and interpersonal resources became more employability-relevant when students could use digital tools and digital communication practices.

This finding extends work that defines digital literacy as a broad capability involving information evaluation, communication, creation, safety, collaboration, and problem solving rather than only technical operation (Ng, 2012; Vuorikari et al., 2022; Gutierrez-Angel et al., 2022). It is also consistent with studies showing that digital employability skills, digital literacy, and digital learning contribute to workforce readiness and employability-related outcomes (Adegbite, 2024; Kholifah et al., 2025; Liu et al., 2023; Narmaditya et al., 2024).

The result may be consistent with these studies because the employability value of foundational competencies increasingly depends on digitally mediated evidence. Cognitive competence is displayed when students evaluate online

information, solve digital tasks, and interpret data. Social competence is displayed when students communicate across platforms, collaborate asynchronously, and manage professional online interaction. Behavioural competence is displayed when students learn new tools, maintain digital portfolios, and search persistently through online labour-market channels.

The theoretical implication is that digital literacy should be positioned as a conversion mechanism. It is not merely one additional employability skill; it is a channel through which broader competencies become visible, usable, and credible in digital labour-market environments.

### 5.3 Psychological resilience as a boundary condition

The third major finding is that psychological resilience moderated the relationship between digital literacy and employability. Digital literacy was not significantly associated with employability at low resilience, but the relationship became significant and stronger at medium and high resilience.

This result is consistent with resilience theory, which treats resilience as the capacity to recover, adapt, and continue functioning under stress (Connor & Davidson, 2003). It also extends employability studies that include psychological resources, future work self, confidence, or career agency as conditions that shape graduate transition outcomes (Chen et al., 2023; Ma et al., 2024). Methodologically, the pattern also fits standard interaction logic: the value of one predictor can depend on the level of another resource (Aiken & West, 1991).

The explanation is that digital literacy is used under pressure. Students may know how to use digital tools but still encounter platform competition, automated screening, uncertainty, rejection, and rapidly changing employer expectations. When resilience is low, these pressures may prevent students from applying

digital skills consistently. When resilience is higher, students may be more able to continue learning, revise applications, seek feedback, and translate digital competence into employability confidence.

The theoretical implication is that digital employability is not purely technological. It is a socio-psychological process in which digital capability and resilience work together. Digital literacy provides tools and channels, but resilience helps students keep using those tools when career transition becomes uncertain or emotionally demanding.

### 5.4 Zhejiang digital economy and higher education implications

The fourth finding concerns context. In Zhejiang's digitally intensive economy, employability is likely to be demonstrated through online applications, digital portfolios, platform communication, data-supported problem solving, and hybrid collaboration. The study's results therefore suggest that the regional digital economy shapes how student competencies are converted into employability.

This interpretation is consistent with research showing that digital capability and digital employability skills are becoming central to workforce readiness (Liu et al., 2023; Kholifah et al., 2025). It also connects with higher education research arguing that employability is a core but contested role of universities, because labour-market preparation must be balanced with broader educational development (Tight, 2023).

The result may differ from studies in less digitally intensive settings because Zhejiang students are likely to encounter employers, recruitment platforms, and workplace routines that require visible digital performance. In this context, digital literacy cannot be separated from disciplinary learning, social communication, or career services. A course that teaches software skills alone is unlikely to build employability unless students also learn how to use digital evidence to communicate

competence, solve problems, and manage career uncertainty.

The theoretical implication is that employability should be understood as regionally embedded. Competencies do not have the same labour-market meaning in every context; their value depends on the technological and institutional environment in which graduates must display them. For Zhejiang universities, this means integrating digital information evaluation, AI-output assessment, online collaboration, portfolio evidence, and resilience-building into both curriculum and career development.

### 5.5 Limitations and future research

Several limitations should be noted. The model was supported by cross-sectional, self-reported survey data, but the design cannot establish causality or prove actual employment outcomes. The findings should therefore be interpreted as evidence about perceived employability and model relationships rather than as proof of job attainment, salary, job fit, or long-term career success.

This limitation is common in employability and behavioural research using questionnaire designs. Common method bias remains a risk when predictors and outcomes are collected from the same respondents, even when diagnostic checks are acceptable (Podsakoff et al., 2003). The mediation and moderation claims are statistically meaningful, but stronger causal claims would require longitudinal designs, experimental interventions, or linked post-graduation outcome data (Preacher & Hayes, 2008; Zhao et al., 2010).

The likely reason these limitations matter is that employability develops over time. Students' self-perceptions may change after repeated job applications, internships, employer feedback, or exposure to new technologies. Subgroup differences may also exist by gender, discipline, institution type, and digital access. These differences cannot be fully tested from the

aggregate results reported here.

The theoretical implication is that future models should treat digital employability as a developmental process. Future research should use longitudinal data, multi-group analysis, and respondent-level moderated-mediation testing to examine whether digital literacy and resilience operate similarly across student groups and whether perceived employability predicts later employment quality.

## 6. Conclusion

This article shows that foundational competencies, digital literacy, and psychological resilience jointly shape perceived graduate employability among final-year students in Zhejiang. Cognitive, social, and behavioural competencies were positively related to employability; digital literacy partly converted these competencies into employability; and resilience strengthened the pathway from digital literacy to employability. The contribution is a bounded conversion model: in digital regional economies, employability depends not only on what students know or can do, but also on whether they can express those competencies through digital practice and sustain that practice under labour-market pressure.

### Data Availability

Aggregated data supporting the tables and figures are reported in the manuscript and can be supplied as supplementary source-data files. De-identified respondent-level survey data are not publicly released because the dataset contains human participant questionnaire responses and data sharing must follow participant-consent and institutional data-protection requirements. Qualified researchers may request access through the corresponding author and the responsible institution, subject to ethics approval where required and a data-use agreement.

### Ethics Statement

This study used anonymous and voluntary questionnaire responses from higher education

students. Before completing the questionnaire, participants received research information explaining the study purpose, voluntary participation, anonymity, confidentiality, and their right to withdraw before submission. No directly identifying information is reported in this article, and the extracted dataset did not contain direct identifiers. The survey was treated as an anonymous, non-interventional educational survey with minimal risk to participants under the applicable institutional procedures for educational survey research.

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### Conflict of Interest

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

### AI Disclosure

During the manuscript revision process, we only used AI-assisted language translation functions.

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