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The Impact of Entrepreneurship Education on Strengthening Entrepreneurial Behaviors in Sports Science Students, with the Mediating Role of Digital Literacy

Javad Karimi[1] | Maziyar Kalashi[2*] | Monire Mohebalipour[3]

1. Department of Sports Sciences, Faculty of Literature and Human Sciences, Lorestan University, Khorramabad, Lorestan, Iran. Email: karimi3488@gmail.com
2. Corresponding Author, Department of Sports Management and Media, Faculty of Sports Sciences and Health, Shahid Beheshti University, Tehran, Iran. Email: K_Maziyar@sbu.ac.ir
3. Department of Human Resource Management, Faculty of Management, Kharazmi University, Tehran, Iran. Email: M.Malipour@yahoo.ir

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ABSTRACT

Objective: The current study seeks to investigate the effect of entrepreneurship education in empowering the entrepreneurial behavior of sports science university students, with the mediating role of digital literacy. **Method:** The population under investigation in the current study consists of all university students studying sports science at the universities located in Tehran. Sampling in the current study has been conducted in a random manner, and a total of 387 students studying sports science have been selected as the sample. A 29-item survey tool, rated in terms of a 5-point Likert scale, has been utilized for collecting data. Partial least square (PLS) using the software of Smart PLS 3 was employed to test the hypotheses. **Findings:** According to findings, entrepreneurship education positively and significantly influenced digital literacy (β= 0.746, t=24.291). In a similar manner, digital literacy positively and significantly influenced entrepreneurial behavior (β= 0.480, t=9.098), and, finally, entrepreneurship education positively and significantly influenced entrepreneurial behavior (β = 0.429, t = 7.773). **Conclusion**: Overall, it can be observed that entrepreneurship education contributes significantly to developing entrepreneurial behavior in sports science students both directly and indirectly by developing digital literacy. Therefore, the study suggests that the entrepreneurship programs should include digital literacy so that students become competent and future-ready in the era of technology for entrepreneurship to succeed.

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1. Introduction

Today entrepreneurship is perceived as a source of social and economic development, and in most cases, its success is measured by human capital (knowledge, skills, and abilities) acquired through educational processes. Entrepreneurial and educational experiences lay the foundation for successful start-ups, and a solid educational foundation guarantees entrepreneurial success (Sitaridis & Kitsios, 2023). As a component of educational processes, entrepreneurship education can teach not only how to be an entrepreneur and how to make entrepreneurship effective but also strengthen confidence, personality, and competencies that can broaden students' horizons in both educational and career development (Bismala, 2021; Rodrigues, 2023). Such education aligns with students' curricula and fosters behavior competencies, such as opportunity perception, and attitude-related competencies, such as adaptability and efficacy (Browning & Bustard, 2024). After all, it emphasizes a close relationship with reality, and research shows that work experience, motivation, and professionalism of teachers underly entrepreneurship education quality (Oksanen et al., 2023). This type of education, which develops and shapes entrepreneurial competencies and dispositions, plays a crucial role in influencing and enhancing students' entrepreneurial intentions (Hassan et al., 2020). It fosters the development of entrepreneurial competencies and dispositions, including adaptability, initiative, the ability to take calculated risks, and a sense of responsibility. On the other hand, entrepreneurship training is not mere academic vector that fosters creative thinking but also is a skill set that cultivates a sense of worth in students and empowers them to construct multi-faceted entrepreneurial efficacy on their own. Training raises awareness of entrepreneurial skills (Miço & Cungu, 2023), which encompasses what individuals learn. This training plays a key role in driving entrepreneurial intentions and behaviors among students in higher education institutions through motivation, creativity, risk-taking, and efficacy (Oulhou & Ibourk, 2023). Moreover, one of its functions in transformational leadership is to foster industrial development (Le & Loang, 2024). Independence, confidence, and access to entrepreneurial networks are augmented, which in turn prepares students for opportunity discovery and instilling an entrepreneurial orientation (Cui & Gu, 2024). Additionally, in building proficiency in the digital field, entrepreneurship training is also significant since it enables the use of digital technology to make processes of learning variable and exciting, thereby motivating students to study (Nuryadi & Widiatmaka, 2023). Entrepreneurship training, focused on utilizing electronic media and digital sources, strengthens cognitive capacities and allows students to use electronic tools when creating a business (Ervianti et al., 2023). Another important variable in preparing students for success in a digital environment is the continuous professional upskilling in competencies related to digital proficiency. This upskilling fosters critical competencies such as information management, electronic communication, content creation, cybersecurity, and problem-solving, which contribute to entrepreneurial success (Ervianti et al., 2023; Sánchez-Cruzado et al., 2021). Consequently, not only is entrepreneurial behavior strengthened but individuals are also empowered to utilize new technologies in creating and developing digital ventures. As argued by Yang et al. (2020), A direct positive association can be observed between success in digital entrepreneurship and the level of digital literacy, as this skill provides entrepreneurs with access to information, the ability to perceive new opportunities, and information-based decision-making capabilities. Furthermore, a significant role in entrepreneurship development arises from creating and enhancing entrepreneurship and innovation through the development of one's effectiveness (Zhang & Rathakrishnan, 2024).

Entrepreneurial orientation is both endogenous, such as entrepreneurial passion and motivation, and exogenous, including government intervention and educational direction (Nguyen et al., 2024). Indeed, empirical studies have demonstrated that possessing digital capabilities enhances performance and productivity in the workplace (Reddy et al., 2023). Furthermore, individuals who are highly digitally educated are better equipped to overcome entrepreneurial challenges and excel at capturing digital opportunities (Moorthy & Sahid, 2022; Zahoor et al., 2023).

The study aims to explore and understand the impact of entrepreneurship training and its strengthening of entrepreneurial behavior in sports sciences students, with the mediating role of digital literacy. Entrepreneurship training, a gateway to developing entrepreneurial competencies, is increasingly being acknowledged; however, its role in its effectiveness and its strengthening through digital literacy is yet to be researched in detail. First and foremost, its principal objective is to explore its impact and entrepreneurial behavior in sports sciences students and understand the mediating role

of digital literacy. With increased prominence for digital literacy in current times, in an attempt to bridge gaps in current studies, this study explores the impact of digital literacy in a specific field—sports sciences. This study draws its theoretical frameworks and analytical lenses from a variety of theoretical schools in entrepreneurship and psychology. In an attempt to understand and explore the role and impact of these theories, it examines not only the individual impact of each variable but also their interrelationships and their collective influence on entrepreneurial performance. As a mediator, digital literacy can make entrepreneurship training acceptable and accessible, and through developing its digital competencies, enable students to use new opportunities in the virtual environment effectively. With such an orientation, it can specifically contribute towards developing new and future-thinking approaches in an emerging and growing field such as that of sports sciences. The structure of this study includes a variety of sections that analyze and critique its theoretical and conceptual frameworks. This begins with the theoretical model, followed by a review and development of its hypotheses, which form an integral part of the analysis and critique. The methodology section addresses techniques for data collection, measurement tools, and methods for data analysis. Following this, an analysis of the collected data is conducted. Finally, the conclusion presents recommendations for future studies and discusses real-life implementations in entrepreneurship education and the improvement of entrepreneurial behavior among students in sports science.

1.1. Theoretical Framework

In the theoretical model of this study, entrepreneurship training is examined as one of the most significant factors in developing entrepreneurial character in students. Entrepreneurship training can contribute to developing entrepreneurial skills and competencies such as opportunity discovery, taking a risk, and generating innovation. Empirical studies have proven that entrepreneurship training programs, through entrepreneurial skills, such as innovation, management, and creativity, can positively impact on the success of new ventures (Bell & Bell, 2023; Singh et al., 2024). In general, entrepreneurship training can build entrepreneurial character and mold students' career aspirations towards entrepreneurship.

Digital competency, a set of skills for proper use of digital technology, can make a meaningful contribution towards entrepreneurial behavior development. According to Nambisan (2017) and Zhang and Rathakrishnan (2024), the use of digital technology in entrepreneurial processes can reduce uncertainty and improve decision-making in opportunity and danger management. In reality, digital competency enhances one's expertise in utilizing new tools for the development and management of virtual companies and can serve as a mediator between entrepreneurial training and entrepreneurial behavior (Wijayanto et al., 2023). Furthermore, entrepreneurial behavior encompasses a range of characteristics and actions through which individuals can recognize entrepreneurial opportunities and transform them into successful ventures. Both entrepreneurship and digital literacy, through the improvement of individual competencies, can enhance such behavior. Numerous studies have confirmed that high digital literacy can improve one’s ability to utilize new technologies and foster innovation in new ventures (Moorthy & Sahid, 2022; Young et al., 2020). This study emphasizes that digital literacy can amplify the impact of entrepreneurship education on entrepreneurial behavior, thereby better preparing students for a successful transition into entrepreneurial life.

1.2. Literature Review and Development of Hypotheses

1.2.1. Entrepreneurship Education and Digital Literacy

Digital competency in current times is regarded as a critical skill for effective integration in both society and the digital economy (Weninger, 2023). Entrepreneurship training contributes significantly to developing competency in digital literacy, as it integrates current technology and digital tools in training, with a view to enhancing practice and effective use of such technology (Zhang & Rathakrishnan, 2024). Entrepreneurship training enhances technical competencies in terms of computer technology, critical thinking, problem-solving, and innovation (Reddy et al., 2022). In addition, employing computer tools, entrepreneurship training enables students to use computer environments actively and build entrepreneurial experiences (Malik et al., 2023). According to studies, not only an individual is supposed to work with technological tools but also is supposed to have cognitive, social, and affective competencies for effective use of computer technology (Reddy et al., 2023).

Digital entrepreneurship education improves students' problem-solving and analytical skills and creates new ways to build professional networks and access global markets (Park et al., 2021; Sitaridis & Kitsios, 2023). The process opens new channels for cooperative learning, networking, and access to worldwide markets (Park et al., 2021). Moreover, through its stimulation of new instruction approaches, it promotes students' motivation and curiosity in raising their level of digital competency (Nuryadi & Widiatmaka, 2023). Digital literacy empowers learners to use digital tools safely and effectively. Education in digital literacy provides a comprehensive framework for developing essential competencies, such as information management, communication and networking, content creation, online security, and problem-solving (Ervianti et al., 2023; Khan et al., 2022). This enables students to confidently navigate the complexities of modern work and social environments (Ervianti et al., 2023). Therefore, the first hypothesis is presented as follows:

H1: Entrepreneurship education positively influences digital literacy.

1.2.2. Digital Literacy and Entrepreneurial Behavior

Digital literacy affects entrepreneurial behavior, a complex multidimensional issue that is closely connected to individual capacities, digital skills, and social interactions in the digital age (Cui & Bell, 2022). As intentional, self-determined, self-efficacious, and socially-driven behavior, entrepreneurial behavior motivates individuals to enter and operate businesses (Cui & Bell, 2022). Digital literacy, defined as the skills and knowledge required to utilize Information and Communication Technology (ICT) for creativity, innovation, and entrepreneurship, can significantly enhance these behaviors and capabilities (Ali et al., 2023). Digital literacy is one of the key competencies necessary in today's world, enabling consumers to find information and equipping entrepreneurs to identify and capitalize on business opportunities (Reddy et al., 2020). According to the European Commission, digital literacy refers to the ability to leverage technology to create opportunities and acquire skills, which is essential for the development and management of digital businesses (Reddy et al., 2020). Digital literacy directly influences the success of digital entrepreneurship by fostering creativity and problem-solving capabilities according to numerous studies (Zhang & Rathakrishnan, 2024). Both endogenous and exogenous factors can play a role in this context (Nguyen et al., 2024). On the endogenous side, dispositional characteristics, such as perceived creativity and entrepreneurial passion, touch upon critical items, driving influential entrepreneurial motivation and commitment (Nguyen et al., 2024). On the other hand, educational, academic, and governmental support provide exogenous powers which are essential for strengthening these skills (Reddy et al., 2023). Entrepreneurs can surpass knowledge musculoskeletal extremities and even employ optimum technology apprehension for better entrepreneurial performance in the digital world (Neumeyer et al., 2020). This capability can have strong implications in the real-world workplace, as enhanced digital skill sets for entrepreneurs are often associated with better levels of performance or productivity (Reddy et al., 2023). Conversely, it has been disclosed that digital literacy likely has a positive and substantial impact on online entrepreneurial intentions in which digital competences, namely in the domains of online marketing and digital resource management, empowers entrepreneurs to recognize and seize new opportunities (Chen et al., 2024 & Kang et al., 2024). Therefore, by improving problem-solving, creativity, and innovation in entrepreneurship, digital literacy allows people to function effectively in the digital universe and to pursue their ambitions (Hosseini et. al., 2017). Therefore, the second hypothesis is presented as follows:

H2: digital literacy positively influences entrepreneurial behavior.

1.2.3. Entrepreneurship Education and Entrepreneurial Behavior

Entrepreneurship education, which serves as an effective means of fostering affiliation, developing personal competencies, and enhancing entrepreneurial skills, is a predictor of entrepreneurial behavior. These educational programs emphasize self-efficacy, opportunity recognition, and creativity to assist students and future entrepreneurs in understanding management skills and innovation (Harahap et al., 2023; Montazeri & Karimi, 2024). Moreover, entrepreneurship education encompasses not only technical knowledge and skills but also strengthens behavioral values such as risk-taking, planning, and management. Bismala (2021) highlights the importance of practical learning in entrepreneurship education programs, through which individuals become empowered to discover, create, and capture

opportunities. Another significant benefit of entrepreneurship education is the enhancement of self-efficacy and empowerment. These programs not only boost students' confidence but also enhance their capacity to address entrepreneurial challenges (Rodrigues, 2023). Programs focused on problem-solving, networking, and creative thinking can help students develop entrepreneurial traits such as creativity and innovation (Kaur & Dhawan, 2023). This type of learning, which emphasizes practical, real-world experiential engagement with the community, helps students understand how to apply their skills and better recognize career and business opportunities present in real environments (Oksanen et al., 2023). Furthermore, education in entrepreneurship positively impacts behavioral dimensions such as risk-taking and leadership. These skills can be improved through educational programs that emphasize enhancing planning abilities, project management, and opportunity evaluation, thereby developing students' managerial and leadership skills (Prastyaningtyas et al., 2023). Conversely, these programs encourage students to formulate innovative ideas to tackle a wide variety of entrepreneurial challenges and opportunities by creating environments that foster critical thinking and creativity (Miço & Cungu, 2023). In general, entrepreneurship education not only fosters the development of entrepreneurial spirit and behaviors but also promotes economic and social development. Therefore, the third hypothesis is presented as follows:

H3: Entrepreneurship education positively influences entrepreneurial behavior.

1.2.4. The Mediating Role of Digital Literacy Between Entrepreneurship Education and Entrepreneurial Behavior

The use of ICT can have a positive influence on entrepreneurial goals through AI, and moderate the relationship between entrepreneurial attitude and risk. Such technologies create much-needed transformations in the way we cope with uncertainty in the entrepreneurial processes, what we deliver in terms of teaching, organizational design, and assessments (Zhang & Rathakrishnan, 2024). These tools will help us to be more creative in an entrepreneurial way and to make better decisions (Bell & Bell, 2023). Therefore, entrepreneurship programs should help students to take advantage of new opportunities enabled by the adoption of technology. However, it was recognized that the education on digital entrepreneurship has a significant effect on the entrepreneurial competencies that play a mediating role in the relationship between digital entrepreneurship education, teaching methodology, and the entrepreneurial intention (Singh et al., 2024). The relationship between entrepreneurial knowledge and technological entrepreneurship is positively significant, and digital literacy mediates this effect on technological entrepreneurial behavior. As a result, students need to improve their entrepreneurial insight and are enriched by digital literacy (Wijayanto et al., 2023). Fear of missing out on opportunities or current jobs does not lead to digital transformation; technological evolution requires proper training to develop the skills needed to support digital entrepreneurship (Moorthy & Sahid, 2022). Digital literacy enhances critical thinking and digital skills in the workplace, thereby boosting employability (Khan et al., 2022). These abilities help individuals become competent in the digital environment and versatile across various domains (Hussain & Phulpoto, 2024). For instance, digital literacy is interlinked with essential competencies such as cybersecurity, innovation, critical thinking, and digital project management in the job market (Gutiérrez-Ángel et al., 2022). Ultimately, improving digital literacy and acquiring digital skills are crucial for effective development in both workplace and personal contexts (Bejakovic & Mrnjavak, 2020). Therefore, the fourth hypothesis is presented as follows:

H4: Digital literacy plays an intermediary role in the relationship between entrepreneurship education and entrepreneurial behavior.

1.3. Research Framework

This research model explains the impact of entrepreneurship education and digital literacy on the entrepreneurial behaviors of sport management students. It posits that entrepreneurship education leads to increased entrepreneurial behavior, while digital literacy moderates this relationship. Furthermore, digital literacy serves as a mediating factor, intensifying the influence of entrepreneurship education on the entrepreneurial behaviors of sport management students. As an essential skill, digital literacy enables students to recognize entrepreneurial opportunities in digital settings and utilize digital tools to create and expand their businesses. This model specifically aims to

explore how entrepreneurship education and digital literacy can collaboratively promote entrepreneurial behaviors among sport management students.

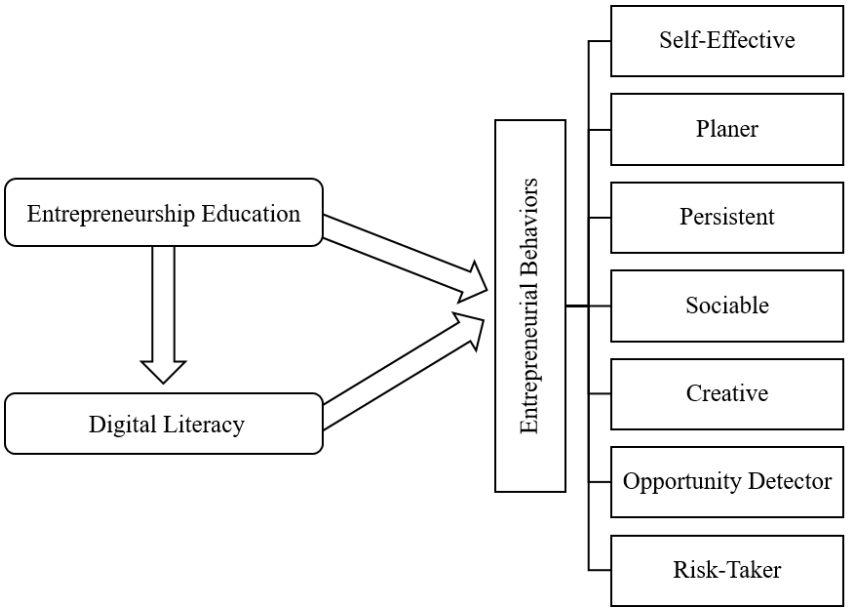

Fig. 1. Research Framework

2. Method

2.1. Procedure for Data Collection

In this study, the Persian translation of the original survey, the official language of Iran, was used. Before running the complete questionnaire, we carried out a pilot study using 30 sports science students. Data were collected from sports science students in the Faculties of Sport Sciences at Tehran Universities. From July 2024 to December 2024, an online survey was conducted based on a non-probability sampling method (purposive sampling). All participants provided informed consent prior to taking the survey, which was purely optional. We requested no personal information, ensuring total anonymity. The survey would take approximately 7 minutes to complete.

2.2. Participants

A total of 387 sports science students took part in the survey. Among the participants, 59% were male and 41% were female. The majority of respondents, amounting to 39%, fell within the age range of 21 to 25 years. Additionally, 67% held at least a bachelor's degree.

2.3. Measures

In this study, the dimensions of entrepreneurial behavior were measured using 21 items across 7 components from the questionnaire developed by Schmidt et al. (2018). Digital literacy was assessed with 5 items derived from Setiawati (2022), while entrepreneurship education was measured with 4 items adapted from the Walter and Block (2016) questionnaire. All items were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot test involving 30 sports science students indicated satisfactory reliability, with test-retest correlations exceeding 0.70 for all 30 items over a 7-day interval. To ensure robustness, a sample size of at least 10 respondents per item was targeted, leading to the distribution of 400 questionnaires, of which 387 were fully completed.

2.4. Data Analysis Techniques

The data were analyzed using Smart PLS 3, and the level of statistical significance was set at $\alpha < .05$. We used Partial Least Squares Structural Equation Models (PLS-SEM) to test the overall and internal model fits and the proposed relationships among the variables. Internal model fit was assessed through reliability, convergent validity, and discriminant validity. A Composite Reliability (CR) above 0.70 indicates acceptable reliability (Black et al., 2010), while convergent

validity was confirmed with factor loadings greater than 0.707 and an average variance extracted (AVE) above 0.50 (Fornell & Larcker, 1981).

Path analysis examined the hypothesized relationships, and bootstrapping with 5,000 resamples assessed indirect effects at a 95% confidence interval (Preacher & Hayes, 2008). The standardized root mean square residual (SRMR) indices evaluated the model's adequacy. Lower values suggest better model fit, highlighting PLS-SEM's focus on predictive capability.

3. Findings

The partial least squares (PLS) approach was used to examine the research hypotheses. First, the measurement model was examined and, as can be observed in Table 1, the factor loadings of all questions were also greater than 0.7, while Cronbach's alpha and rho-A were greater than 0.7 (Wong, 2013). Composite reliability values exceeded 0.8, while the mean variance values were greater than 0.5 (Hair et al., 2021).

Table 1. Psychometric Properties of the Measures

		Entrepreneurial Behaviors	Loading	A	rho_A	CR	AVE
Self-Effective	EB1	I believe I am very capable of organizing and executing actions to be successful.	0.870	0.859	0.859	0.914	0.780
	EB2	I have all the capacity needed to realize my professional/academic future	0.907				
	EB3	I am sure I am competent enough to develop my career successfully	0.872				
Planer	EB4	I have issues regarding my work/study always planned well in advance	0.840	0.789	0.790	0.876	0.703
	EB5	I have a detailed plan for my academic/professional issues	0.847				
	EB6	I like to have the activities of my next year always well planned	0.828				
Persistent	EB7	I frequently influence other people's opinions	0.875	0.862	0.863	0.916	0.784
	EB8	It's easy for me to inspire other individuals to do what I want	0.921				
	EB9	I am frequently chosen as leader in academic/professional projects or activities	0.859				
Sociable	EB10	I have a lot of friends	0.876	0.820	0.821	0.893	0.736
	EB11	I can easily relate with others, even with those I still do not know	0.858				
	EB12	I like to be in contact with others	0.838				
Creativ e	EB13	I repeatedly change the way I study/work	0.872	0.853	0.853	0.911	0.773
	EB14	I like to do tasks that are completely new everyday	0.896				
	EB15	I do not like routine activities	0.868				
Opportunity Detector	EB16	I frequently think of products/services that could be offered in the market	0.880	0.866	0.867	0.918	0.789
	EB17	Whenever I observe people complaining about some products/services, I think of the market opportunities that may be opening	0.889				
	EB18	I frequently imagine the possibility of success that certain products/services could have in a certain market	0.894				
Risk-Taker	EB19	I like to be exposed to situations that involve some kind of risk	0.765	0.775	0.777	0.870	0.692
	EB20	To be successful in life, it is necessary to run some risks	0.878				
	EB21	A person that does not run some risks will rarely achieve a successful academic/professional life	0.848				
		Entrepreneurship Education					
	EE1	My school education helped me develop my sense of initiative – a sort of entrepreneurial attitude	0.797	0.961	0.961	0.964	0.563
	EE2	My school education helped me better understand the role of entrepreneurs in society	0.824				
	EE3	My school education made me interested in becoming an entrepreneur	0.795				
	EE4	My school education gave me skills and knowledge that enabled me to run a business	0.843				
		Digital Literacy					
	DL1	I can interpret the information that comes from social media	0.835	0.870	0.871	0.906	0.660
	DL2	I can create a profile on WhatsApp or Instagram media	0.836				
	DL3	I can distinguish hoax news/information from the facts on social media	0.852				
	DL4	I can adopt digital devices, applications, and services	0.803				
	DL5	I can use social media in commercial activities such as promoting products and selling products	0.730				

The cross-loadings coefficient and Fornell-Larcker criteria are two indexes used to evaluate the discriminant validity of the scale (Hair et al., 2017). After testing, the cross-loadings coefficient for each structure was significantly larger than those for other structures. Additionally, the square root of the AVE for each structure, as presented in the Fornell-Larcker criterion results table (Table 2), is greater than the correlation coefficients between the structures.

Table 2. Correlations Among the Second-Order Factors

Variables	Digital Literacy	Entrepreneurship Education	Entrepreneurial Behaviour
Digital Literacy	**0.813**		
Entrepreneurship Education	0.800	**0.791**	
Entrepreneurial Behaviour	0.746	0.787	**0.815**

Note: The diagonal elements (in bold) are the square roots of the AVE for each construct.

The first part of Table 3 shows the results of the research hypotheses. The results indicated that entrepreneurship education had a positive and significant effect on digital literacy (β = 0.746; t =24.291). Digital literacy also had a positive and significant effect on entrepreneurial behaviour (β = 0.480; t = 9.098), and finally, entrepreneurship education also has a positive and significant effect on entrepreneurial behaviour (β = 0.429; t = 7.773).

Table 3. Parameter Estimators in the Hypothesized Structural Model

	Relationships	β	SD	T	Decision
H1	Entrepreneurship Education → Digital Literacy	0.746	0.031	24.291	Supported
H2	Digital Literacy → Entrepreneurial Behaviour	0.480	0.053	9.098	Supported
H3	Entrepreneurship Education → Entrepreneurial Behaviour	0.429	0.055	7.773	Supported
Model Fit	Variable	R^2	Q^2	SRMR	
	Digital Literacy	0.556	0.340	0.086	
	Entrepreneurial Behaviour	0.722	0.375		

*Significant at p =.05.

In the partial least squares (PLS) approach, the quality and fit of the model are assessed using several measures. These measures included the R2 and Q2 coefficients, which, according to the results presented in Table 4, are within the appropriate range for the two variables of digital literacy and entrepreneurial behaviour (Henseler et al. 2014). Another measure is the SRMR index, which was less than 0.1, indicating the appropriate quality of the tested model.

Table 4. Sobel Test Results for Assessing the Significance of the Mediating Variable

	Relationships	β	S. E	T	VAF	VIF	Decision
H4	Entrepreneurship Education → Digital Literacy → Entrepreneurial Behaviour	0.317	0.042	8.476	0.480	2.252	Supported

Table 4 presents the results of the Sobel test assessing the significance of the mediating role of digital literacy. As shown, the t-statistic for the digital literacy variable exceeds the critical value of 1.96, confirming the presence of a mediating effect. Additionally, the Variance Accounted For (VAF) is 48%, which falls within the acceptable range of 20% to 80%, indicating partial mediation. Furthermore, the Variance Inflation Factor (VIF) is 2.252, which is below the threshold of 5, confirming the absence of multicollinearity. Overall, the results confirm the mediating role of digital literacy in the relationship between entrepreneurship education and entrepreneurial behavior.

4. Discussion

4.1. Entrepreneurship Education and Digital Literacy

The outputs fully confirmed the first hypothesis, indicating that entrepreneurship education has a positive and significant impact on digital literacy. The path coefficient (β = 0.746) is relatively high, and the obtained P value suggests that there is a strong positive correlation between entrepreneurship education and digital literacy. Specifically, T = 24.291, p = 0.031 (significant at the 0.05 level),

indicating that this relationship is statistically significant. Furthermore, this finding suggests that learning how to become an entrepreneur, which includes the use of digital technologies and tools to facilitate the learning process, can enhance individuals' digital literacy.This training not only provides people with the ability to enhance their digital skills but also teaches them how to apply those skills to solve deeper problems and innovate in business. These findings align closely with the results of Qalati et al. (2025) and Fan et al. (2023). Qalati et al (2025) demonstrated that knowledge spillover entrepreneurship significantly contributes to the adoption of digital tools, such as social media and customer relationship management systems, highlighting the role of entrepreneurial education in enhancing digital literacy. Similarly, Fan et al. (2023) emphasized that the application of digital technologies mediated by ESG performance and green innovation strengthens organizational competitiveness. Both studies support the notion that digital literacy acts as a strategic bridge between entrepreneurial initiatives and behavioral outcomes. The current research extends these insights to the context of sports science education, confirming that entrepreneurship education not only directly fosters entrepreneurial behavior but also indirectly enhances it through digital empowerment.

The results of this study are consistent with prior research highlighting the importance of the role of entrepreneurship education in improving digital literacy. Based on these studies, it has been observed that entrepreneurship education (especially when integrated with digital tools and modern technologies in the learning process) may help individuals become more proficient in using new technologies and apply these skills better in professional and social contexts (Zhang & Rathakrishnan, 2024). These results also emphasize that entrepreneurship education, while honing technical skills, fosters skills in critical thinking, problem-solving, and innovation—core elements of digital literacy (Ervianti et al., 2023). Here, various studies highlight that entrepreneurship education, especially by means of digital technologies, enables students to engage in digital learning environments and acquire new experiences in applying technologies in business development (Malik et al., 2023). Entrepreneurship education plays a crucial role in enhancing entrepreneurial behaviors among sports science students. Research has shown that various factors influence students' entrepreneurial attitudes (Mohammadkazemi & Madandar, 2012). Furthermore, the development of business models for sports academies, with an emphasis on value propositions and customer segmentation, has highlighted the importance of strategic planning in sports entrepreneurship (Izadfar et al., 2020).

Moreover, it essentially signifies that digital literacy comprises technical, cognitive, social and emotional skills, and that these skills enable the effective use of digital technologies (Reddy et al., 2023). These findings indicate that entrepreneurship education, implemented via innovative technologies, such as artificial intelligence and big data during students' time in school, can help improve their problem-solving and data analysis skills and open the door to additional collaborative learning opportunities and greater access to emerging global markets (Park et al., 2021; Sitaridis & Kitsios, 2023).

4.2. Digital Literacy and Entrepreneurial Behavior

The second hypothesis, specifying that there is a positive and significant effect of digital literacy on entrepreneurial behavior, has been proven. Based on the data, the path coefficient (β) = 0.480, indicated a moderate positive relationship between digital literacy and entrepreneurial behavior. Moreover, the t value is 9.098, and the p value is 0.053, which is marginally above the threshold of significance at 0.05. These results indicate a significant influence of digital literacy on individuals' entrepreneurial actions. Indeed, a strong level of digital literacy positively contributes to individuals' effective use of digital tools throughout their entrepreneurial journey, enabling them to recognize opportunities and generate new ideas utilizing advanced technologies. This could indicate that people who are proficient in these digital skills can better improve their entrepreneur behaviors and perform better in the competitive digital environment. The findings of this study align with those of Fan et al. (2023), confirming that digital literacy plays a key mediating role in enhancing entrepreneurial outcomes. While Fan et al. (2023) focused on enterprise competitiveness through digital technology and green innovation, both studies highlighted how digital capabilities foster strategic thinking and innovative behavior—core elements of entrepreneurship.

Each of these findings are in line with existing literature, demonstrating that not only digital literacy help move individuals into the digital society but also it can engender homegrown

entrepreneurial behaviours and the inception of new enterprises. In this respect, there is a widely accepted view that digital literacy influences entrepreneurial behaviors and digital innovations, which will lead to the successful growth of innovatively and digitally driven businesses.

The role of digital literacy in ensuring the success of digital entrepreneurship has been found in several studies to be both direct and significant. More specifically, digital literacy promotes creativity and problem-solving skills that enable entrepreneurs to perform well in digital marketplaces (Zhang & Rathakrishnan, 2024). Additionally, digital literacy assists entrepreneurs in broadening their knowledge networks and using emerging technologies efficiently to enhance their companies (Neumeyer et al., 2020). Studies also demonstrate that digital literacy can have a positive effect on online creative ventures, particularly in fields such as digital resource management and online marketing. Such abilities allow entrepreneurs to gain unique insights and capitalize on new trends (Hosseini & Setiaji, 2019). Overall, digital literacy, which fosters creativity, innovation, and problem-solving in entrepreneurship, empowers individuals to thrive in the digital age while pursuing their goals (Hosseini & Setiaji, 2019).

4.3. Entrepreneurship Education and Entrepreneurial Behavior

The outcomes of the third hypothesis are confirmed, indicating that entrepreneurship education influences positively and significantly on entrepreneurial behavior. Based on the data, the path coefficient (β) = 0.429 shows a moderate positive relationship between entrepreneurship education and entrepreneurial behavior. Moreover, t-value is 7.773 while the p-value is 0.055, which is again lower than 0.05 significance level. This indicates that individuals exposed to entrepreneurship education exhibit increased entrepreneurial behavior. Training in entrepreneurship not only cultivates technical and specialized skills but also strengthens motivation and self-confidence to start and advance their own business. Through this education, people are better able to take advantage of market opportunities, identify risks, and implement new entrepreneurship innovations. The findings of Suder et al. (2026), Tajeddini et al. (2020), and Tajeddini & Mueller (2012) indicate that entrepreneurial orientation, innovation, risk-taking, proactiveness, and networking are key factors in enhancing organizational performance and achieving competitive advantage. These results are aligned with the goals of entrepreneurship education, as it equips individuals with the ability to identify opportunities, adapt to dynamic environments, strengthen networking skills, and foster innovative mindsets, thereby providing the foundation for the development of entrepreneurial behavior.

Supported by prior research indicating that entrepreneurship education leads to intention and behavior, the results align with the notion that entrepreneurship education enriches key entrepreneurial skills, including critical thinking, problem-solving, and innovation, ultimately leading to behaviors associated with entrepreneurs. Entrepreneurship education is widely perceived as a helpful approach in the development of the entrepreneurial spirit and entrepreneurial behavior, with a view to promoting the creative industries. According to research, entrepreneurship education directly affects the strengthening of entrepreneurs' characteristics (e.g., risk-taking, innovation, leadership, etc.) by improving their self-confidence, problem-solving, and creative thinking skills (Prastyaningtyas et al., 2023; Rodrigues, 2023). Such educational programs, targeting the development of project management skills and assessing the profitability of opportunities, can enable students to better develop the behavior required for an entrepreneur to be more competitive in the market (Bismala, 2021).

These findings are consistent with previous literature indicating that entrepreneurship education not only increases technical knowledge but also improves certain general behavioral patterns. More specifically, experiential-based education enables students to apply their skills in a realistic atmosphere and improve their self-efficacy (Oksanen et al., 2023). In conclusion, this research implies that entrepreneurship education is an important driver in this process, as it helps shape entrepreneurial behavior and the skill set needed for building successful and innovative businesses. The introduction of the concept of sports entrepreneurship, as an innovative approach in sports management, has highlighted the necessity of fostering entrepreneurial thinking within the curricula of this field (Mohammadkazemi & Omidi, 2012). Research findings have also confirmed the significant role of educational interventions in the development of entrepreneurial behaviors (Mohammadkazemi et al., 2014).

4.4. The Role of Digital Literacy in the Relationship Between Entrepreneurship Education and Entrepreneurial Behavior

The results of the fourth hypothesis, which address the indirect effect of entrepreneurship education on entrepreneurial behavior through digital literacy, have been confirmed. Based on the data, the indirect path coefficient was 0.317, showing that entrepreneurship education indirectly and positively affected entrepreneurial behavior through digital literacy. The t-value is 8.647, and the p-value is 0.037. These findings imply that entrepreneurial behavior is not only directly influenced by entrepreneurship education but is also indirectly promoted via the enhancement of digital literacy. By providing students and entrepreneurs with entrepreneurship education, it enhances their ability to perform in digital environments through the introduction of digital tools and technologies for entrepreneurship education. These types of educational programs enable individuals to enhance their digital skills and translate their acquired knowledge into business success, fostering a growth mindset and optimized goals to mitigate risks and prepare for success in the digital landscape.

These results are consistent with previous studies, as they demonstrate that digital literacy, based on its mediating character, is a highly contributing factor to enable the shaping of entrepreneurial behaviors. To put it differently, integrating digital tools in entrepreneurship education mean that individuals prepare themselves to be better entrepreneurs and digital literacy empowers the entrepreneurs to act efficiently in the digital age and broaden the scope for new ventures.

Such findings are consistent with studies that have shown that Information and Communication Technology (ICT) impacts the risk-and-attitude relationship regarding entrepreneurship, with Artificial Intelligence (AI) specifically facilitating the realization of entrepreneurial objectives (Nambisan, 2017; Zhang & Rathakrishnan, 2024). The research design explains the impact of digital entrepreneurship education on entrepreneurial competencies and also examines the mediating relationship among digital entrepreneurship education, teaching methods, and entrepreneurial intentions (Singh et al., 2024). Digital literacy, encompassing information, media, and visual literacy, enhances skills related to entrepreneurship and strengthens critical thinking abilities, leading to improved workplace employability (Khan et al., 2022; Martin, 2005). These competencies are interlinked with skills in innovation, cybersecurity, and project management in a digital world (Gutiérrez-Ángel et al., 2022).

5. Conclusion

The findings of this research show the positive effect of entrepreneurship education on enhancing the entrepreneurial behaviors of sports sciences students. Entrepreneurship education, focusing on skills that help shape individuals, fosters confidence and risk-taking abilities that can help mold entrepreneurs. Furthermore, digital literacy has also been recognized as an intermediary in the process, which should be considered important in the improvement of entrepreneurship behaviors. Digital skills enable the students to identify and exploit new opportunities in the digital entrepreneurship domain, as it leads to increasing efforts and improving entrepreneurial performance. Therefore, the study suggests that sport sciences educational programs could be designed with a special focus on digital literacy and entrepreneurial skills, allowing students to act more efficiently in a digital world and establish new paths for themselves. Moreover, the current study indicates that future research should investigate the potential for digital tools to foster entrepreneurial skills and create entrepreneurial opportunities across the range of fields, particularly in sports and emerging technologies.

Overall, the findings of this study provide novel insights into how entrepreneurship education enhances entrepreneurial behavior among sports science students, mediated by digital literacy. While prior research has examined entrepreneurship education in business and engineering disciplines, and in the field of sports science, these investigations were conducted in a limited way. This study contributes to the literature by focusing on sports science—an understudied yet increasingly relevant field where entrepreneurial skills can drive innovation in sports management, fitness technology, and health promotion.

5.1. Novelty of the Findings

1. Unique Population (Sports Science Students)

Most existing studies on entrepreneurship education (EE) have concentrated on business schools or engineering programs, implicitly assuming that entrepreneurial training is most relevant in these fields. However, the rapid growth of the sports industry, spanning fitness technology, sports analytics, event management, and health promotion, demands a new wave of entrepreneurs with specialized domain of knowledge. Our study challenges the traditional boundaries of EE research by demonstrating its significant impact on entrepreneurial behavior even in a non-business discipline like sports science.

2. Digital Literacy as a Key Mediator
While previous studies have explored mediators such as self-efficacy, risk-taking propensity, and social capital, our research introduces digital literacy as a novel and highly relevant mediator in the EE–entrepreneurial behavior relationship. The strong mediation effect underscores those digital skills that are not just supplementary but essential in transforming entrepreneurial knowledge into actionable behavior, particularly in an era where sports entrepreneurship increasingly relies on digital platforms (e.g., fitness apps, e-sports, social media marketing).

Why this matters? We contribute to the EE literature by identifying a previously underexplored mediator that is especially pertinent in today's digital economy. Entrepreneurship programs in sports science should integrate digital skill development, such as data analytics, e-commerce, and digital marketing, to enhance students' ability to launch and scale ventures.

3. Dual Pathway of Influence (Direct & Indirect)
The study reveals that entrepreneurship education enhances entrepreneurial behavior both directly ($\beta = 0.429$) and indirectly through digital literacy. This dual pathway suggests that while entrepreneurial training fosters business mindset and skills, digital literacy amplifies these effects by enabling students to apply their knowledge in a tech-driven marketplace.

5.2. Implications for Theory and Practice

The findings of this study can be examined from multiple perspectives, each carrying significant implications for education, research, and policy-making. From a theoretical perspective, the results indicate that entrepreneurship education not only has a direct effect on entrepreneurial behaviors but also exerts influence through digital literacy as a mediating variable. This represents an important step in advancing conceptual frameworks of entrepreneurship education and enriching theories related to entrepreneurial learning. From an educational and academic perspective, the study highlights the necessity for sports science curricula to move beyond traditional instruction and deliberately integrate digital skills, including the use of social media, digital marketing, and opportunity recognition in technology-driven contexts. From a professional and practical perspective, strengthening digital literacy alongside entrepreneurship education can empower students to enter competitive labor markets and establish innovative ventures within the sports industry. From a policy-making perspective, the findings underscore the need for higher education policies to promote the design of interdisciplinary and integrative programs that simultaneously foster entrepreneurial and digital competencies, thereby preparing the next generation of sports professionals to effectively face the challenges of a dynamic and technology-oriented world.

5.3. Limitations and Future Research

This study, while contributing valuable insights into the role of entrepreneurship education (EE) and digital literacy in sports science students, has several limitations that future research should address. Below, we identify these limitations and suggest methodological and conceptual improvements to address them.

1. Context-Specific Sample (Limited Generalizability):
The study focuses only on sports science students in Tehran, which may not represent students from other regions, disciplines, or cultural backgrounds, and also Sports science programs vary globally in curriculum, resources, and industry ties. Therefore, it is recommended to replicate the study in diverse settings (e.g., Europe, North America, Africa) to assess cultural/economic influences. Moreover, future research should incorporate students from other non-business fields (e.g., healthcare and arts) to examine if findings hold universally.

2. Broad Digital Literacy Construct (Lacks Specificity)
The study treated digital literacy as a single factor, but not all digital skills equally impact entrepreneurship (e.g., social media marketing vs. AI programming). Therefore, it is recommended to break digital literacy into sub-dimensions (e.g., e-commerce, data analytics, AI tools) to identify which skills matter most for sports entrepreneurship.

3. Narrow Focus on Mediation (Missing Moderators)
The study only examined digital literacy as a mediator but overlooked potential moderators (e.g., gender, prior experience, institutional support) that could strengthen/weaken the impact of EE. Therefore, it is advised to examine how factors such as gender, socioeconomic status, and access to technology influence the EE–entrepreneurship link. Moreover, future research should investigate how university policies (e.g., incubators and funding) and national entrepreneurship ecosystems affect outcomes.

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