

Investigating The Role of Entrepreneurship Education on The Technopreneurship Intention of Generation Z Vocational Students: Why Do Digital Business Literacy and Digital Financial Literacy Matter?

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Abstract

Entrepreneurship plays a central role in the economy as a driver of innovation, economic growth, and job creation. Therefore, entrepreneurship education at various levels, including in vocational schools and colleges, is very important to empower the younger generation, especially Generation Z, to have the competencies and entrepreneurial spirit that are relevant to the digital era. This study aims to explore the role of digital business literacy and digital financial literacy as moderating variables in the relationship between entrepreneurship education and technopreneurship intentions among Generation Z students at the vocational level. The approach used is quantitative with the Partial Least Squares Structural Equation Modeling (PLS-SEM) method on 657 respondents obtained through accidental sampling techniques. The test results show that all hypotheses proposed in the research model are significantly accepted ($p < 0.05$), including the direct effect of entrepreneurship education on technopreneurship intentions and the positive moderating role of digital business literacy and digital financial literacy. These findings provide theoretical contributions to the development of a digital entrepreneurial intention model, as well as practical contributions in designing entrepreneurship policy interventions and curricula that are more adaptive to the needs of Generation Z students at the vocational level in the digital era.

1. Introduction

Entrepreneurship plays a strategic role in driving economic growth, innovation, and job creation (Danladi et al., 2023; Abrahams et al., 2023; Huang et al., 2023). In the context of a digitalized world, the role of entrepreneurship is increasingly expanding into the technology sector through what is known as technopreneurship, which is an entrepreneurial activity based on the use of technology to create economic added value (Santos et al., 2019;

Soomro & Shah, 2021). Increasing the intention of technopreneurship among the younger generation is a major concern, especially in developing countries, as part of efforts to reduce unemployment rates and create economic independence (Soomro & Shah, 2021; Odeyemi et al., 2024).

One of the most potential groups to be developed as technopreneurs is Generation Z, a generation that has grown up in a digital and technological ecosystem since an early age (Twenge et al., 2020). In Indonesia, Generation Z is a strategic target in vocational education entrepreneurship programs because they have a practical background that supports the implementation of technology-based business ideas. For this reason, entrepreneurship education is not only aimed at fostering general interest in entrepreneurship but is also directed at encouraging technopreneurship intentions, namely the desire to establish and manage a technology-based business (Nikraftar et al., 2022; Pan & Lu, 2022; Hasan et al., 2024).

Various previous studies have proven the positive influence of entrepreneurship education on entrepreneurial intentions, including technopreneurship intentions (Santos & Liguori, 2020; Struckell et al., 2022). However, most of these studies only highlight the direct influence without elaborating on the psychological and cognitive mechanisms that bridge the relationship. Previous studies also tend to ignore the dynamics of the vocational education context and the development of digital literacy, which are essential in driving the success of technopreneurship, especially in the Generation Z population.

In this context, a relevant and critical research gap has emerged, namely that there are not many studies that examine how digital business literacy and digital financial literacy simultaneously act as mediators in the relationship between entrepreneurship education and technopreneurship intentions, especially among Generation Z students at the vocational level. Several studies have touched on the role of each digital literacy separately, but the combined influence of the two as dual mediation has not been explored in depth (Fathonah et al., 2020; Maziriri et al., 2024). In fact, in practice, the ability to understand the digital business landscape and manage digital finance simultaneously is a crucial competency that shapes Generation Z's readiness to face the challenges of technopreneurship.

Based on these gaps, the research questions (RQ) proposed in this study are (RQ1) how does entrepreneurship education affect technopreneurship intentions? (RQ2) How does digital business literacy mediate the relationship between entrepreneurship education and technopreneurship intentions? (RQ3) How does digital financial literacy mediate the relationship between entrepreneurship education and technopreneurship intentions? And (RQ4) what is the dual mediation role of digital business literacy and digital financial literacy in bridging the influence of entrepreneurship education on technopreneurship intentions?

Therefore, this study aims to analyze the influence of entrepreneurship education on technopreneurship intentions among Generation Z students at the vocational level by exploring the mediation role of digital business literacy and digital financial literacy simultaneously. This study uses a quantitative approach with the Partial Least Squares Structural Equation Modeling (PLS-SEM) method, which is able to test structural models with complex mediation paths. The findings of this study are expected to provide theoretical contributions in the development of a digital literacy-based technopreneurship intention model, as well as offer practical recommendations in designing a digital entrepreneurship curriculum that is more contextual and responsive to the characteristics of the younger generation in the era of digital economic transformation.

This article consists of six sections that provide a comprehensive understanding of each section and subsection contained in this article. The first section describes the background, novelty, and urgency of this research. The second section describes the theoretical perspective, including a description of several previous research studies or findings that serve as the theoretical basis and conceptual framework for the development of the research hypothesis. The third section discusses the research methodology and provides a description of the research method that can provide support for further researchers to reproduce the experiments contained in this article. The fourth section contains a description of the research findings that come from the results of data processing and interpretation. Furthermore, the fifth section is a discussion of the research findings, which is divided into seven subsections that present a discussion of the main findings of the research specifically. The last section is a conclusion that provides an interpretation of the findings at a higher level of abstraction that is related to the objectives stated in the first section. Furthermore, the conclusion also explains the theoretical and practical implications of the research findings.

2. Literature Review

2.1 Theoretical Background: Social Cognitive Theory Approach

The Social Cognitive Theory by Bandura (2001) provides a relevant framework to explain how entrepreneurship education influences Generation Z's technopreneurship intentions. This theory highlights the dynamic interaction between personal factors, social environment, and behavior, with self-efficacy as a core concept—defined as one's belief in the ability to perform actions to achieve goals (Nwosu et al., 2022; Ho et al., 2025). In entrepreneurship education, learning experiences such as hands-on practice, business simulations, and technology projects shape

students' entrepreneurial self-efficacy (Vankov & Wang, 2024; Ghouse et al., 2024). Strong self-efficacy fosters confidence to realize technology-based business ideas (Chen & Tu, 2021), while weak self-efficacy limits risk-taking and proactive behavior (Xin & Ma, 2023). Observational learning also plays a key role, as exposure to successful technopreneurs via social media, digital platforms, and startup ecosystems strengthens students' entrepreneurial intentions (Schunk & DiBenedetto, 2023; Yeh et al., 2021; Ulfert-Blank & Schmidt, 2022).

In this context, digital business literacy and digital financial literacy reinforce the cognitive dimension and technical competence of Generation Z vocational students. Mastery of digital information in business and finance enhances their self-efficacy in the digital domain and mediates the effect of entrepreneurship education on technopreneurship intention. Thus, digital literacy is not only a practical tool but also a factor shaping self-perception and readiness for technology-based ventures. From the perspective of Social Cognitive Theory, technopreneurship intentions are shaped not only by entrepreneurship education as an external factor but also by internal factors such as self-efficacy and digital competence, which develop through experiential learning and a supportive digital environment.

2.2 Entrepreneurship Education

Entrepreneurship education is a process of acquiring knowledge, skills, and understanding of entrepreneurship (Boyd, 2017; Hejazinia, 2018), while also fostering creativity and innovation as a foundation for seeking opportunities and achieving success (Tomy & Pardede, 2020). It contributes to innovation, economic growth, and community development (Apostu et al., 2019), and equips individuals with the ability to start and manage businesses (Hassan et al., 2020; Kucel & Vilalta-Bufi, 2021). Fan et al. (2024) found that entrepreneurship programs can enhance digital business literacy, although some studies (Wijayanto et al., 2023; Suherman & Yusuf, 2021) noted no significant impact on creativity. Even if the effect is not always direct, entrepreneurship education provides a critical foundation for understanding business concepts that support digital literacy (Rizqi et al., 2022; Bannier & Schwarz, 2018), with its effectiveness influenced by educational context, teaching methods, and individual comprehension (Sariwulan et al., 2020).

Furthermore, entrepreneurship education strengthens understanding of fundamental business concepts such as marketing, market orientation, promotion, and market analysis (Fiandra et al., 2023), while highlighting the use of digital technology to increase efficiency, market reach, and resource management. It also enhances digital financial literacy (Kang et al., 2024; Suparno & Saptono, 2018) by equipping individuals with the skills to make sound economic decisions (Bécharde & Grégoire, 2020). This literacy involves knowledge of online financial products and services, safe digital transactions, and managing finances with technology (Uthaileang & Kiattisin, 2023; Amnas et al., 2024; Lusardi, 2019; Kumar et al., 2023; Hasan et al., 2025). Medina-Vidal et al. (2023) confirmed that entrepreneurship education forms a solid foundation for digital financial literacy, thus exerting a positive and significant influence on both digital business and financial literacy among Generation Z vocational students. Based on this, the following hypothesis is proposed:

H1: Entrepreneurship education has a positive and significant influence on digital business literacy in Generation Z vocational students.

H2: Entrepreneurship education has a positive and significant influence on digital financial literacy in Generation Z vocational students.

2.3 Digital Business Literacy

Digital business literacy refers to an individual's ability to understand, use, and apply digital technology in business contexts (Liu et al., 2020; Wardana et al., 2023), playing a vital role in facing digital-era challenges, improving education quality, and expanding economic opportunities (Sutrisno et al., 2022). Mastery of this literacy enhances effectiveness in accessing information, communication, and participation in digital-based economic activities, and it significantly influences technopreneurship intention, which reflects the desire to merge technology and entrepreneurship for innovation and new business creation (Raharjo et al., 2024; Wijayanto et al., 2023; Adu et al., 2020). It helps individuals apply digital tools in operations, marketing, and business strategies (Lindh & Rovira Nordman, 2019), while fostering creativity and innovative solutions for leveraging opportunities in the digital era (Techataweewan & Prasertsin, 2018). Consequently, digital business literacy becomes a key driver in motivating individuals to become technopreneurs—entrepreneurs who develop and implement technology in their ventures (Mugiono et al., 2021)—and equips them to run innovative, sustainable, technology-based businesses (Alakrash & Abdul Razak, 2021). Thus, the following hypothesis is proposed:

H3: Digital business literacy has a positive and significant influence on technopreneurship intention in Generation Z vocational students.

2.4 Digital Financial Literacy

Digital financial literacy is an individual's ability to understand, use, and manage financial information effectively in the context of digital technology (Buenestado-Fernández et al., 2023). According to Frimpong et al. (2022), digital financial literacy has a significant impact on the intention to become an entrepreneur in the field of technopreneurship. In the ever-evolving digital era, the ability to understand and use technology in managing finances is a very important skill for aspiring entrepreneurs (Singhry & Bogoro, 2019). Digital financial literacy allows individuals to understand financial concepts more deeply, manage assets efficiently, and make smart investment decisions in the context of technology (Luo et al., 2021). Uthaileang and Kiattisin (2023) found that with a good understanding of digital financial literacy, a person can be more prepared and confident to become a technopreneur because they are able to optimize the use of technology in the financial aspects of their business. Therefore, the development of digital financial literacy can be a key factor in increasing the intention and success of entrepreneurship in the technopreneurship era. Based on this, the following hypothesis is proposed:

H4: Digital financial literacy has a positive and significant influence on technopreneurship intention in Generation Z vocational students.

2.5 Technopreneurship Intention

Technopreneurship intention describes an individual's willingness to engage in technology-based entrepreneurship by combining innovation and value creation through digital ventures (Maziriri et al., 2024). It reflects the readiness to establish and develop technology-driven businesses as agents of change in the industry (Maziriri et al., 2024). Entrepreneurship education has been found to positively influence technopreneurship intention by improving digital business literacy (Mugiono et al., 2021), while also equipping students with knowledge of innovation, business strategy, and management (Hejazinia, 2018; Fayolle & Gailly, 2019), as well as digital competencies such as e-commerce, digital marketing, and online business management. These elements prepare students to initiate innovative technopreneurship ventures in the digital era.

Digital business literacy has also been identified as a mediator in the relationship between entrepreneurship education and technopreneurship intention. Studies show that entrepreneurship education provides the skills and knowledge required for technology-based ventures while strengthening the digital competencies needed to address the challenges of the digital economy (Mulyono et al., 2023; Maziriri et al., 2024; Cui & Bell, 2022). Prior research emphasizes that digital business literacy acts as a bridge that connects entrepreneurship education with students' technopreneurship intentions (Kateryna et al., 2020; Wardana et al., 2023), highlighting its critical role in fostering entrepreneurial interest in the digital era (Sulistiyowati et al., 2022).

In addition, entrepreneurship education that incorporates digital financial literacy enhances the ability to manage financial aspects of technopreneurship. This includes knowledge of financial management in digital contexts (Kiliyanni & Sivaraman, 2016), understanding of technology-based financial applications (Bottazzi & Lusardi, 2020; Ben Belgacem et al., 2024), and skills in asset management, investment decisions, and financial optimization (Singhry & Bogoro, 2019). Research shows that digital financial literacy mediates the link between entrepreneurship education and technopreneurship intention (Wibowo et al., 2023; Sharma, 2020), reinforcing how financial knowledge integrated with technology prepares students for technopreneurship (Abad-Segura & González-Zamar, 2019; Suri & Jindal, 2022). By mastering digital financial literacy, students can transform entrepreneurial knowledge into technology-oriented business goals (Kehinde, 2023). Thus, the following hypothesis is proposed:

H5: Entrepreneurship education has a positive and significant effect on technopreneurship intention in Generation Z students.

H6: Entrepreneurship education has a positive and significant effect on technopreneurship intention in Generation Z vocational students through digital business literacy.

H7: Entrepreneurship education has a positive and significant effect on technopreneurship intention in Generation Z vocational students through digital financial literacy.

Based on Bandura's social cognitive theory and supported by previous empirical findings, this study develops a conceptual framework that explains the relationship between several variables. Entrepreneurship education (X) is an independent variable that is considered capable of influencing technopreneurship intentions through increasing knowledge, self-efficacy, and entrepreneurial skills. Technopreneurship intentions (Y) are dependent variables that represent Generation Z's interest in engaging in technology-based entrepreneurial activities. Digital business literacy (M1) and digital financial literacy (M2) act as mediating variables, which bridge the influence of entrepreneurship education on technopreneurship intentions. Visually, this conceptual framework is depicted as in figure 1 below.

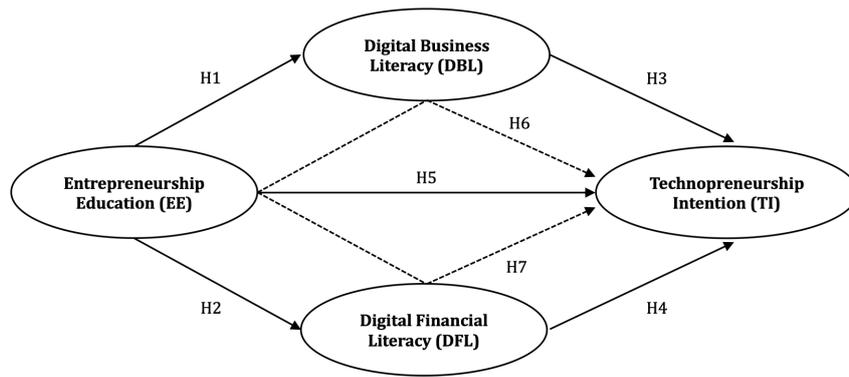


Fig. 1 Conceptual framework

3. Method

3.1 Data Collection and Samples

This study employed a quantitative approach with entrepreneurship education as the independent variable (X), technopreneurship intention as the dependent variable (Y), and digital business literacy (Z1) and digital financial literacy (Z2) as mediators. The population consisted of Generation Z in Makassar City, South Sulawesi (398,624 people), with a minimum required sample of 156. Using non-probability convenience sampling, the criteria included being born between 1997–2012 and having taken or currently taking formal entrepreneurship education. Data were collected from May to July 2024 via an online questionnaire distributed to 860 vocational students, with 657 valid responses. The instrument contained 50 items across respondent profiles and research variables, measured on a five-point Likert scale from “strongly disagree” (1) to “strongly agree” (5).

Prior to data collection, the instrument underwent content validity testing through expert judgment by three specialists in digital entrepreneurship and vocational education. Minor revisions were made to improve clarity and terminology, and the instrument was deemed valid. Ethical approval was obtained from the Research Ethics Committee of Universitas Negeri Makassar, with procedures adhering to standards for adolescent populations. Informed consent was secured from all participants, with additional parental/guardian consent for minors. Participation was voluntary, nondiscriminatory, and without coercion or incentives. Confidentiality and data protection were ensured, and the study followed the Declaration of Helsinki to safeguard participants’ rights, dignity, and well-being.

3.2 Statistical Tools and Methods

This study applied Structural Equation Modeling–Partial Least Squares (SEM–PLS) using SmartPLS 4.0, chosen for its suitability in handling complex models with multiple constructs and indicators without requiring data normality. The analysis consisted of two stages: the measurement model (outer model) to test validity and reliability, and the structural model (inner model) to examine relationships among latent variables. PLS–SEM was considered appropriate because the study is exploratory, involves dual mediation, tolerates moderate sample sizes, and allows efficient testing of complex models with several constructs and mediation paths. With 657 respondents, PLS–SEM ensured stable parameter estimates, supported by its robustness even for samples as small as 10 times the number of construct paths (Hair et al., 2017). Bootstrapping with 5000 resamples was employed to test the significance of mediation effects, with criteria of $t \geq 1.96$ and $p < 0.05$.

The model included four constructs: entrepreneurship education (AEE), measured by methods of learning, materials, teaching objectives, and awareness of business opportunities (Hasan et al., 2024); technopreneurship intention (BTI), measured by desire, perceived necessity, personal plans, and readiness to start a business (Handaru et al., 2015); digital business literacy (CDBL), measured by general knowledge, digital marketing strategies, and business development (Hasan et al., 2024); and digital financial literacy (DDFL), measured by knowledge of digital finance, understanding of risks, advanced insurance knowledge, and digital savings and loan systems (Ravikumar et al., 2022). This methodological framework allowed the study to capture direct, indirect, and total effects of entrepreneurship education on technopreneurship intention, while clarifying the mediating role of digital literacy.

4. Results

4.1 Descriptive Statistics

Table 1 provides information on the demographic characteristics of the respondents. In the table, it can be seen that the participants of this survey are vocational students of Generation Z who are in Makassar City, South Sulawesi, Indonesia and are in the age range of 11-26 years and are dominated by female students. The highest percentage of age is 19-22 years which reaches 53.2%, while the lowest is at the age of 11-18 years at 23%. In addition, the participants also come from different sub-districts.

Table 1 Demographic profile of respondents

No.	Aspect	Frequency	Percentage (%)
1	Gender:		
	Male	227	34.6
	Female	430	65.4
2	Age:		
	11-18 years	151	23
	19-22 years	350	53.2
	23-26 years	156	23.7
3	Subdistrict:		
	Mariso	68	10.3
	Mamajang	42	6.4
	Tamalate	63	9.6
	Rappocini	47	7.1
	Makassar	38	5.8
	Ujung Pandang	38	5.8
	Wajo	30	4.5
	Bontoala	63	9.6
	Kep. Sangkarang	21	3.2
	Tallo	63	9.6
	Panakkukang	51	7.7
	Manggala	42	6.4
	Biringkanaya	33	5.1
	Tamalanrea	33	5.1
Ujung Tanah	25	3.8	

4.2 Assessment Model Results

The outer assessment model in this study was evaluated using four indicators: convergent validity, discriminant validity, composite reliability, and construct reliability (see Table 2). The statistical results showed that all variables—entrepreneurship education (AEE), technopreneurship intention (BTI), digital business literacy (CDBL), and digital financial literacy (DDFL)—achieved factor loadings between 0.896 and 0.958, exceeding the threshold of 0.70, thereby meeting convergent validity criteria (Hair & Sarstedt, 2019). Table 2 further indicates that all AVE values were above 0.50, confirming discriminant validity. Reliability testing using Cronbach's alpha and composite reliability (CR) also demonstrated strong results, with composite reliability coefficients ranging from 0.950 to 0.969 and Cronbach's alpha values of 0.937 (AEE), 0.929 (BTI), 0.958 (CDBL), and 0.955 (DDFL), all exceeding 0.70 (Hair & Sarstedt, 2019). These findings confirm that the measurement model meets the required validity and reliability standards (see Table 2 and Figure 2).

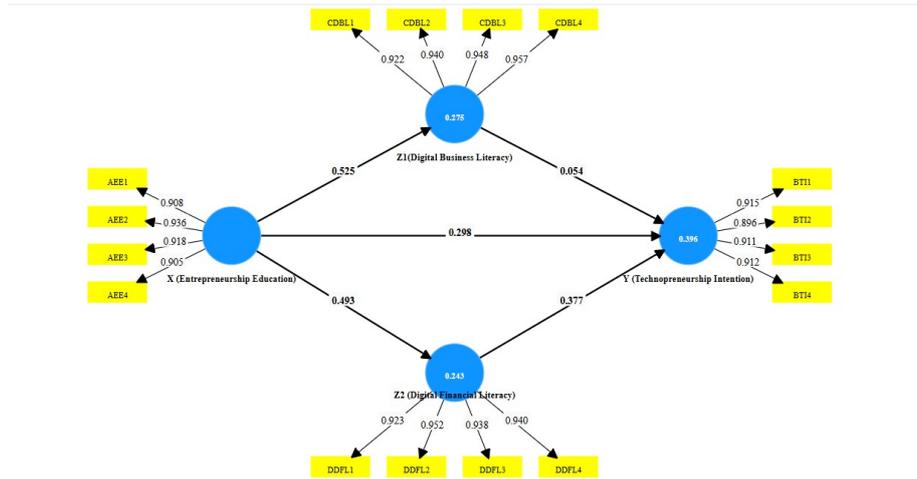


Fig. 2 Measurement model test results

Table 2 Measurement (outer) model calculation

Variable	Item	Loading	α (≥ 0.7)	CR (≥ 0.7)	AVE (≥ 0.5)
Entrepreneurship Education (AEE)	AEE1	0.908	0.937	0.955	0.840
	AEE2	0.936			
	AEE3	0.918			
	AEE4	0.905			
Technopreneurship Intention (BTI)	BTI1	0.915	0.929	0.950	0.825
	BTI2	0.896			
	BTI3	0.911			
	BTI4	0.912			
Digital Business Literacy (CDBL)	CDBL1	0.922	0.958	0.969	0.887
	CDBL2	0.940			
	CDBL3	0.948			
	CDBL4	0.957			
Digital Financial Literacy (DDFL)	DDFL1	0.923	0.955	0.967	0.881
	DDFL2	0.952			
	DDFL3	0.938			
	DDFL4	0.940			

In addition, the convergent validity in table 3 shows that the loading values of AEE, BTI, CDBL, and DDFL are higher than 0.70, which implies that these variables achieve convergent validity (Hair & Sarstedt, 2019). Table 3 shows the cross-loading results for the three variables: entrepreneurship education, digital business literacy, and digital financial literacy, which are greater than 0.70, which illustrates that these variables meet the requirements for convergent validity (Hair & Sarstedt, 2019).

Table 3 Discriminant validity

Variable	AEE	BTI	CDBL	DDFL
Entrepreneurship Education (AEE)	0.817			
Technopreneurship Intention (BTI)	0.513	0.808		
Digital Business Literacy (CDBL)	0.524	0.531	0.842	
Digital Financial Literacy (DDFL)	0.491	0.564	0.852	0.869

4.3 R-Square Test

The R square test is intended to make corrections from predictions with standards of 0.67 (strong), 0.33 (moderate), and 0.19 (weak) (Hair & Sarstedt, 2019). The calculation of the R-square test shows that BTI has a

value of 0.393, which means that 39.3% of the technopreneurship intention variable is influenced by entrepreneurship education. In addition, the R-square value of CDBL is moderately indicated by AEE, with a value of 0.275. Finally, the DDFL variable is substantially indicated by AEE with a percentage of 72.9%.

4.4 F-Square Test

In this study, the size effect (f^2) test was determined by several criteria: small (0.02), medium (0.15), and large (0.35). The calculation shows that the f^2 value of AEE against BTI is 0.301, which implies that it has a moderate effect. The f^2 value of AEE against CDBL is 0.524, which indicates a large effect. The f^2 value of AEE against DDFL is 0.061, which indicates a small effect. In addition, the f^2 value of CDBL against BTI is 0.068, which indicates a small effect. The f^2 value of DDFL against BTI is 0.358, which indicates a large effect. Finally, the value of CDBL against DDFL is 0.820, which indicates a large effect.

4.5 Hypothesis Testing

The structural model analysis using PLS-SEM confirmed that all seven proposed hypotheses were statistically significant, with p-values below 0.05 and t-statistics above 1.96, indicating that each relationship in the model was accepted. Entrepreneurship education (AEE) significantly influenced digital business literacy (H1) and digital financial literacy (H2), while both digital business literacy (H3) and digital financial literacy (H4) positively and significantly affected technopreneurship intention (BTI). In addition, entrepreneurship education directly affected technopreneurship intention (H5). The mediation test further revealed that digital business literacy (H6) and digital financial literacy (H7) significantly mediated the relationship between entrepreneurship education and technopreneurship intention. Thus, all hypotheses (H1–H7) were supported, and the detailed summary of hypothesis testing results is presented in Table 4.

Table 4 Hypothesis test results

	Hypothesis	Standar Deviation	T statistic	P values	Information
H1	AEE → CDBL	0.071	7.409	0.000	Sig.
H2	AEE → DDFL	0.073	5.887	0.000	Sig.
H3	CDBL → BTI	0.117	2.508	0.012	Sig.
H4	DDFL → BTI	0.131	2.729	0.006	Sig.
H5	AEE → BTI	0.073	5.887	0.000	Sig.
H6	AEE → CDBL → BTI	0.069	2.225	0.026	Sig.
H7	AEE → DDFL → BTI	0.089	1.933	0.039	Sig.

4.6 Testing the Mediation Effect

The mediation effect in this study was analyzed using the nonparametric bootstrapping method in the PLS-SEM approach. This technique involves resampling the original data randomly (resampling) 5000 times to produce an empirical distribution of the estimated values of the indirect effects. The significance test was carried out by looking at the t-statistic and p-value. The mediation effect is declared significant if the t-statistic value ≥ 1.96 and the p-value < 0.05 . This method is considered the most appropriate in PLS-SEM because it does not rely on the assumption of a normal distribution and is able to test mediation effects directly or complexly.

The test results show that digital business literacy (CDBL) and digital financial literacy (DDFL) act as significant mediators in the relationship between entrepreneurship education (AEE) and technopreneurship intention (BTI). On the AEE → CDBL → BTI path (Hypothesis H6), a t-statistic value of 2.225 was obtained with a p-value of 0.026, indicating that digital business literacy significantly mediates the effect of entrepreneurship education on technopreneurship intention. This means that the higher the digital business literacy of Generation Z supported by entrepreneurship education, the stronger their intention to run a technology-based business. Meanwhile, on the AEE → DDFL → BTI path (Hypothesis H7), the mediation effect was also found to be significant with a t-statistic of 1.933 and a p-value of 0.039. This shows that digital financial literacy has a mediating role in strengthening the influence of entrepreneurship education on Generation Z's technopreneurship interest.

5. Discussion

This section discusses the main findings of the study in the context of the underlying theory and previous empirical results. The main purpose of this discussion is to interpret the meaning of the relationships found between entrepreneurship education, digital business literacy, digital financial literacy, and technopreneurship intention among Generation Z students at the vocational level. The results show that entrepreneurship education has a direct and indirect influence on technopreneurship intention through strengthening digital business literacy and

digital financial literacy. This suggests that in the digital era, the success of entrepreneurship programs among students depends not only on the content of entrepreneurship learning itself but also on its integration with digital literacy skills that are relevant to the modern business and financial context. Therefore, this discussion will link the results of the study with Bandura's Social Cognitive Theory framework and previous literature.

5.1.1 The Influence of Entrepreneurship Education on Digital Business Literacy of Generation Z Vocational Students

Digital business literacy plays a crucial role in preparing individuals and organizations to face challenges and opportunities in today's digital era (Sari et al., 2023). The ability to understand, use, and integrate digital technology in a business context is key to improving operational efficiency, optimizing marketing strategies, and creating product innovations that are relevant to the market. Through digital business literacy, individuals can develop the ability to adapt to technological changes, utilize data and analytics for better decision-making, and identify new business opportunities that arise from technological developments. According to research by Wardana et al. (2023), digital business literacy is an important foundation for utilizing the potential of digital technology to achieve sustainable business success. Therefore, to support becoming an entrepreneur, it is very important for Generation Z to have digital business literacy.

The results of the first hypothesis test show that there is an influence between entrepreneurship education and digital business literacy among vocational students in Generation Z. Through entrepreneurship education, a person's ability to understand, interpret, evaluate, and use various forms of information in various contexts is enhanced through formal or informal processes that aim to transfer knowledge, skills, values, and norms to individuals so that they can develop optimally (Del Vecchio et al., 2021). In this case, entrepreneurship education plays an important role in improving a person's literacy skills. Li et al. (2020) stated that entrepreneurship education has a very important impact on helping Generation Z students improve their digital business literacy because Generation Z is a generation that grew up in the digital technology era. Entrepreneurship education provides Generation Z with the opportunity to develop the skills and knowledge needed to succeed in an increasingly digitally connected business world. Generation Z tends to have a better understanding of using digital technology and social media, so digital entrepreneurship education can help them utilize these skills to create new business opportunities, expand market reach, and increase creativity in entrepreneurship (Sitaridis & Kitsios, 2024). With good digital entrepreneurship education, Generation Z can become innovative and adaptive entrepreneurs, facing rapid changes in the digital era.

5.1.2 The Influence of Entrepreneurship Education on Digital Financial Literacy of Generation Z Vocational Students

Digital financial literacy plays an important role in preparing Generation Z to face financial challenges in an increasingly complex and connected world (Uthaileang & Kiattisin, 2023). According to Lyons and Kass-Hanna (2021), with a good understanding of digital financial literacy, Generation Z can make smarter financial decisions, manage debt, and plan their financial future better digitally. Knowledge of personal financial management, investment, and the use of digital financial products will help them avoid debt traps and take advantage of existing investment opportunities. In addition, digital financial literacy can also increase Generation Z's confidence in making important financial decisions, which in turn can contribute to their financial stability in the future (Rahayu et al., 2022).

Digital financial literacy has a significant impact on entrepreneurship, especially in helping small business owners and aspiring entrepreneurs manage their finances more effectively (Buenestado-Fernández et al., 2023). With a good understanding of digital financial literacy, entrepreneurs can access and utilize various available digital financial tools and platforms, such as banking applications, online payment systems, and digital lending services. This allows them to do better financial planning, manage cash flow, and make smarter investment decisions. According to Setiawan et al. (2022), digital financial literacy not only improves entrepreneurs' ability to manage financial resources but also encourages innovation and business growth by facilitating access to the information and services needed to develop their businesses.

The second hypothesis shows that there is an influence between entrepreneurship education and digital financial literacy among vocational students in Generation Z. Medina-Vidal et al. (2023) found that entrepreneurship education has a significant influence on financial literacy, especially among the younger generation. According to Yousaf et al. (2021), entrepreneurship education can increase individuals' awareness and knowledge of financial management, which in turn helps them make better financial decisions. In addition, Grohmann et al. (2018) showed that better digital financial literacy is correlated with higher financial inclusion, where individuals who are educated in entrepreneurship tend to have a better understanding of financial products and risks. Thus, entrepreneurship education not only equips individuals with business skills but also improves their ability to manage personal finances, which is essential for achieving financial well-being.

5.1.3 The Influence of Digital Business Literacy on The Technopreneurship Intention of Generation Z Vocational Students

Digital business literacy plays an important role in improving the employability of Generation Z students. According to Mulyono et al. (2023), digital business literacy not only includes technical skills in using technology but also the ability to understand and analyze information in the digital world. Digital business literacy has an impact on technopreneurship intention through the formation of the employability of Generation Z graduates. According to research findings by Yousaf et al. (2021), digital business literacy has an impact on technopreneurship intention and can encourage individuals to develop innovative ideas by utilizing technology in creating relevant business solutions. This shows that digital business literacy has a significant role in shaping technopreneurship intentions, especially in facing business demands in the digital era.

The third hypothesis shows that there is an influence between digital business literacy and the technopreneurship intentions of vocational students in Generation Z. Research by Wijayanto et al., (2023) shows that digital literacy provides a strong foundation for individuals to understand and utilize technology in the context of entrepreneurship. The research findings of Mugiono et al. (2021), show that the ability to use digital tools and online platforms not only improves technical skills but also broadens Generation Z's horizons about business opportunities in the digital world. With good digital business literacy, Generation Z can be more confident in developing technopreneurial ideas as well as being able to identify and utilize technology trends to create innovative solutions (Techataweewan & Prasertsin, 2018). This shows that digital business literacy serves as a major driver in shaping technopreneurship intentions, which in turn can increase their participation in the technology-based entrepreneurial ecosystem.

5.1.4 The Influence of Digital Financial Literacy on Technopreneurship Intentions of Generation Z Vocational Students

Azeez and Akhtar (2021) found that to become a successful entrepreneur, strengthening digital financial literacy is very important because weak literacy can be fatal to business sustainability. Therefore, good basic knowledge of digital financial literacy is very necessary among entrepreneurs. By having a strong understanding of digital financial literacy, entrepreneurs can take advantage of the various financial tools and platforms available to optimize their business operations, reduce costs, and increase efficiency (Respati et al., 2023).

The fourth hypothesis shows the influence of digital financial literacy on the technopreneurship intentions of vocational students in Generation Z. Based on the results of research conducted by Frimpong et al. (2022), it appears that digital financial literacy plays an important role in technopreneurship intention because it provides individuals with the understanding and skills needed to manage the financial aspects of technology-based businesses. With a good understanding of digital financial literacy, Generation Z can access and utilize various financial tools and platforms available online, such as banking applications, digital payment systems, and investment services (Liew et al., 2020). Generation Z, who have strong digital financial literacy, tend to be more motivated to engage in technopreneurship, create solutions that are relevant to market needs, and contribute to the increasingly rapid development of the digital economy.

5.1.5 The Influence of Entrepreneurship Education on The Technopreneurship Intention of Generation Z Vocational Students

Entrepreneurship education plays a key role in shaping the technopreneurship intentions of Generation Z. Generation Z, known as the digital generation, has wide access to technology and information, so entrepreneurship education can provide them with the skills and knowledge needed to innovate and become entrepreneurs in the digital era. Research by Fan and Wang (2024) shows that entrepreneurship education significantly influences technopreneurship intention among Generation Z students, who are increasingly encouraged to explore opportunities in the world of technology-based entrepreneurship.

The fifth hypothesis shows that there is an influence between entrepreneurship education and the technopreneurship intentions of vocational students in Generation Z. The findings of Soomro and Shah (2021) state that entrepreneurship education can have a positive influence on individual technopreneurship intentions. Through entrepreneurship education programs, individuals can gain the knowledge and skills needed to become successful entrepreneurs, including an understanding of innovation, business strategy, and management in the context of digital entrepreneurship (Hejazinia, 2018; Fayolle & Gailly, 2019). In addition, the findings of Mugiono et al. (2021) also state that entrepreneurship education can provide a strong foundation for the development of individual technopreneurship intentions, which include an understanding of technology, e-commerce, digital marketing, and online business management. Thus, through entrepreneurship education, individuals can gain the motivation and skills needed to start an innovative and successful technology-based business in today's digital era.

5.1.6 The Role of Digital Business Literacy in Mediating The Relationship Between Entrepreneurship Education and Technopreneurship Intention in Generation Z Vocational Students

The findings of this study indicate that digital business literacy plays a significant mediating role in the relationship between entrepreneurship education and technopreneurship intentions among Generation Z students at the vocational level. In the context of education, entrepreneurship materials serve not only to convey conventional business concepts but also to equip students with adaptive skills that are relevant to today's digital business dynamics. One of these important skills is digital business literacy, which includes an understanding of digital marketing strategies, the use of technology platforms in business, and the development of digital information-based businesses.

This phenomenon is in line with Social Cognitive Theory (Bandura, 1986), which emphasizes that human behavior, including entrepreneurial intention, is the result of reciprocal interactions between personal factors (cognitive and affective factors), environmental factors (social/learning context), and the behavior itself. Entrepreneurship education acts as an environmental factor that provides stimulus and learning experiences, while digital business literacy represents students' internal cognitive capabilities formed through the learning process.

With increasing digital business literacy, Generation Z students at the vocational level have higher digital self-efficacy, namely the belief in their ability to utilize technology to run a business. This self-efficacy is a central component in social cognitive theory, which is believed to contribute strongly to the emergence of entrepreneurial intentions and actions. In other words, digital business literacy acts as a cognitive mechanism that bridges learning experiences (entrepreneurship education) and behavioral intentions (intentions to become technopreneurs).

The results of the sixth hypothesis test (H6) strengthen this framework, where the influence of entrepreneurship education on technopreneurship intentions is not only direct but also strengthened through indirect channels through increasing digital business literacy. This supports previous research such as that conducted by Wardana et al. (2023) and Mulyono et al. (2023) and is reinforced by Maziriri et al. (2024) and Cui and Bell (2022), which consistently place digital literacy as an important element in developing the readiness and confidence of the younger generation to become entrepreneurs in the digital era.

Furthermore, Kateryna et al. (2020) also emphasize that the transformation of entrepreneurial intentions towards technopreneurship requires a combination of contextual learning and well-internalized digital cognitive abilities. Within the framework of social cognitive theory, the interaction between the learning environment (entrepreneurship education) and personal factors (digital business literacy and digital self-efficacy) is the main determinant in shaping technopreneurship intentions as students' future behavior.

Thus, the results of this study provide an important theoretical contribution that the success of entrepreneurship education in encouraging technopreneurship intentions is greatly influenced by the formation of cognitive capabilities, one of which is through digital business literacy. Practically, these results emphasize that entrepreneurship curricula at various levels of vocational education must integrate digital learning strategically so that the formation of entrepreneurial intentions is not only conceptual but also supported by digital competencies that are applicable and adaptive to the challenges of the digital business world.

5.1.7 The Role of Digital Financial Literacy in Mediating The Relationship Between Entrepreneurship Education and Technopreneurship Intention in Generation Z Vocational Students

In addition to digital business literacy, the results of this study also show that digital financial literacy significantly mediates the relationship between entrepreneurship education and technopreneurship intentions in Generation Z students at the vocational level. This finding indicates that entrepreneurship education not only increases entrepreneurial interest directly but also builds students' cognitive abilities in understanding and managing digital finance, a very vital competency in running a technology-based business. Digital financial literacy in this context includes skills in using electronic financial instruments, managing technology-based financial risks, and planning business finances through digital platforms.

Within the framework of Social Cognitive Theory (Bandura, 1986), digital financial literacy can be understood as a personal-cognitive factor formed through a social learning process (observation, experience, and interaction). Entrepreneurship education acts as a learning environment (enabling environment) that provides real experiences, instructions, and simulations in managing the financial aspects of a business. Through these interactions, students build digital financial self-efficacy, namely the belief in their ability to make the right financial decisions in the context of technology-based businesses.

The results of the seventh hypothesis test (H7) confirm the AEE → DDFL → BTI path as a significant mediator, indicating that digital financial literacy is an important path that bridges the effect of entrepreneurship education on technopreneurship intentions. This literacy not only acts as a technical ability but also forms students' internal

self-confidence and psychological readiness in facing digital business challenges, two aspects that are highly emphasized in social cognitive theory. Bandura stated that self-efficacy is a strong predictor of behavioral intentions, and in this context, digital financial self-efficacy serves as a key driver of the emergence of intentions to start and manage a technology-based business (Bandura, 2001).

This finding is in line with previous studies. Kiliyanni and Sivaraman (2016) and Suri and Jindal (2022) emphasized that digital financial literacy strengthens the influence of entrepreneurship education on the intention to become a technology-based entrepreneur. Wibowo et al. (2023) also stated that this literacy is a crucial mediator in changing exposure to entrepreneurship education into technopreneurship readiness. Sharma (2020) highlighted the importance of integrating digital financial literacy into the curriculum, as it can increase financial resilience and adaptive response to the dynamics of digital finance.

Furthermore, Selladurai (2016), Abad-Segura and González-Zamar (2019), and Singhry and Bogoro (2019) showed that an in-depth understanding of digital financial management supports better decision-making in the context of technopreneurship. This confirms that digital financial literacy is not just an additional skill but a strategic component in students' cognitive systems that enables them to transform knowledge into entrepreneurial behavior.

Thus, in the perspective of Social Cognitive Theory, digital financial literacy becomes a link between the external learning environment (entrepreneurship education) and internal personal factors (beliefs, skills, self-efficacy), which together form technopreneurship intentions as behavioral outcomes. The practical implication of this finding is the need for the integration of digital financial literacy content into the entrepreneurship curriculum at various levels of vocational education systematically so that the formation of entrepreneurial intentions for Generation Z is not only ideational but also realized through strong managerial and financial readiness in facing the challenges of the digital economy.

Conclusion

This study aims to investigate the effect of entrepreneurship education on technopreneurship intention among Generation Z students at the vocational level, as well as the mediating role of digital business literacy and digital financial literacy. The main findings indicate that entrepreneurship education has a positive and significant effect on technopreneurship intention, both directly and indirectly through improving students' digital literacy competencies. In particular, digital business literacy and digital financial literacy are shown to play an important mediating role, bridging the process of transforming entrepreneurial knowledge into concrete intentions to start a technology-based business.

6.1 Theoretical Implications

This study provides a significant theoretical contribution to the development of a technology-based entrepreneurial intention model (technopreneurship) among Generation Z students at the vocational level. The finding that digital business literacy and digital financial literacy act as significant mediators in the relationship between entrepreneurship education and technopreneurship intention enriches the entrepreneurship literature by introducing digital cognitive mechanisms as a pathway to forming entrepreneurial intention in the era of digital transformation.

Specifically, this study extends the application of Social Cognitive Theory developed by Bandura (1986) by showing that personal factors, such as digital literacy capabilities, play an important role in bridging the relationship between the learning environment (entrepreneurship education) and behavior or intention (technopreneurship intention). Digital literacy in this study is not only seen as a technological tool but as a cognitive structure that shapes self-efficacy, decision-making, and individual perceptions of self-success in the technology-based business world.

This theoretical implication is important because it shows that digital self-efficacy and practical knowledge based on technology need to be considered as important variables in modifying or developing the entrepreneurial intention model, which has so far been dominated by general approaches, such as the Theory of Planned Behavior (Ajzen, 1991) or the Entrepreneurial Event Model (Shapero & Sokol, 1982), which have not explicitly integrated the digital competence dimension.

In addition, this finding opens up a new theoretical space that entrepreneurial intentions in the digital-native generation are not only formed from social norms and attitudes towards behavior but are greatly influenced by digital skills and beliefs that can be developed through the education process. This strengthens the position of social cognitive theory as an adaptive and relevant framework to explain the dynamics of entrepreneurial intentions and behavior in a modern context.

Thus, this study not only confirms the validity of social cognitive theory in the context of entrepreneurship education but also contributes new modeling of how technology-based competencies can be an integral component in explaining technopreneurship intentions. In the future, this theoretical approach can be used as a basis for developing a richer empirical framework for explaining digital entrepreneurial intentions and behavior across levels and educational contexts.

6.2 Practical Implications

The findings of this study provide important practical implications for various stakeholders in the field of education, especially in the formulation and implementation of entrepreneurship education policies at various levels of entrepreneurship education at the vocational level. First, the results of the study confirm that strengthening digital literacy, both in terms of business and finance, needs to be strategically integrated into the entrepreneurship curriculum at the vocational level. This means that entrepreneurship education is no longer sufficient to only teach basic entrepreneurship concepts but must develop into digital-based entrepreneurship education that is relevant to the needs of Generation Z, who were born and grew up in the era of technology.

Second, educators and education practitioners need to be provided with ongoing training that includes the use of digital platforms in business and financial contexts, such as e-commerce simulations, digital cash management, marketing through social media, and utilization of financial applications. Project-based learning experiences that combine digital practices with simple business models will help learners build digital self-efficacy, as emphasized in Bandura's Social Cognitive Theory as a prerequisite for the formation of intentions and actions.

Third, educational institutions should expand their collaboration with the business world, startups, and digital industry players to provide authentic entrepreneurial experiences, either in the form of internships, mentoring, or case studies. This collaboration will create a learning environment that allows for observational learning and vicarious experience, two main elements in shaping behavior according to Social Cognitive Theory.

Fourth, for the government and policymakers, the results of this study are the basis for designing contextual entrepreneurship education policies that are responsive to digital disruption. Support for the development of digital content in learning materials, the provision of technological infrastructure in schools, and incentives for the development of technopreneurship-based teaching innovations are crucial steps to create an adaptive and sustainable entrepreneurship education ecosystem.

Finally, from the perspective of students, the integration of digital literacy in entrepreneurship education will improve their readiness not only to become job seekers but also to become job creators through innovative digital businesses. This is in line with the vision of developing an inclusive, creative, and technology-based digital economy in Indonesia.

6.3 Limitations and Recommendations for Future Research

However, this study has several limitations that need to be considered. First, the sample size and sampling technique using accidental sampling can limit the generalizability of the findings. Second, although the study population was Generation Z students at the vocational level, the age structure and experience of students in entrepreneurship were not strictly controlled, so they could affect perceptions of entrepreneurship education and digital literacy. Third, the quantitative approach with self-report data is at risk of containing social and perception bias and does not capture in depth the more complex psychological dynamics of students.

For further research, it is recommended to use a mixed methods approach to obtain a more comprehensive picture of how entrepreneurship education and digital literacy affect technopreneurship intentions, including by exploring learning experiences, risk perceptions, and actual obstacles faced by students. Comparative analysis between regions, majors, or other demographic groups is also needed to strengthen the external validity of these findings.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contribution

Conceptualization: M.H.; **methodology:** N.N., and N.A.; **validation:** M.H., and N.N.; **formal analysis:** N.A., M.H., and T.T.; **investigation:** N.N., and N.A.; **data curation:** M.H., and N.N.; **writing—original draft preparation:** M.H.; **writing—review and editing:** M.H., and T.T.; **supervision:** H.K., and T.T.

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