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Original Article

Startup-Based Learning as an Innovative Method for Pharmacy Education: Medicinal Plants Course Model

Ehsan Amiri-Ardekani[1,2,3], PharmD; Mohammad Hasan Keshavarzi[4], PhD; Seyed Aliakbar Faghihi[4], PhD; Parmis Badr[5], PharmD, PhD; Mohammad Mehdi Zarshenas[1], PharmD, PhD; Zohreh Abolhassanzadeh[6], PharmD, PhD; Abdolali Mohagheghzadeh[1,2], PharmD, PhD

[1]Department of Phytopharmaceuticals (Traditional Pharmacy), School of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran;
[2]Student Association of Indigenous Knowledge, Shiraz University of Medical Sciences, Shiraz, Iran;
[3]Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran;
[4]Clinical Education Research Center, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran;
[5]Pharmaceutical Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, Iran;
[6]Medical Plants Research Center, Basic Health Sciences Institute, Shahrekord University of Medical Sciences, Shahrekord, Iran

Correspondence:
Abdolali Mohagheghzadeh, PharmD, PhD;
Pharmaceutical Sciences Research Center, Karafarin Ave., Postal code: 1583-71345, Shiraz, Iran
Tel/Fax: +98 71 32426070
Email: mohaghegh@sums.ac.ir
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What's Known

- Entrepreneurship can be taught to students.
- Multiple pharmacy schools now offer entrepreneurial programs, where students can complete additional entrepreneurial coursework in a pharmaceutical context.

What's New

- The simulated business model can create entrepreneurial spirit, familiarize students with the business environment, and help them observe and interact with the market and health system experts.
- Startup-based approaches can provide interest in educational content for students and help them prepare for the job market.

Abstract

Background: Familiarizing students with knowledge-based businesses is one of the goals emphasized in the developed educational systems worldwide. This study aimed to design a startup-based learning model (SBL).

Methods: As a qualitative research study, startup teams were formed by the pharmacy students of Shiraz University of Medical Sciences in 2020. This model was used to train 120 students as pharmaceutical entrepreneurs through related lectures, simulations, and field activities. We employed this model for students to become familiar with the various stages of examining market needs, knowledge-based company registration, intellectual property, logo design, and even pharmaceutical product development. Students' feedback was assessed with a questionnaire designed by the team of researchers, and its results were used to analyze the course and improve the quality of the proposed model.

Results: Most of the studied indices revealed that the students rated this model as good or excellent. Satisfaction with more important indices includes student creativity and ideation in educational activity (60.7%), attractive presentation (60.4%), teamwork among learners (62.2%), appropriateness of evaluation method (65.4%), understanding how to make herbal remedies (49.1%), learner participation in the educational activity (74.8%), entrepreneurial motivation (60.7%), and applicability (64.4%).

Conclusion: We found this model effective in boosting students' satisfaction, creativity, and entrepreneurial spirit. Lecturers also play a facilitator role in addition to specialized training. Therefore, in this model, both lecturers and students can grow more and make education more attractive. This study, for the first time, demonstrated that SBL could be applied in education systems and make the students more interested in educational content and help them to prepare for the job market.

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Introduction

Entrepreneurship education aids students to think outside the box and nurture talents and skills. The importance of entrepreneurship

has been recognized in both theory and practice to create opportunities for ensuring social justice and stimulating the economy. Entrepreneurial outcomes in education have referred to new business startups, venture development, and job creation contributing to economic growth and development.[1, 2] It is important to know that entrepreneurship can be taught through experience and discovery, such as hands-on experience or learning by doing.[3-6] European Commission Education and Training Committee lists improving creativity and innovation, consisting of entrepreneurship, as its fourth long-time strategic goal.[7, 8]

The more pharmacy students experience exposure to entrepreneurship, the better job performance they indicate.[9] Although entrepreneurship abilities are not included amongst pharmacists' skills, diverse pharmacy faculties are currently teaching and using innovation as a key issue in pharmacy practice.[10] The American Association of Colleges of Pharmacy suggests utilizing Rubino and Freshman's entrepreneurship competency clusters, including decision making, strategic thinking, risk-taking, confidence building, communicating ideas, motivating team members, tolerance of ambiguity, and internal locus of control, as a framework for developing a pharmacy entrepreneur.[11, 12] The center for the Advancement of Pharmacy Education included entrepreneurship within domains in 2013 to encourage the pharmacy schools in this area. Moreover, Accreditation Council for Pharmacy Education included entrepreneurship within the standards applied to evaluate professional pharmacy programs in 2016.[13, 14] In addition, in the new version of "Essential Competencies of Iranian Pharmacists", the entrepreneurial spirit of pharmacists has been emphasized.[15]

Several studies have described activities that students practice innovation and entrepreneurship skills in the classroom.[16, 17] Additionally, multiple schools now offer entrepreneurial programs in which students can complete additional entrepreneurial coursework in a pharmaceutical context.[16, 18, 19] We can refer to The Master of Science degree in Pharmaceutical Formulation and Entrepreneurship of the University College London School of Pharmacy as an example.[20] We can also refer to the graduate programs in Pharmacy Entrepreneurship, Leadership, and Management of the University of South Florida and the University of Georgia.[21, 22]

Programs of many pharmacy organizations and institutions reflect their desire to design and implement an entrepreneurial ecosystem for the profession of pharmacy.[23, 24] While the importance of entrepreneurism in pharmacy has been emphasized, the role of innovation and entrepreneurship within pharmacy practice and education and a consensus set of knowledge, attitudes, and skills of a pharmacist entrepreneur has not been explained enough.

To meet the needs of the pharmacists' society and prepare pharmacy students for the job market and industry, we developed a new instructional entrepreneurial course for PharmD students in the course of medicinal plants at Shiraz University of Medical Sciences, Shiraz, Iran.

Material and Methods

Ethical considerations, including informed consent, objective and procedures of the study, and confidentiality of personal information were considered and explained to all the students. The study received ethical approval from the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1399.911).

Setting and Participants

In this qualitative action research study, the researcher and colleagues proposed a new instructional design model to teach entrepreneurship to pharmacy students of SUMS in the spring and summer of 2020. This model is comparable with the ASSURE model (A: Analyze learners, S: State goals and objectives, S: Select methods and media, U: Utilize media and technology, R: Require learner participation, E: Evaluate and revise the blended learning strategy), the instructional design model presented by Heinich and others (table 1).[25] The ASSURE model is consistent with the constructivist approach, blending media and technology to enhance learning in the environment.[26] The ASSURE model consists of steps, including the analysis of learner characteristics, expressing goals, selecting methods and media, utilizing media, learner involvement, and assessment.[27]

In the Startup-Based Learning model (SBL), there are rules for the teaching method, such as how the class is managed, how the teachers interact and teach, and several others. Finally, we could compare the SBL with the ASSURE model as below.

The current study population was 120 students mostly during their fourth and sixth semester, including 62 male and 58 female students. In this post-test single-group study, a simulated SBL model in medicinal plants course was designed to teach entrepreneurship to PharmD students

Table 1: Comparison between ASSURE model and Startup-Based Learning model

ASSURE model steps	Expected activities in the SBL* model	Actions were taken in the course of medicinal plants
Analysis of learner characteristics	Providing student educational needs, communicating with industry, providing teacher training	Meeting with student agents and faculty members
Expressing goals	Setting the course goals	Explaining the objectives of the course and the teaching method
Selection of methods and media	Determining appropriate teaching methods for the course and learners	Using instructional videos, coordinating with companies and industries to facilitate coordination with students, holding a workshop for faculty members on how to teach and interact with students
Utilizing media	Applying planned lecture method, teamwork, participating in group discussion, simulated teaching, using social networking, preparing interactive online forms for discussion	Using entrepreneurial and motivational TED talks, providing e-learning content
Learner involvement	Performing activities and assignments to create innovative and creative thinking in the form of communication with industries, starting a KBC**, developing a KBC logo, producing a pharmaceutical product, and providing feedback to learners	Dividing students into small teams to start the project, defining the project for each team, familiarizing with the KBCs forms and completing them to start a KBC, team learning and participatory learning, creating a new startup KBC logo, preparing a pharmaceutical product with the participation of students and faculty members
Assessment	Achieving educational goals, testing the participants to assess knowledge and student satisfaction assessment questionnaire	Designing a questionnaire to measure satisfaction from educational content, teaching methods, practical tasks, and evaluation methods

SBL: Startup-based learning; KBC: Knowledge-based company

of SUMS. Based on the Cochrane formula considering 95% confidence level, the sample size was calculated 92. However, herein, all the study population was examined. Due to the small study size and semester duration, measures and improvements were made to the teaching and learning process to enhance learning and prepare learners for the business environment. To this end, with the help of the principal lecturer and PharmD students, a collaborative effort was undertaken over a semester.

After feeling the problem and recognizing the need for students to be present in the business environment and experience interacting with stakeholders and customers, the principal lecturer consulted with faculty members to design a new method of education, we call SBL, including seven steps:

Expressing Goals and Expectations by Providing Early Learning and Preparing Students' Minds for Startup Activities: Two themes of creativity and entrepreneurship played a key role in designing and implementing the model. Accordingly, at this stage, an explanation was given about the importance of paying attention to the market. Afterward, articles on the topic of replacing the new methods with the lecture-based method and the importance of entrepreneurship teaching in medical sciences education were presented to students.

One of the methods employed to educate the students at this stage was the broadcast of business-related videos from the TED Talk lecture series. These lectures explained the most important factors influencing the success of startup activities and complimented them by reviewing real examples.

To provide a rational view and ensure global trends to similar patterns, the oriental model of traditional product commercialization and some Iranian models of natural product development were discussed.

Teaching Ideation Techniques and Related Helpful References: After searching through each of the sources (ethnopharmacology, traditional medicine resources, and scientific articles), the students chose their suggested products according to patient compliance and considering the benefits of a successful medication. Among the benefits considered in choosing the finished product, the cost of the medication, the availability of other appropriate medications, and the ease of manufacturing were more important than others. Social networks were utilized for information exchange in this way.

Reviewing and Evaluating Ideas by the Members of Each Group under the Supervision of a Faculty Member: The students were classified into small groups based on their interests and personality traits. The groups were named and consisted of four to six pharmacy students. For a week, group members were allowed to relocate to enable the groups to become teams.

The members of each team suggested a faculty member as a supervisor to the principal teacher. The principal teacher managed the groupings; thereby enabling each faculty member to oversee three to four entrepreneurship teams. Afterward, each member was assigned tasks person, and each group selected their intended medication under the supervision of the faculty member. Tasks included reviewing information sources to determine goal medication, evaluating medication efficacy based on the scientific pieces of literature, supplying raw materials needed for medication preparation, administrative coordination, manufacturing process control, assigning TM, and packaging license application forms, and medication brochures.

Learning Legal Actions of a Knowledge-Based Company (KBC), such as Choosing a KBC Name, KBC Statute, and Intellectual Property Issues: The students were provided with explanations on how to do things, such as designing a logo and writing a statute. In this regard, the students completed the forms through team activities. The teams also discussed their policies to respect nature. Another topic discussed in the teams was how to have Halal income.

Drug Design based on Traditional Persian Medicine Manufacturing Principles and Modern Pharmaceutical Sciences: At this stage, the process of making the medication from the idea and laboratory studies to license was presented. A variety of studies investigating the efficacy of herbal medications and their differences were then discussed. Subsequently, the herbs used in the preparation of the medication prepared by each group in the form of herbarium or plant material were approved by the Herbarium of the School of Pharmacy of Shiraz University of Medical sciences, Shiraz, Iran.

Examining the KBC Licensing and Product Production Processes: The students first determined the characteristics of the product to obtain a production license in their team. Then, they filled out application forms for the medication, which included packaging licenses, product line licenses, herbal medicines licenses, TM and natural product licenses, and supplements licenses.

Teaching the Importance of Drug Brochures and Labels: One of the important points in preparing a product is a good brochure and label. For this purpose, brochures on some of the medicines available on the market were distributed to students, who were asked to review the brochure text and suggest any necessary corrections. Ultimately, the teams tried to design an appropriate label for their medications.

Data Collection and Analysis

The main issue in this project was the nature of the medicinal plants course closely related to the activities of the students after graduation with the industry and the labor market. The conventional method for teaching this course is lecture-based teaching. This new instructional design improved the learning of this course, linking education with the production process and training students for the job market. As this course is closely related to the labor market and industry and the need to move on the path of entrepreneurship, a new model called SBL was proposed.

Finally, the post-test evaluation of the course was performed. To this end, the researchers designed a 21-item questionnaire. The following was obtained from a student survey and the researchers' meeting on the questionnaire (table 1).

Statistical Analysis

The questionnaire was given to 10 Faculty members, and the Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated. At the end of the course, a survey was conducted to evaluate the students' views on conducting classes, teaching methods, practical work, and a simulated business educational design model. The statistical analyses of recorded data were done with the MS Office Excel 2019 (Microsoft Redmond Campus, Redmond, Washington, United States), and mean satisfaction was calculated.

Results

Cronbach's alpha was calculated to be 0.964, which was excellent, indicating the reliability of the questionnaire. CVR was calculated at 0.7. Since the obtained CVR value was more than 0.62, the content validity of the items was thus confirmed. CVI was also calculated for all the items, and the average was 0.8. Content validity was confirmed, as the CVI score was higher than 0.79. Out of the study population (120), 105 students completed the questionnaire; 49 were women, and 56 were men. The students in their sixth semester were 48 (45.71%), 55 (52.38%) students were in their fourth semester, and two (1.90%) students were in other semesters. The grade of 85 (80.00%) students was in the 8-10 (max=10) range followed by 19 (18.10%) students with a 6-8 grade, one (0.95%) student with a 4-6 range, one (0.95%) student in the 2-4 range, and no student's grade was under two.

The steps investigated in the material and methods section were taken to teach

Table 2: The results of the Startup-Based Learning model evaluation

Questions	Very weak n (%)	Weak n (%)	Fair n (%)	Good n (%)	Excellent n (%)
1. Quality of content presentation	8 (7.48%)	4 (3.74%)	24 (22.43%)	36 (33.00%)	37 (33.94%)
2. The applicability of course content	10 (9.35%)	9 (8.41%)	19 (17.76%)	33 (30.84%)	36 (33.64%)
3. The quality and content of the pamphlets and books presented	13 (12.04%)	10 (9.26%)	34 (31.50%)	28 (25.93%)	23 (21.30%)
4. The novelty of the educational material presented	3 (2.73%)	5 (4.55%)	18 (16.36%)	40 (36.36%)	44 (40.00%)
5. Promoting specialized knowledge through content	6 (5.67%)	10 (9.43%)	24 (22.64%)	32 (30.19%)	34 (32.07%)
6. The impact of the course on preparing the students for the job market and boosting entrepreneurial spirit	8 (7.48%)	15 (14.02%)	19 (17.76%)	27 (25.23%)	38 (35.51%)
7. Rhetoric and fluent presentation	7 (6.60%)	4 (3.77%)	12 (11.32%)	27 (25.47%)	56 (52.83%)
8. Professional knowledge of lecturer	4 (3.77%)	3 (2.83%)	11 (10.38%)	23 (21.70%)	65 (61.32%)
9. Time management during the course	11 (10.38%)	10 (9.43%)	14 (13.20%)	25 (23.58%)	46 (43.40%)
10. Diversity of educational content and teaching methods	3 (2.78%)	9 (8.33%)	18 (16.67%)	27 (25.00%)	51 (47.22%)
11. Learner engagement in the classroom	3 (2.80%)	8 (7.50%)	16 (14.95%)	23 (21.50%)	57 (53.27%)
12. The impact of the teaching method on understanding how to make herbal remedies	10 (9.10%)	17 (15.45%)	29 (26.36%)	30 (27.27%)	24 (21.82%)
13. Lecturer accompaniment during course	10 (9.26%)	5 (4.63%)	22 (20.37%)	33 (30.56%)	38 (35.19%)
14. Coordination of the traditional pharmacy department, including faculty members and staff	9 (8.33%)	13 (12.04%)	26 (24.07%)	22 (20.37%)	38 (35.19%)
15. Attractive presentation	11 (10.38%)	11 (10.38%)	20 (18.87%)	34 (32.08%)	30 (28.30%)
16. The appropriateness of the course evaluation method	10 (9.34%)	6 (5.60%)	21 (19.63%)	26 (24.30%)	44 (41.12%)
17. Teamwork among learners	6 (5.67%)	8 (7.55%)	26 (24.53%)	33 (31.13%)	33 (31.13%)
18. Learner motivation to participate in targeted activities	9 (8.41%)	18 (16.82%)	27 (25.23%)	30 (28.04%)	23 (21.50%)
19. Student involvement in the workplace and production process	14 (13.21%)	11 (10.38%)	31 (29.25%)	30 (28.30%)	20 (18.87%)
20. Student creativity and ideation in educational activity	6 (5.61%)	5 (4.68%)	31 (28.97%)	33 (30.84%)	32 (29.90%)
21. Students' willingness to commercialize the produced drug	15 (14.15%)	10 (9.43%)	26 (24.53%)	29 (27.36%)	26 (24.53%)

entrepreneurship. In each phase, the impact of actions in the educational environment was evaluated by the team of researchers (table 2).

Most of the studied indices revealed that the students rated this model as good or excellent. Satisfaction with more important indices includes student creativity and ideation in educational activity (60.7%), attractive presentation (60.4%), teamwork among learners (62.2%), appropriateness of evaluation method (65.4%), understanding how to make herbal remedies (49.1%), learner participation in the educational activity (74.8%), entrepreneurial motivation (60.7%), and applicability (64.4%).

Discussion

Herein, we considered good and excellent answers to be satisfactory results. The results showed that 60.7% of the students agreed that the teaching method offered in this course, included defining a project for developing a pharmaceutical product with simulated business and teamwork in small groups, has positively influenced their creativity. The evaluation of the novelty in the proposed model demonstrated a 76.4% satisfaction of the students. Quantitative research results from the questionnaire analysis revealed a 62.2% satisfaction with teamwork and participation during the course. The students' satisfaction with their engagement in the research was reported to be 74.8%. Based on question 20, it was found that 60.7% of students considered this course to be effective in their creativity, which is a significant result. We found that presenting entrepreneurship-related courses to students affects their entrepreneurial spirit. In this regard, 60.7% of students believed that this course effectively prepares students for the job market. The students' willingness to commercialize the produced drug showed their interest in this learning method. Our result indicates the importance of innovative content and teaching method shown by Torres and others.[28] These results were in accordance with previous studies, finding a positive relationship between

the perceptions of entrepreneurship education and innovation.[29-31] The results of this section are inconsistent with the results of the study by Oosterbeek and colleagues on college students learning entrepreneurial skills, revealing that their method hurt students' intention and attitude to be an entrepreneur.[32] Matlay and others found that students receive feedback in entrepreneurship teaching and the environment from their business customers. Therefore, they can analyze their rivals to gain a deeper understanding of the market.[33] Consequently, entrepreneurship training should be performed through a practical approach.[34, 35]

We could see the positive effect of this model on students' interest in the course of medicinal plants. The students in the model also worked as part of a team, trying to create a hypothetical KBC and experiencing all the stages of KBC registration, the legal licensing processes, and the conditions they would have to face in the future. In the SBL model, we can claim that the students have key roles in education, while faculty members have the facilitator role. This model has increased the satisfaction and interest of the students of the medicinal plants' course.

Despite all the advantages of this model, one of the major concerns of the researchers was the reduction in the content presented. Contrary to the initial expectation, based on evaluating students' opinions, it showed that students were 62.3% satisfied with the knowledge learned. It is recommended that future studies consider the impact of such methods on the examination results and evaluate students' opinions.

To the best of our knowledge, in addition to the importance of the executive model, the teacher's skill in presenting the content can also affect the efficiency of the model. For this reason, the teacher's performance was evaluated via questions 7-16. Based on the evaluation of the questions, satisfaction was seen in each indicator to be between 49.1% and 83%. This result demonstrates the effect of teachers' mindsets and teaching methods on students' creativity seen in the previous study of Paek and colleagues.[36] The role of the teacher in students' attitude toward entrepreneurial education has been implied in a study by Ruskovaara and others.[37]

In the last section of the questionnaire, the students answered an open-ended question. The results and analysis of students' opinions shed light on their interest in this method, which has increased their motivation to work in drug development.

Finally, we can discuss that a new form of relationship between theory and practice was accomplished in our study. By applying the simulated business design template for the course of medicinal plants, the students became familiar with the various stages of KBC name registration, intellectual property rights, logo design, and even product preparation. One of the conclusions of the current work is that the simulated business model can create entrepreneurial spirit, familiarize students with the business environment, and help them observe and interact with the market and health system experts. Finally, in our research, students were generally satisfied with the course and SBL. Applying various teaching skills in this method for pharmacy students, such as small groups, simulated teaching, problem-solving, and peer-learning made students satisfied with SBL. We can claim that our model was an exercise for the teachers and faculty members to guide the students as facilitators versus knowledge transferers. In the new instructional design called the "Startup-Based Learning" method, students are given the main responsibility for learning. Numerous novel educational systems, namely the SPICES model,[38] show more interest in student-centered learning, problem-based learning, integrated or inter-professional teaching, and community-based education similar to our study design and findings.[39]

The present work also had some limitations. As this model was designed and implemented for the first time, there was no control group to compare the results with. Moreover, due to the use of this method and the time spent on the new teaching method, it was not possible to provide all the course materials, and the students were required to read the parts of the material in their home. Although five faculty members were provided in our design, they could not be active in social networks and did not have enough time to interact with the teams. Future research into SBL could provide a control group to better analyze our findings.

Overall, the SBL educational model described here would be a new form of group problem-based learning method, with which individual groups of students try to develop a virtual natural preparation with social impact by utilizing entrepreneurship skills.

Conclusion

This study found that startup-based approaches can be employed in the formal education of pharmacy to provide students with interest in educational content and help them prepare for the job market. Our results reinforced the notion that students should be at the core of educational activities.

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Authors' Contribution

A.M: planning and supervised the work, performed the educational intervention, Drafting and revising the manuscript; P.B, MM.Z, and Z.A: performed the educational intervention, Drafting and revising the manuscript; E.A.A, MH.K, and S.AA.F: processed the questionnaires data, Drafting and revising the manuscript; All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest: None declared.

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