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The effect of gamification in entrepreneurship and business education on pharmacy students' self-efficacy and learning outcomes



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Abstract

Purpose The current study aimed to evaluate the effect of an entrepreneurship and business education program using gamification on enhancing self-efficacy and the learning of entrepreneurial and business skills among pharmacy students.

Method This quasi-experimental study was carried out at Shahid Sadoughi University of Medical Sciences. The participants, including 5th and 6th-year pharmacy students (*N*=86), were entered. The objective of the intervention was to improve entrepreneurial and business skills and develop business models in the pharmacy field. During the intervention, students collaboratively engage in a puzzle of a business plan as a project, integrating elements including risk, rewards, completion, multiplayer gameplay, and scenario-based challenges across various pharmaceutical fields. Students were tasked with completing canvas business plan components for their proposals, which were subsequently evaluated by an expert. The students' self-efficacy was assessed using a 23-item questionnaire, and their learning was measured through a project-based examination focused on the business plan. The collected data were analyzed using descriptive statistics, T-tests, Pearson's ANOVA, and regression analysis, with a significance level considered p-value < 0.05.

Results The students' learning scores were reported as 89.93 ± 5.66 . The scores of students' self-efficacy domains before (46.11 ± 2.59) and after the educational program (69.58 ± 2.04) had a significant difference. (p-value = 0.0001). The results of the regression test showed that students' learning scores have a substantial relationship with initiating investor relationships (p = 0.005) and coping with unexpected challenges (p = 0.03). After controlling the demographic information, the domains of initiating investor relationships (p = 0.038) significantly correlate with a student's entrepreneurship score.

Conclusion The educational program using the gamification method with a focus on business models significantly enhances students' self-efficacy in pharmaceutical entrepreneurship. This improvement was observed across all domains assessed, indicating a comprehensive impact on students' self-perception of their ability to succeed in entrepreneurship. Further study of entrepreneurship development and business education using a game-based learning method as a collaborative and active method in pharmacy education is recommended.

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Clinical trial number Not applicable.

Keywords Pharmacy, Game-based learning, Entrepreneurship, Business, Gamification, Pharmaceutical education, Self-efficacy, Learning

Introduction

The Center for the Advancement of Pharmacy Education (CAPE) has highlighted entrepreneurship as an integral component within the pharmacy education framework. The capability encompasses a range of competencies from identifying and capitalizing on new opportunities to implementing novel ideas, embracing change, and improving the tendency to the innovative process. These skills contribute to the individual's professional growth and assist in revolutionizing patient care through the development of new pharmaceutical solutions and services [1]. Students enhance their abilities in creative thinking, risk assessment, and the pursuit of unmet needs by participating in entrepreneurial activities, ultimately enhancing their capacity to contribute to the progression of their fields [1]. Strengthening entrepreneurial capabilities among students led to enhancing their capabilities to find new ways to develop pharmaceutical businesses in their future careers and create innovative opportunities in pharmacy fields [2].

Entrepreneurship aspects can be taught and learned, and education is a key element in bolstering entrepreneurial strength [3]. Recently, a targeted approach to integrating entrepreneurship in educational programs has been highlighted to improve the quality of educational processes and the growth of entrepreneurial abilities in graduates in pharmacy education programs [4]. In this regard, entrepreneurship and business education have become essential components of education in health professions education systems to facilitate equipping students with the necessary skills to succeed in the business world and provide tools for students to develop skills for dynamic, innovative, and technological work [5]. Entrepreneurship and business education facilitate learning about the knowledge, skills, values, and attitudes required to start, manage, and grow a business. Entrepreneurship involves recognizing opportunities, managing resources in risk situations, and creating a business venture. In addition, the goal of entrepreneurship and business education is to develop organizational capacity and prepare students with an entrepreneurial and innovative attitude [6]. Mattingly et al., in a multiphase study, explored the entrepreneurial competencies of pharmacy students. These include the identification and execution of opportunities, the implementation of innovative ideas, risk tolerance, addressing unmet needs, creating new value, responsiveness to change, and dedication to intraorganizational and social entrepreneurship. Mastery of these skills not only expands the role of pharmacists but also plays a pivotal role in advancing patient care through continuous innovation. The study underscores the importance of integrating entrepreneurial education into the pharmacy curriculum to prepare students for the dynamic and multifaceted roles they will assume in their future careers [1].

Entrepreneurship training programs are focused on cultivating entrepreneurial self-efficacy among participants. Self-efficacy, which refers to the belief in one's ability to succeed in entrepreneurial ventures, is influenced by a multitude of factors. Self-efficacy, as proposed by Albert Bandura, is a pivotal concept within the social cognitive theory, serving as a foundational element for nurturing latent capabilities within individuals. Self-efficacy encapsulates an individual's appraisal of their competencies, shaped by their motivational drive, cognitive reserves, and track record of performance. In entrepreneurship, self-efficacy is identified as the most significant determinant of entrepreneurial activities, guiding the entrepreneur's actions, attitudes, and decisions as they navigate the path to establishing a new enterprise or realizing entrepreneurial objectives [7-9]. Entrepreneurship is recommended in the pharmacy curriculum, but the implementation mechanisms of the program with an emphasis on the development of practical skills require more studies [10].

In a comprehensive study by Valerio et al., 230 entrepreneurship education programs were assessed, and the outcomes suggested that these programs significantly enhance both the entrepreneurial skills and the entrepreneurial intention of students. This research underscores the positive impact of structured entrepreneurship education on learners' readiness to engage in entrepreneurial activities [3]. Furthermore, Makizadeh's findings show that entrepreneurship training is effective in promoting the belief in students' capabilities to engage with entrepreneurial ventures and promote the tendency of students to pursue entrepreneurship as a viable career option [4]. The studies indicate that entrepreneurship and business education are effective in improving the self-efficacy belief that is crucial for students who aim to engage in entrepreneurship. The findings suggest that when students have the confidence that they can succeed in entrepreneurship, they are more inclined to be involved in entrepreneurial activity, thus perpetuating a cycle of entrepreneurial action, learning, and success [4, 11].

In recent years, the game-based learning approach and gamification have been introduced as an effective method

in teaching creativity, entrepreneurship, and business skills [12]. Game-based learning is a popular method in curricula known as "serious games," "educational games," and "gamification" in medical science education systems [13]. Gamification is a balanced combination of challenge and learning that uses competitive elements, feedback mechanisms, and fun to actively engage learners in learning. Gamification through spaced repetition and feedback provides active participation, a sense of independence, and positive experiences for learners [14]. The method provides opportunities for team members to learn a variety of tasks simultaneously [13]. Yang et al. used virtual simulation game learning in the development of entrepreneurial skills. Their results show that game design and the collaborative nature of the game process had a positive effect on student participation and skill development in entrepreneurship and business education [15]. Designing game environments through challenging situations promotes the "immersion flow experience in the game" that leads to improved learning outcomes in entrepreneurship education. This finding was confirmed by Grivokostopoulou et al., which shows that game-based learning activities can significantly improve students' knowledge and skills in entrepreneurship and management [16]. The significant impact of entrepreneurship and business education has been underscored; however, a well-structured program to nurture innovation and entrepreneurial skills tailored for pharmacists needs further studies [11, 17]. Mogul et al. advocate employing creative and collaborative methods to engage pharmacy students in entrepreneurial endeavors [17]. Shahiwala has proposed the integration of entrepreneurship education in the pharmaceutical sector, recommending project-based and problem-solving-centric approaches [18].

In the investigated context, entrepreneurship and business education within the pharmacy curriculum are often planned as non-core and perhaps neglected in some institutions. Effective entrepreneurial education through interactive and cooperative strategies, which can afford students practical experience in diverse entrepreneurship fields, is suggested [19–21]. In this study, the educational program used gamification for the first time in the investigated context.

The present study aimed to evaluate the effect of a gamified entrepreneurship and business education program on the learning and self-efficacy in entrepreneurship among pharmacy students. The research addresses the following key questions: [1] How does gamification as a pedagogical approach in entrepreneurship education affect students' learning and self-efficacy following the training [2]? Are there significant differences in students' learning and self-efficacy scores post-training based on gender, academic year, and age [3]? What is the relationship between students' learning and their scores of self-efficacy domains after completing the training?

Method

The quasi-experimental study was conducted at Shahid Sadoughi University of Medical Sciences.

Participants

The participants included 5th- and 6th-year pharmacy students in internship courses across industrial, community pharmacy, and hospital settings. Out of 176 eligible students in the school, 86 were randomly selected to participate. They participant cohort comprised 27 male students (31.4%) and 59 female students (68.6%). Among the participants, 46 were in their 5th year of pharmacy (53.5%), while 40 were in their 6th year (46.5%). The average age of the students was 25 years (\pm 3 years).

Educational intervention

Gamification, project-based learning, and group discussion methods were implemented in the educational intervention.

Development of the education program

The education program was designed through a comprehensive review of the literature and expert consensus. Initially, frameworks for entrepreneurship in pharmacy education, such as a framework for entrepreneurship in pharmacy education and the educational outcomes of the Center for the Advancement of Pharmacy Education, were examined [1, 22]. In addition, various business plan models were reviewed to develop the board game platform.

Subsequently, the findings were discussed in an expert panel comprising specialists in entrepreneurship (n = 2), pharmacy (n = 3), and health professions education (n = 1). During these discussions, the program's components—including educational objectives, strategies, teaching-learning methods, and assessment techniques—were developed. The draft program was then evaluated by a broader group of experts (n = 12) with an average of 15 (± 2) years of experience in pharmacy entrepreneurship. Their feedback was reviewed and incorporated into the program, finalized, and confirmed through consensus. An overview of the educational program is presented in Table 1.

Gamification features and game structure

The gamification method was designed using game elements, including badges/scores, competition, risk/ challenge, the entrepreneurial storyline in different pharmaceutical fields, a puzzle method, a collective approach with multiplayer, and providing feedback.

Table 1 Overview of the entrepreneurship and business program in pharmacy education

Educational Objectives Educational Content [1, 22]		 Upon completion of the program, students will be able to: 1. Develop innovative concepts grounded in the principles of entrepreneurship and the pharmaceutical field. 2. Construct a comprehensive business plan for their ideas using the Canvas Model, addressing key components such as customer segments, value propositions, revenue streams, and cost structures. 3. Demonstrate improved self-efficacy in entrepreneurial competencies, including problem-solving, critical thinking, and the ability to navigate challenges in business development. 					
		 -Idea generation -Identifying opportunities and challenges from idea to entrepreneurship -Financial managem -Executive management -Business, market, and product management -Business environment in pharmacy -Cost structure -Revenue streams -Effective presentation in the business process -Business plan based on the Canvas Model 					
Teaching-Learn- ing Methods	Workshop (8 sessions)	 Didactic Education: Students received foundational training on the principles of entrepreneurship in the pharmaceutical business through didactic teaching methods. Discussion on Business Plan Components (Canvas Model): The nine blocks of the Canvas Model, covering the main areas of a business plan (e.g., customer segments, value propositions, revenue streams, and cost structures), were discussed in small groups. -Students analyzed real-world examples and case studies of entrepreneurship and business in the pharmaceutical field, applying the principles of entrepreneurship. 					
	Gamification (10 sessions)	 Gamification Steps: Group Formation: Students were divided into groups of 5–7 members Idea Generation: Each group developed an innovative idea for entrepreneurship or business development in the pharmaceutical field, addressing areas such as the pharmaceutical industry, clinical pharmacy, or community pharmacy. Idea Presentation: Groups presented their ideas to the class. Expert Assessment: An entrepreneurship expert evaluated the ideas based on criteria such as innovation, feasibility, and scientific merit, providing constructive feedback. Idea Finalization: Groups refined their ideas based on the expert's feedback. Leaderboard Update: Points for each group were recorded on a leaderboard to track progress and maintain engagement. Puzzle Completion: Groups collaboratively completed the puzzle of their business plan using the Canvas Model. Business Presentation: Students presented their completed puzzles, adhering to the principles of effective business presentation. Critical Analysis: The expert and students critically analyzed each group's puzzle, discussing strengths, weaknesses, and risks. Feedback was provided to further refine the projects. Scoring: Each of the four segments of the puzzle was scored. Final Leaderboard Update: The points for each group were updated on the leaderboard, concluding the gamified activity. 					
Assessment	ent -Self-Assessment of self-efficacy in entrepreneurship -Project-based assessment						

The program incorporated the Canvas Model as a foundational tool for the board game component. The Canvas Model is a strategic management framework to design, test, build, and manage scalable and profitable business models. It consists of nine blocks that address five core areas of a business: customer segments, value propositions, channels, customer relationships, and revenue streams [23, 24].

The nine blocks of the Canvas Model include:

1. Customer Segments: Defines the specific groups of individuals or organizations the business aims to serve.

- 2. Value Propositions: Describes the bundle of products or services that create value for a specific customer segment.
- 3. Channels: Outlines how the company communicates with and delivers value to its customer segments.
- 4. Customer Relationships: Explains the types of relationships the company establishes with each customer segment.
- 5. Revenue Streams: Represents the income generated from each customer segment, accounting for associated costs.
- 6. Key Activities: Identifies the most important actions required to execute the business model.

- 8. Key Partnerships: Lists the network of suppliers and partners that support the business.
- 9. Cost Structure: Details the major costs incurred while operating the business model.

This structured approach provided students with a comprehensive understanding of business model development and its application in the pharmaceutical context.

Program implementation

First Step: Didactic and Small Group Training.

The program began with training on the principles and processes of entrepreneurship in the pharmaceutical business. This phase utilized didactic teaching methods combined with small group discussions to ensure a foundational understanding of key concepts.

Second Step: Idea Generation.

In the next phase, Students were tasked with generating innovative ideas for entrepreneurship or business development within the pharmaceutical field. These ideas were required to address one of three areas: the pharmaceutical industry, clinical pharmacy, or community pharmacy. Each idea was presented by the students and evaluated by an entrepreneurship expert. The evaluation criteria included the innovation of the idea, its feasibility, and its foundation in scientific merit. Points for each group were recorded on a leaderboard.

Third Step: Collaborative Puzzle Completion and Presentation.

In the next phase, students engaged in a gamified activity centered around completing a puzzle based on the Canvas business model. Students then worked collaboratively in groups to complete the different components of the puzzle corresponding to their proposed idea. Following this, they presented their completed puzzles, adhering to established principles of business presentation. Each segment of the puzzle was critically analyzed by both the entrepreneurship expert and the students. This process allowed students to participate in evaluating the strengths, weaknesses, and risks associated with each idea. Feedback was provided to each group by the business expert to refine their projects.

Final Step: Scoring and Leaderboard Update.

Each of the four segments of the puzzle was assessed, ensuring a structured and objective evaluation. The scores from each segment were aggregated, and the final points for each group were recorded on the leaderboard, maintaining a competitive and engaging learning environment.

This structured approach combined theoretical knowledge with practical application, fostering critical thinking, collaboration, and innovation among students while providing a realistic simulation of entrepreneurial processes in the pharmaceutical sector.

Study duration

The intervention was implemented every week over six months.

Evaluation of students

Student learning was evaluated through a project-based examination, which required them to develop and complete a business canvas as part of the assessment. The projects were evaluated by an expert in the field of entrepreneurship. Additionally, students' self-efficacy was measured through a self-assessment questionnaire administered one month following the completion of the intervention.

Study measures

Students' self-efficacy using the De Noble questionnaire was completed by each participant before and after the educational program. This questionnaire contains 23 items in six domains, including developing new product and market opportunities, building an innovative environment, initiating investor relationships, defining core purpose, coping with unexpected challenges, and developing critical human resources [25]. The instrument utilized in this study was validated in Iran by Khalili, with its reliability confirmed through internal consistency (Cronbach's Alpha = 0.93) [26]. To ensure its applicability to the pharmaceutical entrepreneurship context, the content validity of the questionnaire was further investigated. An electronic form for validity assessment was distributed to 15 pharmacy students and experts, who were asked to evaluate the relevance and appropriateness of the items for use in the pharmaceutical entrepreneurship field. The quantitative content validity of the questionnaire was assessed using the "Content Validity Ratio" (CVR) and "Content Validity Index" (CVI). Experts were requested to evaluate the necessity of each question based on a three-level spectrum (necessary, useful but not necessary, and not necessary). The minimum acceptable CVR value was determined using the Lawsche Table [27]. Furthermore, the relevance of each question was assessed using a four-point Likert scale to calculate the CVI [28]. The results demonstrated that all questions achieved CVR values above 0.49 and CVI values above 0.79, confirming the quantitative and qualitative content validity of the questionnaire for use in pharmaceutical entrepreneurship. This validation was further endorsed by an expert panel.

To assess the internal consistency of the questionnaire, 30 students participated in a pilot study. The analysis revealed a Cronbach's Alpha value of 0.89, indicating high internal consistency. A Cronbach's Alpha value of 0.70 or

 Table 2
 The students' scores of self-efficacy in entrepreneurship

Domains	Pre-test	Post-test	P-	
	Mean ± SD	$Mean \pm SD$	Value	
Developing new product and market opportunities	12.36±3.14	19.05±3.15	0.0001	
Building an innovative environment	6.48±1.88	11.90±1.64	0.0001	
Developing critical human resources	6.96±1.77	11.91±2.05	0.0001	
Initiating investor relationships	6.73 ± 1.79	7.34 ± 1.73	0.012	
Coping with unexpected challenges	8.45±2.50	11.54±2.22	0.0001	
Defining core purpose	5.13 ± 4.50	7.84 ± 1.49	0.0001	
Total	46.11 ± 2.59	69.58 ± 2.04	0.0001	
Pair t-test				

above is considered acceptable for scales, while a value of 0.80 or higher signifies satisfactory overall reliability [29]. These results confirm the reliability and validity of the instrument for measuring the intended constructs in the pharmaceutical entrepreneurship context (Appendix 1).

The project-based examination was scored using a 10-item checklist, which was developed based on the key components of the Canvas model. These components included customer segments, customer relationships, value propositions, key activities, key partners, distribution channels, key resources, revenue streams, cost structures, and idea generation. The qualitative content validity of the checklist was confirmed through review by a panel of 10 experts in pharmacy and entrepreneurship. A pilot evaluation of the project was conducted using this checklist. Each item on the checklist was scored on a scale of 0 to 10, resulting in a total possible score range of 0 to 100. Higher scores reflected a greater level of effective learning among the students.

Data analysis

Data were analyzed using descriptive tests (Mean, SD, and Percentage). Pearson's correlation coefficient was employed to examine the relationship between total learning scores, self-efficacy scores, and age. A paired t-test was conducted to compare students' scores before and after the intervention, while an independent t-test was used to analyze differences in scores based on gender and academic year. Moreover, regression analysis was utilized to explore the relationship between the dependent variable (learning) and independent variables (e.g., self-efficacy domains, age, gender). Statistical significance was set at the 0.05 level. All analyses were performed using IBM SPSS Statistics, Version 21.0.

Results

The students' learning scores were reported as 89.93 ± 5.66 . The scores of students' self-efficacy areas were reported as 46.11 ± 2.59 before and 69.58 ± 2.04 after the training program. (P-value = 0.0001). (Table 2).

The results of the regression test showed the students' learning scores with self-efficacy scores in the domain of "initiating investor relationships" had a negative correlation (p = 0.005), and their scores in the domain of 'coping with unexpected challenges' had a positive correlation (p=0.03) according to the crude model. In the regression analysis, the initial examination of the relationship between the domain of "developing new product and market opportunities" and self-efficacy scores yielded no significant findings. However, after adjusting for age, gender, and academic year of students, a significant relationship was revealed. The findings indicated that an increase in the self-efficacy scores in the "developing new product and market opportunities" domain is associated with an average increase of 0.6 in individuals' learning scores. Moreover, an increase in the self-efficacy scores in the "initiating investor relationships" domain is associated with an average decrease of 1.45 in students' learning scores. (Table 3).

The results showed no significant difference in students' learning scores (p=0.4) and self-efficacy scores (p=0.14) by gender. Also, there was no significant difference between students' learning scores (p=0.08) and self-efficacy scores (p=0.20) by academic year. The results showed no significant relationship between age

Table 3 The relationship between the self-efficacy domains and entrepreneurship learning scores of pharmacy students

Domains	Model 1*				Model 2**			
	Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients	
	В	Std. Error	Beta	Sig.	В	Std. Error	Beta	Sig.
Developing new product and market opportunities	0.47	0.30	0.26	0.11	0.64	0.30	0.36	0.03
Building an innovative environment	0.31	0.49	0.09	0.53	0.24	0.48	0.07	0.62
Developing critical human resources	-0.30	0.42	-0.10	0.48	-0.27	0.42	-0.09	0.52
Initiating investor relationships	-1.43	0.50	-0.43	0.005	-1.45	0.49	-0.44	0.004
Coping with unexpected challenges	0.68	0.31	0.26	0.03	0.36	0.34	0.14	0.28
Defining core purpose	-0.77	0.63	-0.20	0.22	-0.95	0.63	-0.25	0.13
*Model 1: Crude (including Self-efficacy domains); R **Model 2: Adjusted for gender, age, and academic v	= 0.38, R Sq /ears: <i>R</i> = 0.4	uare = 0.144, Adju 45, R Square = 0.	usted R Sq 198. Adius	uare = 0.068 ted R Squai	8 re=0.103			

and students' learning scores (p = 0.80) and self-efficacy scores (p = 0.6).

Discussion

The present results showed that the educational program based on gamification improved students' self-efficacy and learning about entrepreneurship and business. The results sugges that scores in domains initiating investor relationships, coping with unexpected challenges, and developing new product and market opportunities were associated with the students' learning scores.

Entrepreneurship and business education involves the intentional transfer of critical knowledge and information for entrepreneurship aimed at improving learners' attitudes, skills, and abilities. Entrepreneurial skills encompass a complex set of interrelated elements. Students must acquire diverse skills across business domains, including customer engagement, creative thinking, and an understanding of business processes and regulations. Learners are expected to understand the steps of idea generation and business processing in various pharmaceutical sectors, such as pharmacy services, sales, and innovative production. Mastery of tax, legal, and financial aspects in their fields is crucial. Therefore, education needs to offer hands-on application opportunities where learners practice the application of business and financial principles across pharmaceutical fields. Gamification enhances complexity and active learning, allowing learners to practice skills in a safe environment [14]. The present study's integration of gamification and interactive and project-based approaches in entrepreneurship and business education has proven effective in enhancing pharmacy students' learning and self-efficacy. By creating a motivational and collaborative environment, students are better prepared to navigate the challenges of entrepreneurship and possess the necessary skills to develop innovative solutions in their future careers. The findings reinforce the significance of experiential learning, feedback, and gamification in entrepreneurship education, providing students with the opportunity to actively participate in all stages of the entrepreneurial process and receive feedback. Memar et al. (2021) used "Strategic Business" to teach entrepreneurship effectively, stimulating analytical skills, improving student interaction, and increasing learning quality [30].

The incorporation of a puzzle game format in the form of a business canvas proved beneficial in teaching students the principles of business canvas development, which is essential in the initial phases of entrepreneurship activities in pharmaceuticals. The findings are consistent with Aparicio et al.'s meta-analysis, which revealed that entrepreneurship and business education positively affect entrepreneurial knowledge, ability, and intention. The meta-analysis involved the synthesis of various studies, demonstrating a strong correlation between entrepreneurship and business education and the enhancement of entrepreneurial competencies [21]. In addition, the present study's findings align with those of Gatwood et al., who found that a team project-based approach in compiling a business environment within the pharmaceutical field led to a deeper understanding of the relationship between the commercialization of pharmacy practice and practical problem-solving in business. This approach not only fostered a better comprehension of the principles and concepts of commercialization in pharmacy but also positively influenced students' understanding of pharmaceutical management and the commercial aspects of pharmaceuticals. Consequently, their results contributed to the enhancement of students' readiness for innovative performance after graduation [31]. The present results showed entrepreneurship and business education play a vital role in developing pharmacy students' entrepreneurial knowledge and intention, as suggested by Aparicio et al.'s meta-analysis [21]. The improvement in self-efficacy scores across various examined domains, such as identifying opportunities, creating an innovative environment, developing human resources, relationships with investors, coping with unexpected challenges, identifying the main goal, and entrepreneurial intention, provides evidence for the effectiveness of systematic entrepreneurship and business education in empowering pharmacy students to pursue business and entrepreneurial ventures in the future.

Self-efficacy in entrepreneurship is recognized as a conscious belief of a person who wants to start a risky business in the future to increase value and earn a profit. Entrepreneurship self-efficacy is introduced as a key factor in the formation and occurrence of entrepreneurial behavior [32, 33]. Since the development of self-efficacy in entrepreneurship requires experience and practice, educational programs require providing situations where students experience active participation in all stages of the implementation of an entrepreneurial process. The students need to practice and receive feedback to understand the consequences of their decision. Creating a motivational and collaborative environment in idea generation and entrepreneurship activities optimizes learner's self-efficacy. The present method to enhance self-efficacy among pharmacy students through gamification and a team project-based approach in entrepreneurship and business education aligns with the growing body of research emphasizing the importance of experiential learning and feedback in developing entrepreneurial competencies. By integrating game elements and projects into the learning process, students grasp the intricacies of Canvas' business plan development and experience active participation in the entrepreneurial process. This immersive approach facilitated a better understanding of the consequences of their decisions and allowed them to practice and refine their entrepreneurial skills. The motivational and collaborative environment fostered by the gamification in the learning process has generated positive outcomes in terms of students' self-efficacy. Casau's systematic review further supports the effectiveness of game-based learning and gamification in entrepreneurship education, highlighting the method's potential to enhance students' entrepreneurship competencies [12]. Moreover, the study by Aries et al. (2020) on entrepreneurship courses with a business plan in online education confirmed the positive impact of gamification on students' self-efficacy in entrepreneurship. Their findings indicate that gamification can influence students' attitudes toward entrepreneurship, perceived behavioral control, and subjective norms, ultimately leading to an increase in self-efficacy [20]. These results underscore the importance of incorporating gamification into entrepreneurship and business education to cultivate students' entrepreneurial mindset and skills.

The present results indicated that students' entrepreneurship scores had a positive and significant relationship with their self-efficacy in "coping with unexpected challenges." The skill of coping with unexpected challenges demonstrated a positive correlation with entrepreneurship self-efficacy scores. This finding highlights the importance of resilience and adaptability in encountering unforeseen obstacles, which are essential qualities for entrepreneurial success. Tolerance for unpredictable changes in business conditions, working under constant stress, pressure, and conflict, and resilience in the face of difficulties in this field were evaluated in the domain. Entrepreneurship is associated with facing various risks and ambiguous and challenging conditions. In the field of entrepreneurship, developing risk-taking and tolerance skills is necessary. The gamification method, by creating opportunities for discussion and exchange of ideas regarding different risks and the practical method to manage them, led to improved beliefs in tolerance and resilience in the pharmaceutical business. Zichella's research highlights the benefits of game-based learning in educating students about entrepreneurship, especially regarding the cognitive processes of decision-making in financial risks. The game emphasizes cognitive biases, like the prior profit effect and risk degree, contributing to amplified student awareness of financial risks [34]. Both studies underline the importance of engaging students in active learning situations. Students in gamified entrepreneurship courses need to understand and manage the financial and legal risks associated with pharmaceutical fields. They require learning about risks, their implications, how to manage them, and the pertinent national and international regulations. The interactive nature of these learning methods ensures that students not only learn theoretical concepts but also apply them practically, which can enhance their understanding and retention of knowledge. Furthermore, by allowing students to analyze and learn from the risk and regulatory aspects of other groups' ideas, they are given a comprehensive learning experience that simulates real-world business environments.

In the gamification teaching method, the students had to examine the different domains of their central idea from the market, value creation, and customer domains inseveral sessions and think about its details. Also, the opportunity to critically evaluate the ideas of other groups and explain the risks and domains of the market, financial affairs, and business details of each idea had a positive impact on the growth of students' belief in developing new products and market opportunities. In the 'developing new product and market opportunities' domain, students' self-efficacy was assessed related to identifying new market opportunities for new services and products, producing products to meet unmet customer needs, finding new ways to improve existing products, designing products to solve current problems, and identifying potential growth areas. The present results showed that gamification and critical appraisal of different projects have significantly improved this skill among students. Mogul et al. designed a course to encourage innovation and entrepreneurship in pharmaceuticals. Students were asked to design an innovative clinical service in a work team to solve pharmacy problems. The findings revealed that a majority of participants reported an enhanced understanding of the role of pharmacy in developing innovative pharmaceutical services. Moreover, 86% tend to be involved in innovative opportunities for pharmaceutical services in their future career. Their results showed that entrepreneurial projects lead to a better understanding of the role of pharmacists in pharmaceutical activities [17]. Shahiwala's findings suggest that integrating active student participation in team projects, such as compiling the business landscape and employing the SWOT method, into educational programs fostered students' entrepreneurial thinking. These initiatives, coupled with problem-based learning focused on societal and professional challenges, help students grasp the various elements influencing business risk creation and better prepare them for the entrepreneurship landscape. The learning methods effectively cultivate students' entrepreneurship-related skills and knowledge [18].

The current findings demonstrated a negative correlation between students' learning scores and their selfefficacy in building relationships with investors. This domain assessed self-efficacy in three areas: establishing connections with key individuals linked to capital sources, maintaining relationships with potential investors, and identifying potential funding opportunities for investment. The negative correlation observed in the domain of relationships with investors suggests that an overemphasis on cultivating such relationships may not inherently improve students' self-efficacy in entrepreneurship. This finding highlights the need for further investigation to explore the underlying factors contributing to this relationship and to develop strategies that align students' perceptions with other essential entrepreneurial competencies. The negative association raises concerns, particularly in light of students' strong belief in the pivotal role of investment in the success of pharmaceutical businesses. This perception may overshadow the development of other critical skills and knowledge necessary for entrepreneurial success, warranting a more balanced approach to entrepreneurship education. The market and business climate, the lack of economic stability, and favoritism in the business of the field of pharmaceuticals may affect the students' belief about the high impact of the role of investors in the success of entrepreneurship in pharmaceuticals. In line with the present study, Hosseinzadeh et al. showed that the high attractiveness of employment and dependence on government systems in fulfilling career and systemic factors may affect students' self-efficacy and entrepreneurship intention [19]. Further studies are recommended regarding the factors affecting the self-efficacy of pharmacy students in entrepreneurship.

Limitations

This study utilized a quasi-experimental design, which carries inherent limitations, including the absence of a control group. Furthermore, the small sample size and the restriction to a single year of data collection constrained the depth and generalizability of the findings. The specific business laws, financial regulations, and economic environment of the studied context may have influenced students' thought processes and self-efficacy in entrepreneurship. These contextual factors limit the generalizability of the results to settings with similar legal, financial, and cultural frameworks.

Conclusion

Gamification in entrepreneurship education has demonstrated a positive effect on enhancing the learning and self-efficacy of pharmacy students. This approach facilitates a holistic understanding of the commercial landscape within the pharmaceutical sector and equips students with the skills necessary for innovative performance in their future careers. The findings of this study indicate that gamification strategies significantly improved students' self-efficacy and learning in entrepreneurship. The results highlighted that students' self-efficacy scores in entrepreneurship influenced their ability to initiate investor relationships, navigate unexpected challenges, and identify new product and market opportunities. Consequently, the development of business and entrepreneurial competencies among pharmacy students is recommended, with gamification and cooperative, active learning methods as effective tools in entrepreneurship and business education.

Supplementary Information

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Supplementary Material 1

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Author contributions

F.K. conceptualized and designed the study and collected the data. F.K. analyzed the data. F.K. wrote the main manuscript text. The author met the criteria for authorship and played a role in preparing the manuscript. Also, author approved the final manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The present study was approved by the Research Ethics Committee at the National Agency for Strategic Research in Medical Education, Tehran, Iran. (ID: IR. NASRME. REC. 1403.013). All participants were provided with information on the study. The written consent forms were obtained from all participants. The work was conducted following the Declaration of Helsinki. The author applies to the use of basic tools, such as Al tools used to check grammar. The author reviewed and edited the content as needed and took full responsibility for the content of the published article.

Consent for publication

Not applicable.

Competing interest

The authors declare that they have no competing interests.

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References

- Mattingly TJ, Abdelwadoud M, Mullins CD, Eddington ND. Pharmapreneur– Defining a framework for entrepreneurship in pharmacy education. Am J Pharm Educ. 2019;83(10).
- 2. Brazeau G. Entrepreneurial spirit in pharmacy. Am J Pharm Educ. 2013;77(5).
- Valerio A, Parton B, Robb A. Entrepreneurship education and training programs around the world: dimensions for success. Washington, D.C: World Bank; 2014.
- Makizadeh V, Khorram R, Bahri S, Sharaei F. The role of entrepreneurship education and teacher creativity on the entrepreneurial intention of students of hormozgan marine higher education centers. J Res Manage Teach Mar Sci. 2021;7(4):1–15.
- Tony OA. Entrepreneurship education: challenges and implications for educators in higher education institutions. Int J Inform Bus Manage. 2016;8(2):307.
- Hynes B, Richardson I. Entrepreneurship education: A mechanism for engaging and exchanging with the small business sector. Educ + Train. 2007;49(8/9):732–44.
- Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychol Rev. 1977;84(2):191–215.
- Bandura A. Self-efficacy in changing societies. New York: Cambridge University Press; 1995.
- Bandura A, Adams NE. Analysis of Self-efficacy theory in behavior change. J Cogn Therapy Res. 1987;1:287–310.
- 10. Afeli SA, Adunlin G. Curriculum content for innovation and entrepreneurship education in US pharmacy programs. Ind High Educ. 2022;36(1):13–8.
- Mattingly TJ, Mullins CD, Melendez DR, Boyden K, Eddington ND. A systematic review of entrepreneurship in pharmacy practice and education. Am J Pharm Educ. 2019;83(3).
- 12. Casau M, Dias MF, Amorim M, editors. Entrepreneurship and game-based learning in Higher Education: a systematic review. European Conference on Games Based Learning. 2023.
- Graafland M, Schraagen JM, Schijven MP. Systematic review of serious games for medical education and surgical skills training. J Br Surg. 2012;99(10):1322–30.
- 14. Xu M, Luo Y, Zhang Y, Xia R, Qian H, Zou X. Game-based learning in medical education. Front Public Health. 2023;11:1113682.
- Yang Q, Zhang Y, Lin Y. Study on the influence mechanism of virtual simulation game learning experience on student engagement and entrepreneurial skill development. Front Psychol. 2022;12:772157.
- Grivokostopoulou F, Kovas K, Perikos I. Examining the impact of a gamified entrepreneurship education framework in higher education. Sustainability. 2019;11(20):5623.
- Mogul A, Laughlin E, Lynch S. A co-curricular activity to introduce pharmacy students to the concepts of innovation and entrepreneurship. Am J Pharm Educ. 2020;84(8).
- Shahiwala A. Entrepreneurship skills development through project-based activity in bachelor of pharmacy program. Currents Pharm Teach Learn. 2017;9(4):698–706.
- Hosseinzadeh F, Imani R, Chekeni AM, Anvari H, Gh R, Heidari-Soureshjani R. Entrepreneurship in nursing: a literature review. J Med Educ Dev. 2023;18(1):359–78.

- Aries A, Vional V, Saraswati L, Wijaya L, Ikhsan R. Gamification in learning process and its impact on entrepreneurial intention. Manage Sci Lett. 2020;10(4):763–8.
- 21. Aparicio G, Iturralde T, Maseda A. Conceptual structure and perspectives on entrepreneurship education research: A bibliometric review. Eur Res Manage Bus Econ. 2019;25(3):105–13.
- 22. Medina M, Plaza C, Stowe C et al. Center for the Advancement of Pharmacy Education Educational Outcomes. Am J Pharm Educ. 2013;77(8):162–72.
- Debarliev S, Mitrovska S. Creating Distinctive Value Proposition in Tourism by Business Model Tools: Case Study of the City of Ohrid. European Scientific Journal, ESJ. 2016.
- 24. Mustaniroh S, Prabaningtias N, Citraresmi A, editors. Analysis of business development strategies with business model canvas approach. IOP Conference Series: Earth and Environmental Science; 2020: IOP Publishing.
- De Noble AF, Jung D, Ehrlich SB. Entrepreneurial self-efficacy: the development of a measure and its relationship to entrepreneurial action. Front Entrepreneurship Res. 1999;1999(1):73–87.
- 26. Khalili Khezrabadi M, Hassani M. The impact of entrepreneurship education and entrepreneurial social identity on entrepreneurial intention of university students; the mediating role of entrepreneurial Self-Efficacy. Educ Manage Entrepreneurship. 2023;1(1):1–18.
- 27. Lawsche C. A quantitative approach to content validity. Pers Psychol. 1975;28(4):563–75.
- Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Res Nurs Health. 2006;29(5):489–97.
- 29. Taber KS. The use of Cronbach's alpha when developing and reporting research instruments in science education. Res Sci Educ. 2018;48:1273–96.
- Memar N, Sundström A, Larsson T. Teaching causation and effectuation in the large classroom: A production–trade game. J Manage Educ. 2021;45(3):438–78.
- Gatwood J, Hohmeier K, Farr G, Eckel S. A comparison of approaches to student pharmacist business planning in pharmacy practice management. Am J Pharm Educ. 2018;82(5).
- 32. Nabi G, Liñán F. Graduate entrepreneurship in the developing world: intentions, education and development. Educ + Train. 2011;53(5):325–34.
- Safa L, Mangeli N. The effect of entrepreneurial self-efficacy on agricultural students' entrepreneurial intention at university of Zanjan. J Agricultural Educ Adm Res. 2015;7(33):3–15.
- 34. Zichella G, Reichstein T. Students of entrepreneurship: sorting, risk behaviour and implications for entrepreneurship programmes. Manage Learn. 2023;54(5):727–52.

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