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Empowering Innovative Talents in the Digital Era: Exploring the Psychological Mechanism of Accounting Students in China

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Abstract: Higher education plays a key role in fostering national strength through talent and promoting innovation. In particular, accounting education is required to help students improve their digital and innovative skills. Based on social cognitive theory and componential theory of creativity, we have developed a moderated mediation model to study the relation between using digital accounting tools and students' innovation behavior, and its mechanisms. We used partial least squares structural equation modelling (PLS-SEM) to verify 304 accounting students from a private university in Xi'an, China. We obtained a direct and positive influence of digital accounting tool usage on the innovation behavior of students ($\beta = 0.218$, $P < 0.001$). Creative self-efficacy significantly mediates this connection (indirect effect = 0.263) and explains psychological pathways through which technology stimulates innovation. Digital literacy moderates the relationship between tool usage and innovation behavior ($\beta = 0.089$, $P < 0.05$), suggesting that enhanced basic digital skills enhance innovation benefits. These results offer theoretical insights and practical guidance for universities that aim to improve accounting curriculum and move from "operational empowerment" to "psychological empowerment."

Keywords: Digital accounting tools; Innovative behavior; Creative self-efficacy; Digital literacy

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1. Introduction

China has entered a new era of digital and intelligent transformation, leading to a rising demand for interdisciplinary, innovative, and digitally proficient accounting professionals. Specifically, there is an increasing need for experts in digital accounting tools, big data mining, and intelligent analysis [1–3]. The accounting profession is transitioning from "traditional accounting" to "intelligent value management." However, Chinese universities are currently lagging in accounting education compared to industry requirements. They face challenges in cultivating digital accountants. Initially, accounting practice has

undergone a significant transformation, shifting its focus from accounting calculations to analytical decision-making [3]. Additionally, the generation of accounting information has evolved from post-event financial reporting to real-time financial reporting. The core data required for accounting and management decisions is transitioning from a model centered on financial data to a composite data fusion model that integrates financial data and non-financial data, thereby enhancing its richness and multidimensionality. Furthermore, in the digital environment, the dramatic expansion of decision-making information sets, coupled with the significantly increasing demands on data processing methods, technologies, and capabilities, necessitates the adoption of new technologies and digital tools [4]. There exists a notable gap in the research regarding the application of digital accounting tools and their role in fostering innovative behavior among trainees. This gap has become increasingly urgent for the development of multipurpose and innovative accountants.

A significant body of academic research exists on utilizing digital tools to improve creative accounting skills. For instance, a study evaluated the impact of technological self-efficacy and digital literacy on students' innovation within digital accounting education. Hattami highlighted that students with higher digital literacy in accounting education tend to benefit more from modern digital education, fostering enhanced creative thinking. This research indicates potential avenues for enhancing students' data analysis capabilities. Another study focusing on analyzing accountant data demonstrated that the perceived decision quality by corporate management improves when high-quality big data sources are utilized. This research underscores the role of effective and precise data in enhancing decision outcomes. However, technological tools alone are inadequate, necessitating interpretation and application by individuals possessing analytical skills. As a result, management accountants must acquire proficiency in advanced data analytics [5]. Concurrently, scholars are beginning to recognize that digital transformation entails more than just a software update; it also represents a restructuring of educational resources on the supply side [6]. Nevertheless, existing studies exhibit significant gaps, with only a limited number investigating the impact of digital accounting tools (DAT) on fostering significant innovation (INNO) among students.

Jemine *et al.* [7] asserted that future accounting professionals' core competency will lie in the integration of finance, technology, and business logic rather than operational skills. Kuang [3] introduced and elaborated on the TPACK framework, indicating that students' perceptions of digital technologies are linked to their learning experiences. However, the psychological mechanisms through which individual perceptions of digital tools affect students' innovative behavior remain unclear. This research gap impedes a comprehensive understanding of the effectiveness of digital and intelligent teaching, thereby hindering higher education institutions from establishing a solid theoretical foundation for fostering innovative talent. The impact of accounting students' digital literacy on the correlation between digital tools usage frequency and creativity remains uncertain [8]. Therefore, these research gaps, along with the increasing necessity to tackle the gap between learning and application, necessitate an exploration of how the utilization of DAT impacts student INNO. Understanding this relationship could enable universities to tackle the issue of students proficient in software usage but lacking problem-solving skills [9]. This study suggests that creative self-efficacy (CSE) can elucidate the psychological rationale behind "why technology stimulates innovation," facilitating the theoretical shift from operational empowerment to psychological empowerment. As China's demand for accounting professionals shifts towards value creators, elucidating the moderating role of digital literacy (DL) can assist universities in implementing tailored teaching approaches. Consequently, this research poses three key inquiries: Does the use of DAT directly affect INNO? Does CSE mediate the relationship between DAT

and INNO? Does DL moderate the direct or indirect impact?

This study utilizes Bandura's social cognitive theory and the componential theory of creativity in our research model [10], focusing on the environment (digital tools), individual (psychological perception), and behavior (innovation performance). The use of digital tools induces changes in psychological representations at the individual level. CSE, a concept within innovation, pertains to an individual's assessment of their competencies and beliefs regarding innovative tasks. Social cognitive theory (SCT) serves as a central mediating factor in the transition from environment to behavior [9]. The synergy between the technological environment and psychological perception can enhance innovative behavior. Considering the diversity of individuals' abilities, this study has introduced DL as a moderating condition. Digital literacy encompasses the capacity to navigate, evaluate, and create information proficiently and critically using various digital technologies. The inclusion of this moderating variable aims to explore the impact of digital competence on the variance in tool-enabled innovation behavior among accounting students.

The results indicate that (1) the utilization of digital accounting tools has a significant positive impact on students' innovative behavior; (2) self-efficacy in creativity serves as a significant mediating factor between the utilization of digital accounting tools and innovative behavior; and (3) digital literacy significantly moderates the relationship between digital accounting tool utilization and innovation behavior. Learners with higher levels of digital literacy effectively master the functions of core digital accounting tools, thereby fully leveraging the empowering value of their environment to enhance CSE and foster innovative performance. Conversely, students with lower digital literacy may struggle to optimally channel their environmental empowerment into psychological perceptions and innovative behaviors due to insufficient knowledge regarding the tools. By applying social cognitive theory to the realm of accounting education, this study elucidates the psychological mechanisms through which digital devices enhance innovative behavior.

2. Literature review and hypotheses

The accounting profession is currently undergoing a transformation from manual bookkeeping to intelligent data processing [5]. Consequently, a fundamental change in accounting education is necessary to facilitate this impactful transformation. Students can no longer merely use software; they must apply it to generate new ideas and insights. Presently, research in accounting education emphasizes tool efficiency and learning outcomes, such as efficiency, accuracy, and analytical competence, rather than elucidating how the use of tools influences students' innovative behavior through psychological mechanisms [11]. To address this gap, this paper utilizes SCT and the componential theory of creativity to theorize (i) why the utilization of digital accounting tools can stimulate innovative behavior, (ii) how this effect is mediated by creative self-efficacy, and (iii) under what conditions this effect is amplified, particularly in relation to students' digital literacy. Bandura's social cognitive theory [12] discusses human behavior as a consequence of the interaction between environmental factors, such as tools, and personal factors, like self-efficacy and innovation. Traditionally, technology adoption has been described as a linear process that is usually driven by technical aspects. In contrast, social cognitive theory says that environment and tools affect behavior innovation by changing the individual's internal state [10,13]; Amabile's component theory of creativity asserts that domain-relevant skills are needed for innovation to occur [14]. Digital literacy is the core construct, that is, a boundary condition that allows students to transform tool use into productive results [15–17].

2.1. Digital accounting tools and innovative behavior

Accounting education tools such as cloud-based accounting and data analytics are mainly used nowadays [18]. Most of the literature supports the idea that they increase efficiency and accuracy, and the recent accounting education work emphasizes the importance of analytics and new technologies [18,19]. However, much of the research concentrates on the functional mastery of software, learning software, and assumes that a simple exposure to technology improves outcomes mechanically. This leaves the innovation-relevant behavior pathways under-theorized.

Innovative accounting involves not only designing new software, but also applying techniques to new problems, optimizing workflows, and new visualizations of data. In a school setting, students should engage in experiments and recombinations, based on existing rules and process-specific rules. Al-Hattami [4] showed that students are more inclined to adapt when they explore different solutions using digital tools. However, we do not know why similar exposure leads to different innovation levels among students; therefore, it has to take into account internal motivations and capability constraints. SCT posits that environmental attributes influence behaviors by shaping individual cognitions and perceived performances [20]. Therefore, we contend that merely possessing the tools is insufficient; rather, the utilization of these tools, along with the depth and frequency of interactions facilitated by the digital environment, creates repeated opportunities for mastery, feedback, and vicarious learning, which can foster innovative behavior. These tools offer students a secure environment to test their hypotheses and take risks without facing financial repercussions in real life.

H1: The utilization of digital accounting tools has a positive effect on the innovative behavior of accounting students.

2.2. The mediating role of creative self-efficacy

What constitutes innovation and how does the use of digital tools drive innovation? As per the social cognitive theory, environmental resources need to enhance an individual's self-belief before impacting behavior [20]. This research proposes that CSE, defined as one's confidence in generating creative results [21,22], serves as a crucial mechanism.

While recent studies have explored confidence in utilizing technology (technological self-efficacy), this measure primarily focuses on operational confidence, which may not fully elucidate innovation-oriented behaviors [23]. Apart from feeling technically proficient, students must also believe in their ability to generate and advocate for novel solutions in ambiguous circumstances. We contend that digital accounting tools serve as a facilitator because their consistent use enables users to gain mastery experiences (performing analytical tasks, streamlining workflows, or automating processes), which, according to Bandura, represent the most potent wellspring of self-efficacy. Mastery experiences, construed as proof of one's creative aptitude, are likely to boost creative self-efficacy, thereby augmenting students' readiness to explore and implement unconventional solutions.

We find that the studies linking the use of digital tools to creative self-efficacy among accounting students are rare. There is often a link between IT use and performance without considering psychology [21]. We believe that the power of digital tools stimulates innovation among students in practical universities, especially those with initial self-doubt. Creative self-efficacy (confidence in oneself) is the key to turning digital tools into tangible innovations.

H2a: The utilization of digital accounting tools has a positive impact on creative self-efficacy.

H2b: Creative self-efficacy positively affects innovative behavior.

H2c: Creative self-efficacy mediates the relationship between digital accounting tools Utilization and innovative behavior.

2.3. The moderating role of digital literacy

Although digital tools possess significant innovative potential, the capability to unlock this potential is essential [24]; domain-relevant skills are prerequisites for creativity, as outlined in the componential theory of creativity [17]. In the learning environment, digital literacy is indispensable in an increasingly digitalized educational landscape [8]. Beyond mere button-pushing, digital literacy encompasses the ability to employ various cognitive processes to search for, locate, select, evaluate, organize, integrate, and communicate information, thereby constructing new knowledge through digital channels and media. Previous studies have yielded mixed results regarding whether and when digital literacy enhances the impact of technology utilization on innovative outcomes. For example, evidence in the context of higher education supports the enabling role of digital literacy [4].

We critically reassess this relationship by considering the importance of task complexity. Basic literacy suffices for routine work tasks, while advanced digital literacy is crucial for fostering innovative practices that involve adapting tools to solve new challenges. A student with high digital literacy can effectively utilize the sophisticated functions of accounting software, whereas a student with low digital literacy may only use it as a basic calculator, even with frequent use [25]. Therefore, digital literacy is expected to amplify the positive impact of tool utilization on innovation, acting as a catalyst. A highly digitally literate student is likely to achieve greater innovation from the same level of tools utilization compared to a less digitally literate peer.

H3: Digital literacy positively influences the association between the Utilization of digital accounting tools and innovative behavior.

3. Methodology

The research employs a quantitative approach conducted on students from the accounting department at private universities in Xi'an. The study aims to investigate the potential of intelligent accounting tools in enhancing the innovative behavior of accounting students. Additionally, it seeks to explore the influence of CSE and DL on innovative behavior. Data collection was carried out through a questionnaire survey involving students from the accounting department of specific private universities in Xi'an (see **Appendix**). The distribution of student grades was as follows: freshmen 2.72%, sophomores 35.37%, juniors 57.82%, and senior students 4.08%. Regarding internship or work experience, participants were almost evenly split, with 50.68% having no experience and 49.32% having some form of experience. The study evaluated four constructs: digital accounting tools utilization (DAT), creative self-efficacy (CSE), digital literacy (DL), and innovative behavior (INNO). Each construct has been evaluated using previously validated scales adapted to the accounting education context. Specifically, DAT was assessed with four items adapted from Al-Hattami [4] and Haleem [26]. CSE was evaluated with four items from Karwowski [27] and Tierney & Farmer [22]. DL was measured with four items from Avinç & Doğan [28] and Ng [29]. INNO was assessed with four items from Lukes & Stephan [30] and Scott & Bruce [31]. All items utilised a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot study involving 49 fourth-year accounting students from the same university confirmed acceptable reliability for all constructs (Cronbach's α: INNO = 0.930, CSE = 0.928, DAT = 0.833, DL = 0.826), surpassing the threshold of 0.70 (Nunnally, 1978). Descriptive statistics revealed

that mean scores for all constructs varied from 3.66 to 3.93, indicating generally positive attitudes towards digital accounting tools.

As all variables (DAT, CSE, DL, INNO) were self-reported by students, there is a potential issue of common method bias (CMB) that could artificially inflate the observed relationships. In line with Podsakoff [32], procedural remedies were implemented, ensuring anonymity, employing distinct scale anchors, and segregating the measurement of predictor and criterion variables in the questionnaire. Harman's single-factor test was conducted statistically. The unrotated exploratory factor analysis identified five factors with eigenvalues exceeding 1.0, with the primary factor explaining 34.2% of the total variance, falling below the recommended 50% threshold. This outcome indicates that CMB does not significantly compromise the validity of our results.

To empirically test the five proposed hypotheses and analyze the complex relationships between variables, the study utilized partial least squares structural equation modelling (PLS-SEM) as the primary analytical technique. The use of PLS-SEM in this study is justified as it has been found to be superior to other methods in estimating complex models that involve simultaneous mediation and moderation effects, without imposing restrictions on the distribution of data [33]. With a sample size of 304, the study ensured a robust SEM estimation and adequate statistical power to estimate the direct impact of utilization of digital accounting tools on innovative behavior, the mediating role of creative self-efficacy, and the moderating role of digital literacy. A non-parametric bootstrapping procedure (5,000 resamples) was employed for H2c to evaluate the significance of the indirect effect and for H3 to assess the interaction term. The SmartPLS 4.0 software was utilized for every analysis. Using the two-step assessment approach, evaluation of the measurement model was first conducted on the internal consistency, convergent validity, and discriminant validity. Afterward, the structural model was assessed using SRMR as the approximate model fit (< 0.08) measure and R^2 and Q^2 values for model explanatory and predictive relevance [34]. The conceptual framework is depicted in **Figure 1**. It illustrates the hypothesized relationships. After the componential theory of creativity in domain-specific creativity and SCT, we develop a moderated mediation model in which utilization of digital accounting tools (environmental input) directly (H1) as well as indirectly via creative self-efficacy (H2a–H2c) impacts innovation (behavioral outcome). Digital literacy functions as a domain-specific competence that enhances the extent to which tool utilization translates into innovative behavior (H3).

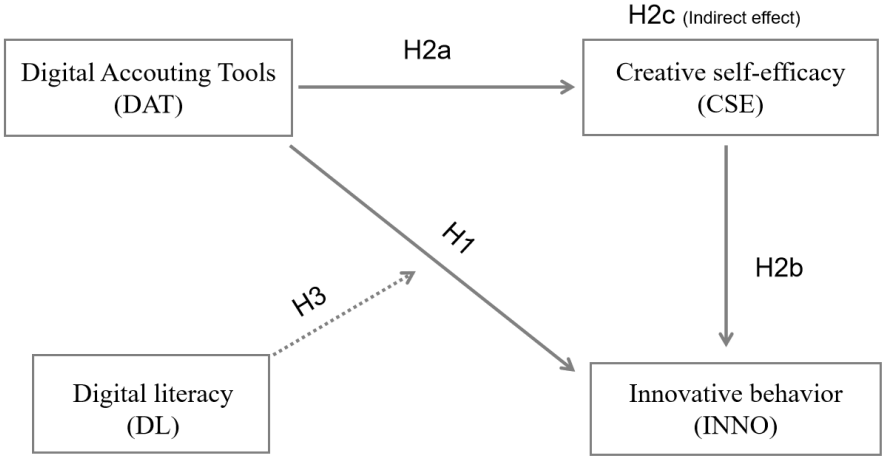

Figure 1. Conceptual framework of the hypothesized relationships

4. Data analysis and results

4.1. Measurement model assessment

Table 1 shows that all Cronbach's alpha values exceed 0.70, ranging from 0.854 to 0.906, indicating satisfactory internal consistency reliability. The composite reliability (CR) for the constructs ranges from 0.901 to 0.934, surpassing the 0.70 threshold, thus affirming the measures' reliability. The average variance extracted (AVE) for each construct falls between 0.696 and 0.780, all exceeding the 0.50 threshold. Therefore, the results confirm adequate convergent validity for the measures [35,36]. Consequently, the measurement model demonstrates validity and reliability based on these findings.

Table 1. Construct reliability and validity

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Creative self-efficacy	0.891	0.892	0.925	0.755
Digital accounting tools	0.867	0.869	0.909	0.715
Digital literacy	0.854	0.856	0.901	0.696
Innovative behavior	0.906	0.907	0.934	0.780

The HTMT criterion was used in assessing validity. All the HTMT values presented in **Table 2** are less than the conservative limit of 0.85, varying between the range of 0.568 and 0.689. The highest value between CSE and INNO is 0.689, which stays below the permissible limit of 0.90. The evidence is strong that the four constructs are empirically distinct [35].

Table 2. Heterotrait-monotrait ratio (HTMT)

Factors	Creative self-efficacy	Digital accounting tools	Digital literacy	Innovative behavior
Creative self-efficacy				
Digital accounting tools	0.582			
Digital literacy	0.612	0.568		
Innovative behavior	0.689	0.578	0.612	

Fornell–Larcker criterion further confirmed the discriminant validity. Based on **Table 3**, the square root of each construct's AVE (between 0.834 and 0.883) was greater than its highest correlation with other constructs (between 0.528 and 0.642), as shown in the processes in the table. For instance, both the square root of AVE for CSE equal to 0.869 is more than its correlation with INNO equal to 0.642, with DAT equal to 0.542, and with DL equal to 0.571. The evidence for discriminant validity is further confirmed as this pattern persists for all constructs [36].

Table 3. Fornell–Larcker criterion

Factors	Creative self-efficacy	Digital accounting tools	Digital literacy	Innovative behavior
Creative self-efficacy	0.869			
Digital accounting tools	0.542	0.846		
Digital literacy	0.571	0.528	0.834	
Innovative behavior	0.642	0.538	0.571	0.883

Note: Diagonal values (bold) are square roots of AVE; off-diagonal values are correlations.

4.2. Structural model assessment

Figure 2 shows that the utilization of digital accounting tools has a positive effect on creative self-efficacy (β = 0.542; $P < 0.001$), supporting H2a. The finding supports H2b on experimental creative self-efficacy, as the result shows that innovative behavior is enhanced by creative self-efficacy. The utilization of digital accounting tools has a positive and significant direct effect on innovative behavior (β = 0.218, $P < 0.001$), hence H1 is confirmed. The findings imply that using creative self-efficacy was partially mediation digital accounting tools on innovative behavior. In order to verify the mediation effect (H2c), we ran an indirect effect test using bootstrapping (5,000 resampling). The findings reveal that the Utilization of digital accounting tools has an indirect effect on innovative behavior through creative self-efficacy of 0.263 (β = 0.542 × 0.486), with a 95% bootstrap CI of [0.198, 0.328]. Since zero does not lie inside the confidence interval, we conclude that creative self-efficacy significantly mediates digital accounting tool utilization, innovative behavior. With partial mediation, the mediation makes up 54.7% of the total effect (0.263 / (0.263 + 0.218)). As a result, H2c is supported. With respect to the moderators' role of digital literacy (H3), the interaction term (DAT × DL) is positive and significantly affects innovative behavior (β = 0.089, P <0.05). This entails that digital literacy enhances the relationship between the Utilization of digital accounting tools and innovative behavior: the positive effect of DAT on INNO is stronger for students with higher digital literacy levels. Hence, there is support for H3 as shown in **Table 4**, the detailed path coefficients of the theory of planned behavior including standard error, t value, and P values related to all the hypotheses.

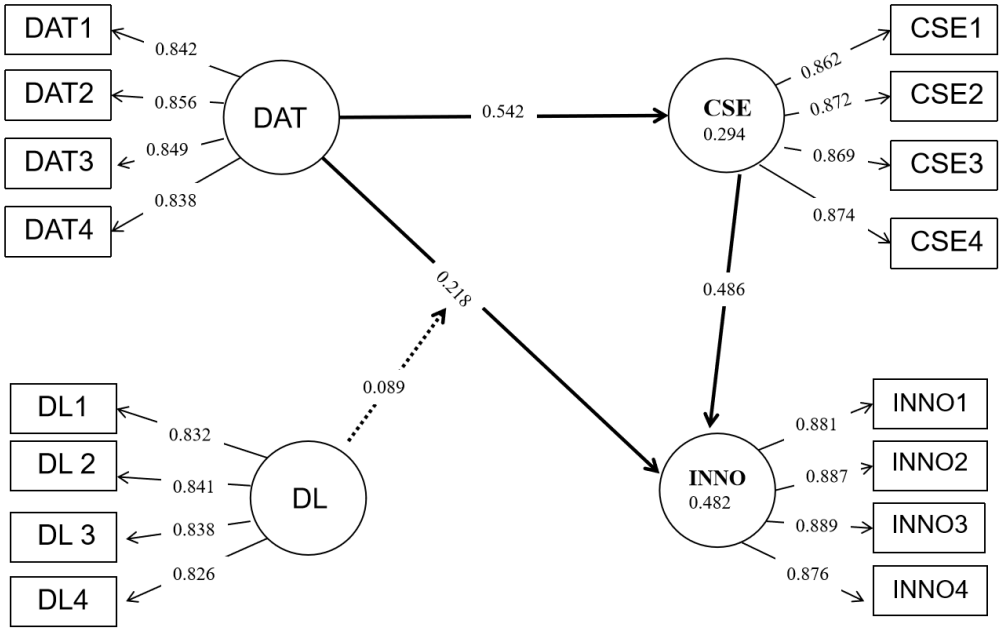

Figure 2. Measurement and structural model results

Note: The values on arrows from indicators to constructs are factor loadings. The coefficients on the arrows between constructs are standardized path coefficients. The endogenous constructs CSE and INNO have their R^2 values. At least $P < 0.05$ levels, all factor loadings and path coefficients are significant.

Table 4. Path analysis results

Hypotheses path	Path coefficient	*t* value	*P* value	Results	
H1	Digital Accounting tools -> Innovative Behavior	0.218	4.126	0.000	supported
H2a	Digital Accounting tools -> Creative Self-Efficacy	0.542	11.847	0.000	supported
H2b	Creative Self-Efficacy -> Innovative Behavior	0.486	9.235	0.000	supported
H3	Digital Literacy x Digital Accounting tools -> Innovative Behavior	0.089	2.124	0.034	supported

Table 5 illustrates that the utilization of digital accounting tools accounts for 29.4% of the variance in creative self-efficacy. The variable DAT, CSE, and interaction term (DL × DAT) together explained 48.2% of variances in innovative behavior, thus it has moderate explanatory power [34].

Table 5. R-square

Constructs	R^2	(Ad- R^2)
Creative self-efficacy	0.294	0.292
Innovative behavior	0.482	0.477

Table 6 estimated model's SRMR value is 0.058, which is below the recommended cutoff of 0.08 that indicates a good fit of the model [37]. The NFI value of 0.858 is above 0.80, which indicates that the model fit is acceptable. Overall, the model fits the data reasonably well.

Table 6. Model fit

Indices	Saturated model	Estimated model
SRMR	0.052	0.058
d_ULS	0.847	0.892
d_G	0.412	0.428
Chi-square	1248.6	1292.4
NFI	0.862	0.858

5. Discussion

This study analyses the impact of DAT on the INNO of accounting students at a private university in Xi'an, China. CSE serves as a mediating factor, while DL acts as a moderating variable. A digital accountant should possess the necessary relational skills for collaboration and effectively utilize tools like programming languages on sophisticated PCs and mobile devices. A sample of 304 students was used to construct a moderated mediation model employing PLS-SEM, grounded in social cognitive theory [13] and the componential theory of creativity [14]. The findings confirm all five hypotheses, demonstrating direct and indirect mechanisms through which digital tools influence innovation, with digital literacy playing a crucial role as a limiting factor.

5.1. Direct effect of digital accounting tools utilization on innovative behavior (H1)

DAT has a positive direct effect on INNO ($\beta = 0.218$, $P < 0.001$). This is in agreement with Al-Hattami [4],

who reported that using digital tools promotes innovation (β = 0.356, $P < 0.001$) among accounting students and practitioners. The results obtained in Yemen and China are consistent, suggesting that digital tools can stimulate innovation in accounting education in different cultural contexts. From a social cognitive point of view, digital tools provide a natural environment that promotes mastery experiences, feedback, and vicarious learning opportunities, which can lead to innovation [20]. Direct effect size observed in our study (β = 0.218) is smaller than that reported by Al-Hattami (β = 0.356). This may be due to different sample composition (students only, not mixed students and professionals) and the different digital tools studied. This is a case where digital tools can be integrated into accounting curricula to improve efficiency and also to promote innovation [26,28].

5.2. Direct effects of creative self-efficacy and digital literacy (H2a, H2b)

The results indicate that DAT favors creative self-efficacy (CSE), β = 0.542; $P < 0.001$, supports hypothesis H2a; CSE favors innovation (INNO), β = 0.486; $P < 0.001$, supports hypothesis H2b. These results agree with Al-Hattami [4], who favors technological self-efficacy (confidence in technology use); Al-Hattami focused on technological self-efficacy (confidence in technology use), but we extended this by exploring creative self-efficacy (confidence in creative results). These results show that self-efficacy, whether domain-specific or creativity-specific, is the key psychological mechanism by which digital tools promote innovation. Bandura [10] states mastery experiences are the most powerful source of self-efficacy; thus, completing analytical tasks or visualizing data with digital tools increases student confidence in their own skills and creativity [22]. The influence of digital literacy on innovative behavior was revealed (β = 0.442, $P < 0.01$). This finding aligns with the research conducted by Al-Hattami [4], which demonstrated that digital literacy exerted a positive direct effect on innovation, with a beta coefficient of 0.288 and $P < 0.001$. Furthermore, previous studies established a connection between digital literacy and problem-solving creativity [29,38]. The effect size observed in our study was somewhat larger, likely due to the student-focused sampling. Digital literacy appears to play a more significant role in academic innovation compared to professional innovation. Collectively, these findings underscore that confidence (CSE) and competence (DL) serve as crucial drivers of innovation in digital learning.

5.3. The mediating role of creative self-efficacy (H2c)

The indirect effect of DAT on INNO through CSE was statistically significant (indirect effect = 0.263, 95% CI [0.198, 0.328]). This effect accounts for 54.7% of the total effect, thereby supporting Hypothesis 2c. The result not only enhances the capacity for innovative thinking but also increases a student's creative confidence through the use of these tools. Our mediation findings contribute to the existing literature by elucidating the psychological processes underlying technology-driven innovation. This supports the premise of social cognitive theory, which posits that environmental factors, such as digital tools, influence behavior (innovation) by altering an individual's cognitive state (specifically, an increase in self-efficacy) [13]. The observation that the mediation is partial rather than complete indicates that both a direct behavioral approach (tools offering ready-made functionality) and an indirect psychological pathway (enhancing confidence) are instrumental in explaining the increasing recognition of this phenomenon.

5.4. The moderating role of digital literacy (H3)

The study finds that digital literacy moderates the relationship between DAT and INNO ($\beta = 0.089$, $P < 0.05$), for example, students with higher digital literacy use more tools to innovate. Al-Hattami [4] found that digital literacy does not moderate the relation between the use of digital tools and innovation ($\beta = -0.106$, $P > 0.05$). He concluded that "digital literacy alone significantly enhances innovation, and thus does not significantly moderate the relationship between the use of digital tools and innovation in accounting education." This is a carefully interpreted difference. There may be several reasons why we found a significant moderating effect of digital literacy and Al-Hattami did not. First, differences in the measure of the dependent variable may explain this difference. Al-Hattami evaluated a general "innovation" construct, while we used Scott and Bruce scale [31], which focuses on observable innovation behaviors such as searching for new ideas, checking ideas, and making innovations. Translating tools use into observable behavior could require more digital skills. Second, variation in sample characteristics could explain the differences observed. Our student sample likely has more variation in digital literacy, and thus could detect moderating effects. Al-Hattami's mixed sample of students and professionals may have a more uniform and higher baseline of digital literacy, which could suppress moderating effects [4]. Third, cultural and policy factors in China could enhance the enabling role of digital literacy. Despite these differences, both studies agree that digital literacy is a fundamentally important predictor of innovation. The significant moderating effect found in our study suggests that in classrooms with different levels of digital fluency, targeted digital skill interventions can improve innovative returns on investment.

6. Conclusion

The aim of this study is to investigate the effect of digital tools utilization on accounting students' innovative behavior, with creative self-efficacy serving as a mediator and digital literacy acting as a moderator, at a private university in Xi'an, China. Analysis conducted through PLS-SEM, utilizing 304 valid questionnaires, demonstrates that DAT influences INNO both directly and indirectly via CSE. Furthermore, the impact of DAT on INNO is enhanced by DL. All hypotheses are supported in this paper. SCT is applied in accounting education in a way that illustrates the triadic interaction of environment, individual, and behavior [39]. SCT is not a new general phenomenon, but a specific application of it to accounting technology is important. We show that CSE mediates the relationship between DAT and INNO, confirming CSE. The practical implications of this study are important for policymakers. Findings suggest accounting programs should move from the narrow definition of a "tools operation" approach to a "digital empowerment" approach, teaching software use but also promoting the confidence and knowledge needed to use tools effectively. This is in line with the goals of China's 15th Five-Year Plan to train technical and innovative people [1,3]. Digital infrastructure investment and professional development for educators are essential for this goal [40]. However, we have limitations, since our sample was taken from one private university in Xi'an, and thus the results are not generalizable. Future work should use this model as a reference for other regions such as public universities in eastern China and cultures distinct from this study.

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Disclosure statement

The authors declare no conflict of interest.

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Appendix

Questionnaire on Innovation Capability of Accounting Students in Digital Intelligence Context

Part I: Introduction

Dear Student, this is an academic survey regarding "How Digital Intelligence Tools Impact Accounting Students' Innovation Capability." The survey is anonymous, and there are no right or wrong answers. Your data will be used solely for academic statistical analysis. Your honest responses are crucial to this study. Thank you very much for your support and cooperation!

Part II: Demographics

1. Gender: ○ Male ○ Female
2. Year of Study: ○ Freshman ○ Sophomore ○ Junior ○ Senior
3. Internship/Work Experience: ○ No ○ Yes, including summer/winter internships or corporate training
4. Digital Tools Experienced (Multiple Choice): □ Advanced Excel functions □ Cloud Accounting Platforms, e.g., Kingdee/Yonyou Cloud □ RPA Financial Robots□ Python/SQL □ BI Tools, e.g., Tableau/PowerBI) □ Others: _____

Part III: Measurement Scales

Please rate based on your actual experience:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Digital Accounting Tools Utilization (Al-Hattami, 2025; Haleem et al., 2022)

DAT1: I frequently use digital accounting tools (e.g., cloud accounting software, financial big data platforms) in my daily professional studies.

DAT2: I rely heavily on these digital tools to complete my accounting assignments, training tasks, or analysis reports.

DAT3: I prefer using digital tools over manual processing to solve complex financial problems.

DAT4: I regularly use cloud-based platforms (or online resources) provided by the university to access and process financial data.

Creative Self-Efficacy (Karwowski et al., 2018; Tierney & Farmer, 2002)

CSE1: I feel that I am good at generating novel ideas in my accounting studies.

CSE2: I have confidence in my ability to solve problems creatively when facing complex financial cases.

CSE3: I believe I have the ability to propose improvements to traditional accounting processes.

CSE4: I am confident that I can find new solutions even when confronted with accounting problems I have never seen before.

Digital Literacy (Avinç & Doğan, 2024; Ng, 2012)

DL1: I am proficient in operating various digital learning platforms and accounting software.

DL2: When I encounter technical difficulties, I know how to quickly find solutions through online searches.

DL3: I am able to use digital technologies (e.g., mobile apps, computer software, AI tools) to enhance my learning efficiency.

DL4: I understand how to protect data security and personal privacy when using digital tools.

Innovative Behavior (Lukes & Stephan, 2017; Scott & Bruce, 1994)

INNO1: I often search for new methods or technologies to complete tasks during my studies or training.

INNO2: When I have a new idea for accounting analysis, I actively work to verify its feasibility.

INNO3: I actively share useful new tools or techniques I have discovered with my classmates or teachers.

INNO4: I do not just dream; I implement my innovative ideas into specific assignments or projects.