



Investigating the Effectiveness of Integrated Entrepreneurship Education

Arzu Kirman Bilgin ¹, Tufan İnaltekin ²

Abstract

This study aims to examine the effect of integrated entrepreneurship education on the development of third-grade preservice science teachers' conceptual knowledge of entrepreneurship. This study includes 79 third-grade preservice science teachers studying at a public university in Turkey and is conducted with a one-group pretest-posttest experimental design. The experimental process consists of three parts. These parts are 1-SMEDO traditional entrepreneurship education, 2-entrepreneurship education in science, and 3-the exhibition of business ideas and business plans. The entrepreneurship test is used to measure the conceptual knowledge of preservice science teachers toward entrepreneurship. This test consists of 12 open-ended questions. The results of the study show that preservice teachers' conceptual prior knowledge of entrepreneurship is inadequate. In addition, it is determined that the conceptual knowledge of entrepreneurship of prescience teachers increases from the level that should be developed to a poorly acceptable level as a result of the experimental process.

Keywords

Conceptual knowledge
Entrepreneurship
Entrepreneurship education
Preservice science teacher
Science education

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Introduction

Entrepreneurship typically creates economic value in the context of a business or social formation (Quality Assurance Agency for Higher Education, 2018). Entrepreneurship is the process of creating and implementing innovative ideas to address economic opportunities or social issues. It also is the ability to introduce a new product development or organization style (Hayes, Subhan, & Herzog, 2020). The entrepreneur serves as the seed for the country's economy, which turns into the largest and most powerful tree. Entrepreneurship not only accelerates development in the country's economy but also independently provides new jobs for individuals (Hameed & Irfan, 2019). Entrepreneurship is a skill that should be gained in every field today (Mayhew, Simonoff, Baumol, Wiesenfeld, & Klein, 2012) and that is taught from primary school (Elo & Kurtén, 2020). They are the teachers who are trying to gain this skill. Teachers need to be adequately equipped during the teacher training process when they gain professional knowledge to bring this skill to students. Science especially appears to be an important field in which to gain this skill (Yıldırım & Bakırcı, 2019). Achor and Wilfred-Bonse (2013) and Onwuachu and Okoye (2012) emphasize that students should gain life skills such as entrepreneurship, especially through science education. Qualified entrepreneurship education through science lessons is seen as a valuable tool that guides the economic growth and sustainable development of countries (Afolabi, Kareem, Okubanjo, Ogunbanjo, & Aninkan, 2017). Thus, it can be said that the need for science

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teachers who will be role models to raise individuals who can employ themselves and can be the source of economic dynamism in the future will increase daily. However, studies show that the conceptual knowledge of preservice science teachers about entrepreneurship is inadequate (Samancı, İnaltekin, & Kirman Bilgin, 2020). It is emphasized that the lack of conceptual knowledge of preservice science teachers leads to a lack of professional knowledge for their entrepreneurial skills (İnaltekin, Samancı, & Kirman Bilgin, 2019). Therefore, preservice science teachers should be exposed to entrepreneurial experiences and develop their conceptual knowledge and tendency toward innovative entrepreneurial actions. When preservice science teachers are exposed to entrepreneurship training, they also will likely learn innovative ways to improve teaching in their classroom in the future (Njati & Omae, 2020). Conducting the training processes for entrepreneurial skills both as a theoretical and practical process will make it easier for candidates to acquire professional knowledge and will enable them to gain entrepreneurial skills. The countries that realize this situation attach importance to the concept of entrepreneurship education and make it the focus of their education systems (Sukmawati & Sarjono, 2019). Few people today have the necessary entrepreneurial skills to start a business. This is because this skill is difficult to acquire, and conceptual knowledge is essential to gain this skill (Morselli, 2019). Education reforms are vital to teach such knowledge and skills (European Commission, 2012, 2013).

When the studies on the acquisition of entrepreneurial skills in the science teacher education literature are examined, it is understood that it is weaker than in other field education studies (Blimpo & Pugatch, 2019; Davis, 2019; Eltanahy, Forawi, & Mansour, 2020; Fejes, Nylund, & Wallin, 2019; Pan & Akay, 2015; Umar, Ayodele, & Man, 2020). Martin, Abd-El-Khalick, Mustari, and Price (2018), one of the pioneers of teacher education research based on entrepreneurship, emphasizes the importance of learning opportunities based on science, technology, engineering, and mathematics (STEM) for science teachers to better understand entrepreneurship. Heinert and Roberts (2017) emphasize that applied entrepreneurship education should be continued based on agricultural knowledge. However, a solution that is integrated with a theoretical and applied training process around the question "how can the conceptual knowledge of preservice science teachers about entrepreneurial skills be gained through an entrepreneurship educational process?" is not offered. In addition, it is possible that research questions such as this call for education faculties to be effective in reviewing educational practices can encourage the candidates to develop innovative solutions for life and occupational challenges in the future. Therefore, it is necessary that both theoretical and practical training processes also are planned in this study, and a different solution is offered by revealing the effect of the integrated entrepreneurship experience.

The education of preservice science teachers regarding entrepreneurial skills should have two features. First, preservice teachers must have educational experiences on how to transform their knowledge of science fields into an economic value to create a new business field. Second, it should include pedagogical structures that will enable students to gain entrepreneurial skills in the field of science in the future. The necessary professional knowledge of the candidates is related to the conceptual knowledge of this skill. Understanding entrepreneurship conceptually is essential to understanding the practices in entrepreneurship education (Zhang, 2020). In summary, the first feature specified is essential for the acquisition of the second feature. Entrepreneurship education should contain three main complementary objectives. These are (1) to learn to understand entrepreneurship, that is, to learn about the discipline and different aspects of entrepreneurship; (2) to learn to be an entrepreneur, to promote entrepreneurial skills and mentality; and (3) to train with the additional knowledge necessary in the context of creating a new business venture (Lane, Hardison, Simon, & Andrews, 2019; Teixeira & Pereira, 2019). In this training, preservice teachers should focus on the practical development of entrepreneurial skills and ensure the integration of theory and practice. Moreover, the conditions should be created for preservice teachers to experience real-world entrepreneurial experiences through various channels in these entrepreneurship programs (Higgins, Refai, & Keita, 2018; Warhuus, Tanggaard, Robinson, & Ernø, 2017). With these practices, the preservice teacher gains conceptual knowledge about entrepreneurship and at the same time improves his entrepreneurial skills (Zhaoxin & Zhiqiang, 2013). The specific entrepreneurship programs implemented often include a variety of methodologies designed to develop entrepreneurial skills and

creativity (Bae, Qian, Miao, & Fiet, 2014; Paulus & Kenworthy, 2019). Despite the number and variety of these methodologies, there are common elements in many of them. These are (1) discovery, evaluation, and the use of opportunities; (2) organizing and managing efforts to seize opportunities by creating new projects within existing organizations; (3) using creativity to develop innovative products and services; (4) realization of the above despite a lack of resources; and (5) willingness to take risks and the ability to deal with them (Maaravi, Heller, Amar, & Stav, 2020). It can be said that there is a need for integrated entrepreneurship education with these features for preservice science teachers.

The main purpose of this study is to examine the effect of integrated entrepreneurship education on the development of the conceptual knowledge of preservice science teachers studying in the third grade of a public university in northeastern Turkey. The following research question guides this study in this context: What is the effect of integrated entrepreneurship education on the development of preservice science teachers' conceptual knowledge of entrepreneurship?

Method

Research Design

In studies investigating how any process affects the participants within the scope of the variable under consideration, the experimental process is conducted on a single group. Since it is developed upon the conceptual knowledge of preservice science teachers about entrepreneurship, this study is conducted with a one-group pretest-posttest experimental design. The reason why one group takes part in the research is that it helps determine to what extent integrated entrepreneurship education is effective. Such experimental studies are considered appropriate for the current research, as they try to reveal only how effective the designed instruction is (Tuckman & Harper, 2012).

Participants

The research is conducted with third-grade preservice science teachers at a public university in northeastern Turkey. The reason why integrated entrepreneurship education is conducted with third-grade preservice science teachers is related to the undergraduate science teaching curriculum. The candidates begin acquiring professional knowledge in the skill learning area in the third grade. They use the knowledge they acquire by doing an internship at secondary schools within the scope of the teaching practice course within the last year. Conceptual knowledge of entrepreneurial skills is included within the scope of the research. Considering that the conceptual knowledge acquisition process will positively affect the professional knowledge acquisition process, this study is conducted with third-grade preservice science teachers. The relevant state university has been selected as the subject of the research by using the criterion sampling type, one of the purposeful sampling methods, since the criterion sampling type is used in order to collect in-depth data on situations, events, or individuals with suitable qualifications for the problem of the research that will be conducted (Suri, 2011).

The entrepreneurship education in science courses begin in the fall term of the 2019–2020 academic years at the Continuing Education Center of the aforementioned state university. There is a prerequisite for this course. This requirement is that "the third-grade preservice science teachers who want to attend the entrepreneurship training course in science must have the traditional entrepreneurship education participation certificate given by the Small and Medium Enterprises Development Organization (SMEDO, 2021)". Seventy-nine preservice science teachers who are entitled to receive this certificate issued by SMEDO (there are 91 third-grade preservice science teachers at the aforementioned state university) voluntarily apply to course-titled entrepreneurship education in science and want to participate in the research. The candidates are divided into 20 teams (T1-T20). One of the teams consists of 5 (T18), one consists of 2 (T8), and the others consist of 4 preservice science teachers. The teams contribute to the research by completing the processes of the course. The candidates have not participated in any entrepreneurship education process before the integrated entrepreneurship education. They have not taken any courses on entrepreneurship during their candidacy. The main reason for selecting the current university is that the candidates have not received any training on the subject of the research.

Experimental Process and Instructional Procedure

The experimental process of integrated entrepreneurship education conducted within the scope of the purpose of the research consists of three parts. These parts are 1-SMEDO traditional entrepreneurship education, 2-entrepreneurship education in science, and 3-the exhibition of business ideas and business plans. The first and second parts constitute the part of the integrated entrepreneurship education where conceptual information is given theoretically. The third part is the applied part of the experimental process. These three parts constitute the whole of the experimental design. An elective course in economics and entrepreneurship has been included in the science undergraduate program since 2018. Since it is an elective course, it does not have to be chosen by every department. This course does not include a hands-on training process. Furthermore, since it is a recommended course for all departments in education faculties, it does not have content that associates the concept of entrepreneurship with science education. In addition, the candidates who are successful in this course are not given a traditional entrepreneurship education participation certificate. This traditional entrepreneurship education participation certificate provides an opportunity to take advantage of the grant or loan advantages offered by the government in case of any attempt. Therefore, it is important to attend SMEDO traditional entrepreneurship training. Although economics and entrepreneurship, which are elective courses, contain theoretical information on the concept of entrepreneurship, they do not offer the opportunities offered by SMEDO to the candidates. Therefore, the experimental process of this research tries to improve the conceptual knowledge of preservice science teachers about entrepreneurship by offering an integrated model to education administrators. The training processes conducted within the framework of these aforementioned sections are summarized below.

SMEDO Traditional Entrepreneurship Training

This training is provided by SMEDO through distance education. The SMEDO entrepreneurship training program is a program launched to help those who want to become entrepreneurs within the organization start or develop their own business. Anyone who wants to start their own business and grow their own business can enroll in this program and benefit from state-sponsored financing and grant benefits. Traditional entrepreneurship training participation certificates are given to participants in SMEDO entrepreneurship training if they meet the necessary conditions and graduate from the training. This training consists of seven parts. These are "1-basic concepts in entrepreneurship, 2-seeing entrepreneurial opportunities and creating ideas, 3-feasibility analysis, 4-business models, 5-economy, industry, competition, customer analysis, and legal infrastructure, 6-ethical foundations of entrepreneurship, and 7-marketing principles and management". The participants who listen to the lectures related to these sections and complete the end-of-course evaluation questions are deemed successful and receive their certificates. The most important documents that are deemed necessary for the participant to benefit from the support provided by SMEDO are the business plan and the traditional entrepreneurship training participation certificate given by SMEDO (URL 1). There is no application to design a business plan within the scope of this training provided by SMEDO. Therefore, the Entrepreneurship Training in Science course is opened by the Continuing Education Center of the university where the candidate study is conducted.

Entrepreneurship Education in Science

The preservice science teachers are entitled to receive a "Traditional Entrepreneurship Education Participation Certificate" to participate in this training. In other words, the preservice teachers who complete the first stage of the experimental process are given the chance to participate in the second stage. This is because this document is needed in Turkey so that the candidates can use the business plans generated in the third part of the experimental process in the future and receive financial support while taking an initiative. The candidates should have conceptual information about entrepreneurship to make an attempt, which will be effective for them to succeed. This training is completed in two days and for 5 hours a day. The content of the training is as follows:

Table 1. Content of Entrepreneurship Education in Science

Hour	The subjects that are treated	The learning outcomes planned
1	Entrepreneurship in Turkey Entrepreneurship and Characteristics of the Entrepreneur The Characteristics of the Entrepreneur	Understanding the development of entrepreneurship in our country To be able to define the concept and types of entrepreneurship within the framework of entrepreneurship theory The economic, social, and cultural foundations of entrepreneurship
2	Creativity in Entrepreneurship and Its Relationship with Science Course Innovation, Technology, and Entrepreneurship	Raising awareness about ways to develop personal and corporate innovation and creativity; generating business ideas within the scope of science Taking advantage of technology while attempting entrepreneurship
3	The Entrepreneurship Process and the Interaction with the Environment	Acting within the rules of nature during the business establishment process
5	The Types of Innovation and The Innovation in Entrepreneurship	Developing awareness of the ways to develop personal and corporate innovation and creativity
9	Enterprise Financing	Evaluating how an entrepreneur acts while making a new business decision
6	Business Plan	Preparing a business plan to start a new business
7	Design in Entrepreneurship	The importance of product development and design in entrepreneurship
8	Entrepreneurship in Developed and Developing Countries	Learning about obstacles and incentives in entrepreneurship and comparing opportunities for the appropriate sector
9	Entrepreneurship and Economic Development	Learning about obstacles and incentives in entrepreneurship and comparing opportunities for the appropriate sector
10	Buying an Existing Business	The features to consider while buying an existing business

The above entrepreneurship training in science takes 10 h. After the training, the information training has been given for exhibiting business ideas and business plans within the scope of the third part of the experimental process for 2 h. The relationship of the business ideas that will be designed within the scope of this training with the achievements of science courses also is discussed.

Exhibition of Business Ideas and Business Plans

The exhibition of business ideas and business plans is the third part of the experimental process. They must participate in this exhibition during the entrepreneurship education in science offered by the Continuing Education Center of the relevant university. The task given within the scope of the exhibition is as follows: "imagine the establishment of a sample village in the region of the city where your university is located. The business plans of the products and products that are intended to be produced and marketed in this sample village will be presented and marketed within the scope of the exhibition. You want to launch an initiative in this village. Generate a business idea and design a business plan for this business idea. Market your product for your business idea at the exhibition and present your business plan. Create a team for this exhibition. It is recommended that the teams consist of four teacher candidates. The number of candidates who will form the teams may change to avoid problems between the teams." The candidates are divided into 20 teams upon their request. They have developed, produced, and designed business plans as a team. They also have explained the relationship of the products they produce in their business plans with the subjects and achievements in the secondary school science teaching program. The sections that should be in the business plans designed by the candidates are "1-the relationship between science and the business idea, 2-general information, 3-information about the entrepreneur/partners and business, 4-market information and the marketing

plan, 5-the production/service plan, 6-the management plan, 7-the financial plan.” The business ideas of the teams in the exhibition and the profit and loss status of the teams at the end of the exhibition are shown in Table 2.

Table 2. Business Ideas Produced by Teams

Team No	Business Idea	Profit–Loss Statements
T1	Fish Burger	Profit
T2	Hazelnut Oil Cream	Neither profit nor loss
T3	Snack with Hazelnut	Loss
T4	Local Cologne	Profit
T5	Natural Fizzy Drink	Profit
T6	Persimmon Tea	Profit
T7	Local Herbal Tea	Profit
T8	Local Turkish Delight-1	Profit
T9	Local Persimmon Drink	Profit
T10	Local Persimmon Chocolate	Profit
T11	Seasonal Crackers	Profit
T12	Biscuits from Eggshell Flour	Profit
T13	Kadayif with Persimmon	Profit
T14	Local Turkish Delight-2	Profit
T15	White Cabbage Cream	Loss
T16	Organic Food Dye	Loss
T17	Flour Halva with Persimmon	Loss
T18	Recycling Newspaper	Profit
T19	Hazelnut Shell Ornaments 1	Profit
T20	Hazelnut Shell Ornaments 1	Profit

The teams are given a 4-week period to produce these business ideas and design business plans. Some images from the relevant exhibition are as follows.

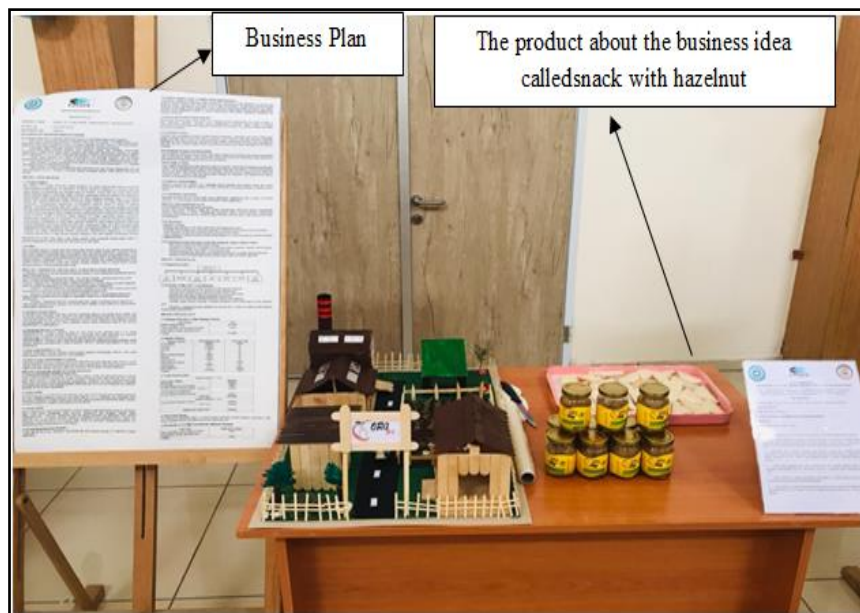


Figure 1. Snack with Hazelnut and Business Plan of T3

When Figure 1 is examined, the business idea and business plan designed by the candidates are seen. The exhibition opens at 10 a.m. and lasts until 3 p.m.

Data Collection Process

The work schedule of the experimental process of the research is shown in Figure 2.

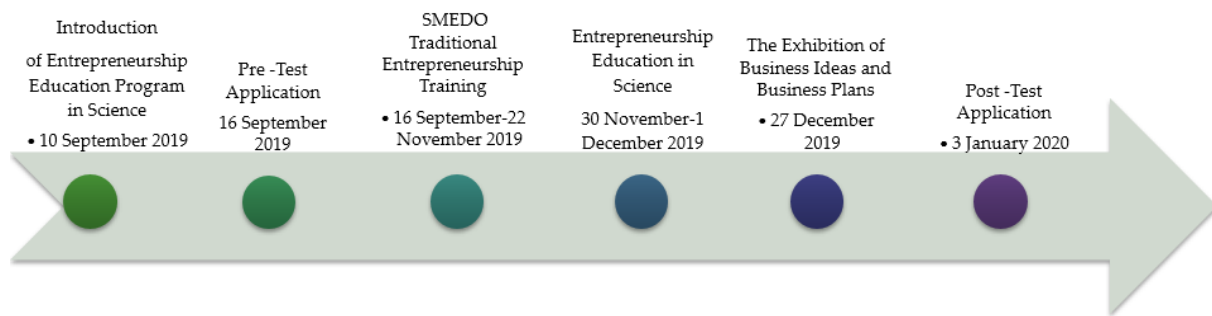


Figure 2. Work Schedule of Experimental Process of Research

The experimental process of the study is conducted in the fall term of the 2019–2020 academic year and lasts 16 weeks in total. The data collection tool is applied as a pretest in the first week. The experimental process of the research is explained to the candidates, and the prerequisites and date of the entrepreneurship training course in science are announced. The candidates are given 8 weeks to participate in SMEDO traditional entrepreneurship training and to receive the traditional entrepreneurship training participation certificate. The entrepreneurship training course in science is held in the 10th week of the experimental process. After this training, the candidates are given 4 weeks to prepare for exhibiting their business ideas and business plans. The exhibition is held for 6 h in the 15th week, on the last workday of the experimental process. A participation certificate ceremony is held by the Continuing Education Center of the relevant university at the end of the day to indicate that they have successfully completed the preservice science teachers' entrepreneurship training course in science. The head of the SMEDO Entrepreneurship Department gives a 20-minute speech on entrepreneurship. It is mentioned that the candidates should design a business plan to benefit from SMEDO support and what they should pay attention to in the business plan in the content of this speech. The data collection tool is applied as a posttest in the last week.

Data Collection Instruments

The entrepreneurship test (ET) developed by İnaltekin et al. (2019) is used to measure the conceptual knowledge of the preservice science teachers regarding entrepreneurship. This test consists of 12 open-ended questions. The ET is applied twice as a pretest before the experimental process starts and as a posttest after the experimental process is finished. The questions are limited to the indicators (Kirman Bilgin, 2019) considered within the conceptual knowledge framework for entrepreneurship. These indicators are as follows:

11. Explains the economic foundations of entrepreneurship
12. Explains the social foundations of entrepreneurship
13. Explains the cultural foundations of entrepreneurship
14. Explains the importance of being creative while attempting entrepreneurship
15. Explains the importance of taking advantage of technology while attempting entrepreneurship
16. Explains how to act with nature in the process of establishing a business
17. Explains how to act while making a new business decision
18. Explains the obstacles in a new business they will start while making a decision
19. Explains the incentives (pp. 22)

The questions included in the ET are developed by one science educator (13 years of experience) and are subjected to validity studies by one science educator (13 years of experience) and one science teacher (12 years of experience). After the relevant validity studies, relevant arrangements are made by applying them to the fourth-grade preservice science teachers (N = 28). The questions in the test are

included in the findings section. The test is applied in two sections. After the first half of the test has been applied for more than two hours, a one-hour break is taken. After the break, the second half of the test is applied for two hours. This application is performed in the same way for both the pre- and posttests.

Data Analysis

After the data are obtained from the relevant data collection tool, ten papers of random candidates from the pretest are separately analyzed by the researchers. The analysis results are compared, and a science educator's opinion is taken for the codes that do not match. After a common consensus is reached, five more papers of the candidates are randomly selected, and data analysis is continued. There is no incompatibility between the codes of the two researchers. After this process, data analysis is continued by a single researcher. The data obtained from the ET are analyzed using the key concepts in Table 3. The point of each question is evaluated in the relevant table.

Table 3. Key Concepts Used in Data Analysis of ET Questions and Evaluated Point of Questions

Q	Key concepts	Point
1	Ensuring Economic Growth (Development) (EEG), Increasing Diversity/Quality through Competition (ID/QTC), Raising/Increasing the Level of Welfare (R/ILW), Launching New Products to the Market (LNPM), Making Domestic Production/Use of Raw Materials (MDP/URM). Each key concept is scored over 1 point.	5
2	Earning Respect in Society (ERS), Eliminates Social Unrest as a Solution to the Problem of Unemployment (ESUSPU), Prevents Migration (PM), Increases People's Self-Confidence (IPSC), Ensures Cooperation Among Society/Provides Tendency to Social Problems (ECAS). Each key concept is scored over 1 point.	5
3	Culture Affects the Entrepreneurial Preferences (CAEP), Entrepreneurship is Effective in the Recognition and Protection of Cultural Values (EERPCV), Culture Has Tendency to Value Entrepreneurship (Family Structure-Raising Children) (CTVE). Each key concept is scored over 1 point.	3
4	Providing Superiority by Creating a Competition Environment (PSCCE), Releasing Different Products (RDP), Earning Profit (EP), Sustaining Economic Growth (SEG), Improving Quality (IQ), Reducing Cost (RC), Improving Productivity (IP). Each key concept is scored over 1 point.	7
5	Provides Convenience in Transportation to The Customer (PCTC), Provides Convenience in Production (PCP), Excess Production in a Short Time (EPST), Provides Efficiency in Production (PEP), Provides the Commercialization of Technology (PCT), Provides Superiority in the Competitive Environment (PSCE). Each key concept is scored over 1 point.	6
6	Natural Resources Should Be Used Consciously (NRSBUC), The Effects of Harmful Outputs Should Be Minimized (TEHOSBM), Attempts Should Be Made Toward Recycling (ASBMTR), The Products That Harm Nature Should Not Be Used (PTHNSNBU), Environmentally Friendly Technologies Should Be Used (EFTSBU). Each key concept is scored over 1 point.	5
7	Researching a Successful Business Idea (RSBI), Choosing a Business Idea (CBI), Doing Business Idea Feasibility Research (DBIFR), Preparing a Business Plan (PBP), Setting Up the Business (SUB). Each key concept is scored over 1 point.	5
8	Insufficient Financial Resources (IFR), Competitive Obstacles (CO), The Obstacles Related to Production (TORP), Psychological Factors (PF), The Obstacles Related to Staff (TORS), Lack of Knowledge and Experience (LKE), The Relationship Between Business Idea and Culture (TRBBIC), National Economy (NE), Bureaucratic Procedures (BP), Planlessness (P). Each key concept is scored over 1 point.	10

Table 3. Continued

Q	Key concepts	Point
9	Financial Resources (FR), Bank Loans (BL), Motivation (M), Promotion (P), Government Aid (GA), European Union Aid (EUA), Sense of Accomplishment (SA). Each key concept is scored over 1 point.	7
10	1. General Information (The Information on Entrepreneur, Business Idea) 2. Information on the Entrepreneur/Partners and the Business (The reason why you establish the business with a partner or alone, and if any, the importance of your partners in terms of the success of your business, Business idea and the reason why it is chosen, the mission and vision of the business, Short-Term Goals, Medium- and Long-Term Goals) 3. Market Information and Marketing Plan (The Size of the Market, Targeted Market Share, Market Profile, Competitor Analysis, Production/Marketing/Sales Targets, Sectorial Developments, The Assessments Related to Opportunities and Threats, The Predictions of Unexpected Situations, Product/Service Promotion, How the Product/Service Price Is Created, Site Selection and Its Reason, Access Channels to Customer, Product/Service Promotion Plan) 4. Product/Service Plan (The Stages of the Service/Production Delivery Process, Workflow Diagram, The Standards, Documents, Licenses, and Permissions Required in the Production/Service Delivery Process) 5. Organization Chart (Organization Chart, The Quality, Duty, and Responsibilities of Staff) 6. Financial Plan (Initial Costs and Other Initial Expenses, Operating Expenses, Cash Projections, Breakeven Point, Funding from Equity and/or Other Sources). There are 28 subtitles in total in these sections. The correct answer that specifies each subtitle is scored over 1 point.	28
11	Draw Attention (DA), Giving Ideas to the Consumer with the Product, Logo and Packaging (GICPLP), Competitive Advantage (CA), Boost the Demand (BD). Each key concept is scored over 1 point.	4
12	Transportation (T), Income and Expense Ratio (IER), Customer Satisfaction (CS), Location (L), Why the Business Is Sold (WBIS), The Growth Trend of the Enterprise (GTE), Legal Obligations (LO), Annual Profit and Loss Statement (APLS). Each key concept is scored over 1 point	8

When Table 3 is examined, it shows that key concepts are related to each question, and each key concept is evaluated on a 1-point scale. The lowest score from the ET is 0, while the highest score is 93. The conceptual knowledge levels of the preservice science teachers who will be in this score interval are classified as in Table 4.

Table 4. Evaluation of Points Obtained from ET

Score Interval	Code	Evaluation
0-18	A	The conceptual knowledge on entrepreneurship is at the level that should be developed.
19-37	B	The conceptual knowledge on entrepreneurship is poorly acceptable.
38-56	C	The conceptual knowledge on entrepreneurship is reasonably acceptable.
57-75	D	The conceptual knowledge on entrepreneurship is highly acceptable.
76-93	E	The conceptual knowledge on entrepreneurship is exceptionally acceptable.

The total points of the preservice science teachers from the pre- and posttest applications are subjected to the classification specified in Table 4, and there are attempts to determine how the

experimental process has an impact on the conceptual knowledge levels for entrepreneurship. The data obtained from the pre- and posttest applications of the ET are subjected to the Wilcoxon signed-rank test. The reason why this test is used is that the questions in the data tool are open-ended questions. The data obtained from the test are analyzed with the Wilcoxon signed-rank test, since the relevant data collection tool does not have the feature of an evenly spaced (or proportional) scale.

Results

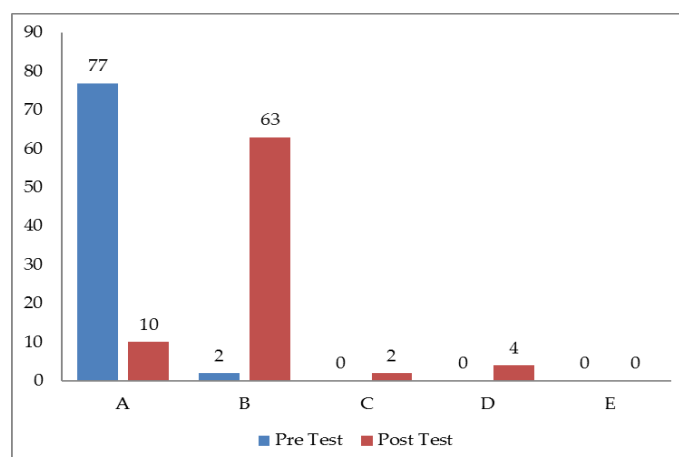
The Wilcoxon signed-rank test results of the scores obtained from the preservice science teachers from the pre- and posttest applications of the ET are given in Table 5.

Table 5. Wilcoxon Signed-Rank Test Results of Data Obtained from ET

Posttest-Pretest	n	Mean Rank	Rank Sum	z	p
Negative rank	3	3.17	9.50	7.63	.000
Positive rank	75	40.95	3071.50		
Equal	1				

* Based on Negative Rank

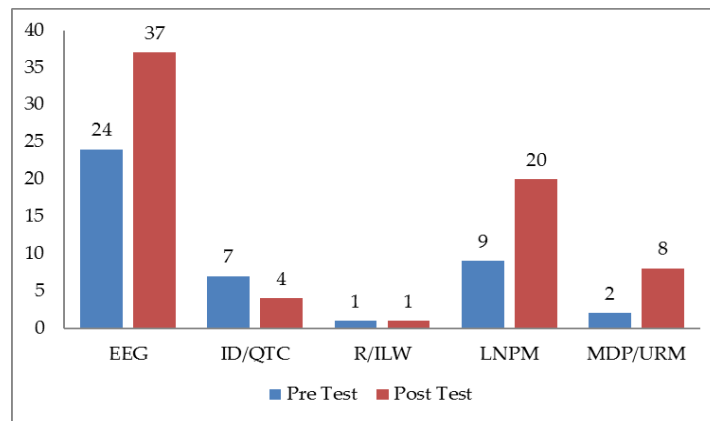
The analysis results of the Wilcoxon signed rank test show that there is a significant difference between the pre - and posttraining ET scores of the candidates participating in the study: $z=7.63$, $p<.05$. Considering the mean rank and sum of the difference scores, it is seen that this difference is in favor of the posttest. Graphic 1, which shows the effect of the training carried out on the development of conceptual knowledge of third-year preservice science teachers toward entrepreneurship, is as follows.



(A: Conceptual knowledge on entrepreneurship is at the level that should be developed, B: Conceptual knowledge on entrepreneurship is poorly acceptable, C: Conceptual knowledge on entrepreneurship is reasonably acceptable, D: Conceptual knowledge on entrepreneurship is highly acceptable, E: Conceptual knowledge on entrepreneurship is exceptionally acceptable.)

Graphic 1. Change of Conceptual Knowledge Levels of Preservice Science Teachers for Entrepreneurship

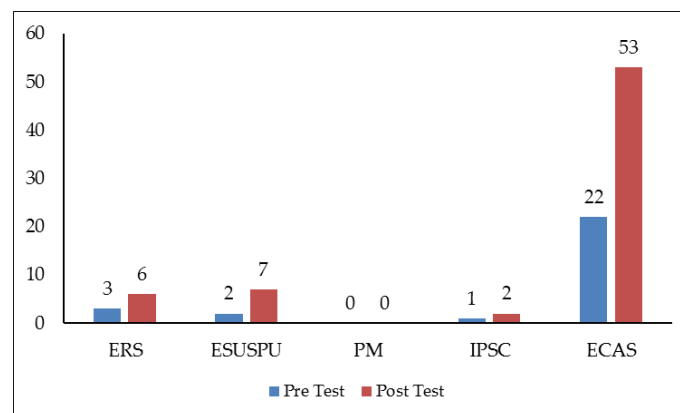
When Graphic 1 is examined, it is seen that the conceptual knowledge of the preservice science teachers about entrepreneurship is at a level that should be developed before integrated entrepreneurship education is performed. After the experimental process, it is seen that more than half of the candidates have a level of conceptual knowledge about entrepreneurship that is poorly acceptable ($f=63$), a small number have a level that is reasonably acceptable ($f=2$), and four preservice teachers have a level that is highly acceptable. The findings from each ET question are presented below. Table 4 shows the abbreviations of key concepts discussed in the questions. The findings obtained from the first question of the test, "what are the economic foundations of entrepreneurship? Discuss with an example", are shown in Graphic 2.



Ensuring Economic Growth (Development) (EEG), Increasing Diversity/Quality through Competition (ID/QTC), Raising/Increasing the Level of Welfare (R/ILW), Launching New Products to the Market (LNPM), Making Domestic Production/Use of Raw Materials (MDP/URM).

Graphic 2. Findings Obtained from 1st Question of ET

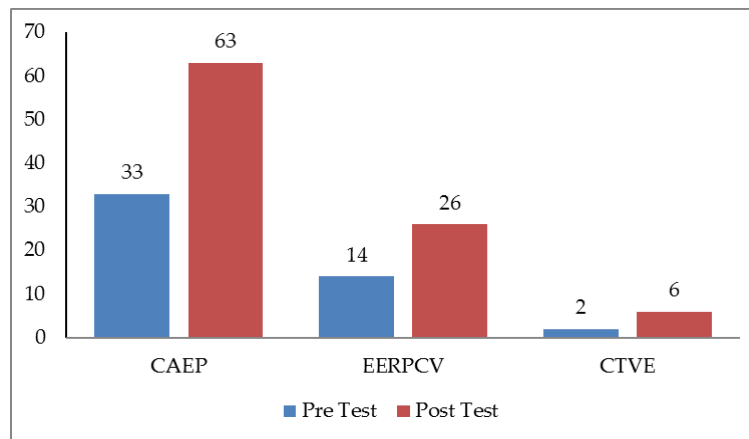
When Graphic 2 is examined, it shows that most of the preservice science teachers have the codes of EEG ($f=37$) and LNPM ($f=20$) in the posttest in terms of the economic foundations of entrepreneurship. In addition, another code where the number of teacher candidates increases is MDP/URM ($f=8$). When the number of preservice teachers in the pretest and posttest is compared in terms of generating ideas about the economic foundations of entrepreneurship, it is seen that the opinions of the preservice teachers develop in certain codes. The findings obtained from the second question of the test, “what are the social foundations of entrepreneurship? Discuss with an example”, are shown in Graphic 3.



Earning Respect in Society (ERS), Eliminates Social Unrest as a Solution to the Problem of Unemployment (ESUSPU), Prevents Migration (PM), Increases People's Self-Confidence (IPSC), Ensures Cooperation Among Society/Provides Tendency to Social Problems (ECAS).

Graphic 3. Findings Obtained from 2nd Question of ET

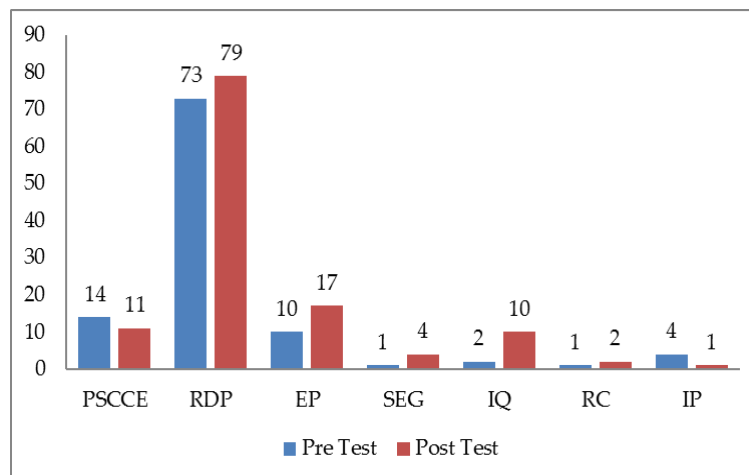
When Graphic 3 is examined, it shows that most of the preservice science teachers have ECAS ($f=53$) codes in the posttest in terms of explaining the social foundations of entrepreneurship. In addition, a small number of preservice science teachers improved in generating ideas about the ERS ($f=6$) and ESUSPU ($f=7$) codes in the posttest. In addition, it is understood that none of the preservice teachers could put forward an opinion about the PM ($f=0$) code both in the pretest and the posttest. The findings obtained from the third question of the test, “what are the cultural foundations of entrepreneurship? Discuss with an example”, are shown in Graphic 4.



Culture Affects the Entrepreneurial Preferences (CAEP), Entrepreneurship is Effective in the Recognition and Protection of Cultural Values (EERPCV), Culture Has Tendency to Value Entrepreneurship (Family Structure-Raising Children) (CTVE).

Graphic 4. Findings Obtained from 3rd Question of ET

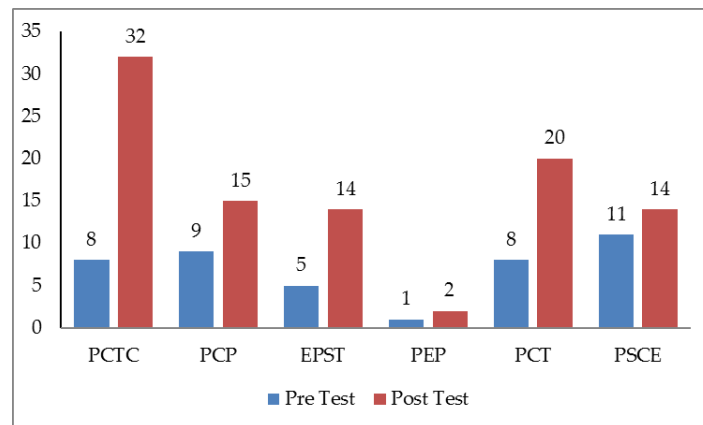
When Graphic 4 is examined, it shows that most of the preservice science teachers have the codes of CAEP ($f=63$) and EERPCV ($f=26$) in the posttest in terms of the cultural foundations of entrepreneurship. In addition, it is understood that a small number of preservice science teachers improved in generating an idea about the CTVE ($f=6$) code in the posttest. The findings obtained from the fourth question of the test, “what is the importance of being creative while attempting entrepreneurship? Discuss with an example”, are shown in Graphic 5.



Providing Superiority by Creating a Competition Environment (PSCCE), Releasing Different Products (RDP), Earning Profit (EP), Sustaining Economic Growth (SEG), Improving Quality (IQ), Reducing Cost (RC), Improving Productivity (IP).

Graphic 5. Findings Obtained from 4th Question of ET

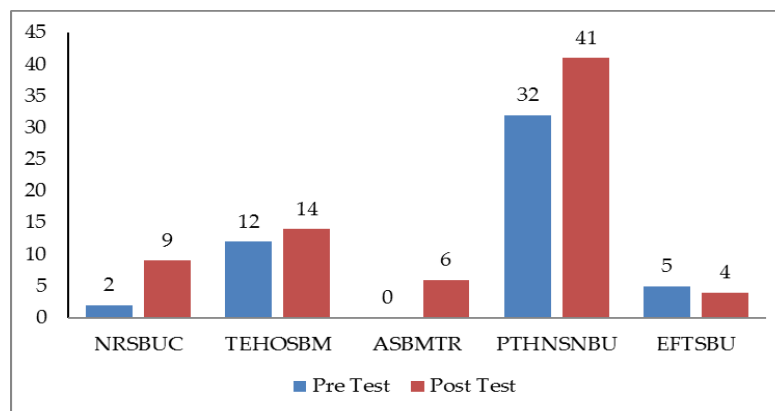
When Graphic 5 is examined, it is understood that most of the preservice science teachers have the codes of RDP ($f=79$), EP ($f=17$), and IQ ($f=10$) in the posttest in terms of the importance of being creative while making an attempt at entrepreneurship. The findings obtained from the fifth question of the test, “what is the importance of making use of technology while attempting entrepreneurship? Discuss with an example”, are shown in Graphic 6.



Provides Convenience in Transportation to The Customer (PCTC), Provides Convenience in Production (PCP), Excess Production in a Short Time (EPST), Provides Efficiency in Production (PEP), Provides the Commercialization of Technology (PCT), Provides Superiority in the Competitive Environment (PSCE).

Graphic 6. Findings Obtained from 5th Question of ET

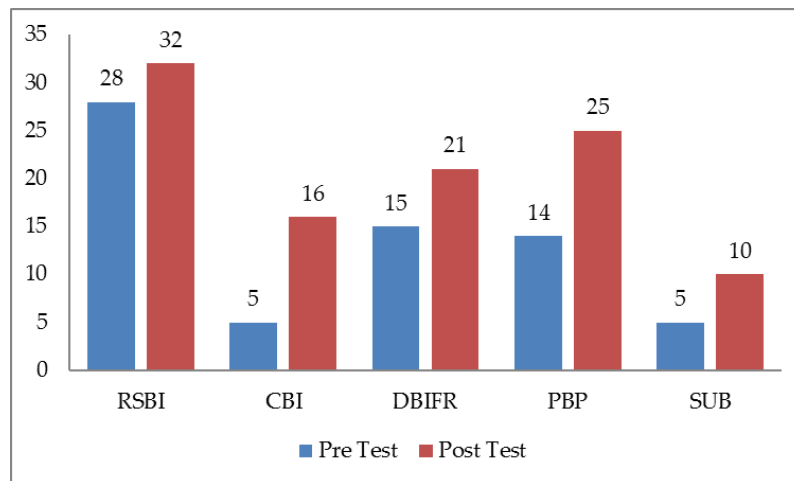
When Graphic 6 is examined, it shows that most of the preservice science teachers have the codes of PCTC ($f=32$) and PCT ($f=20$) in the posttest to explain the importance of using technology while making an attempt at entrepreneurship. In addition, a small number of preservice science teachers improved in generating ideas about the codes of PCP ($f=15$), EPST ($f=14$), and PSCE ($f=14$) in the posttest. In addition, it is understood that a couple of preservice teachers put forward ideas about the PEP ($f=2$) code both in the pretest and the posttest. The findings obtained from the sixth question of the test, “how does one act with nature in the process of establishing a business? Discuss with an example”, are shown in Graphic 7.



Natural Resources Should Be Used Consciously (NRSBUC), The Effects of Harmful Outputs Should Be Minimized (TEHOSBM), Attempts Should Be Made Toward Recycling (ASBMTR), The Products That Harm Nature Should Not Be Used (PTHNSNBU), Environmentally Friendly Technologies Should Be Used (EFTSBU).

Graphic 7. Findings Obtained from 6th Question of ET

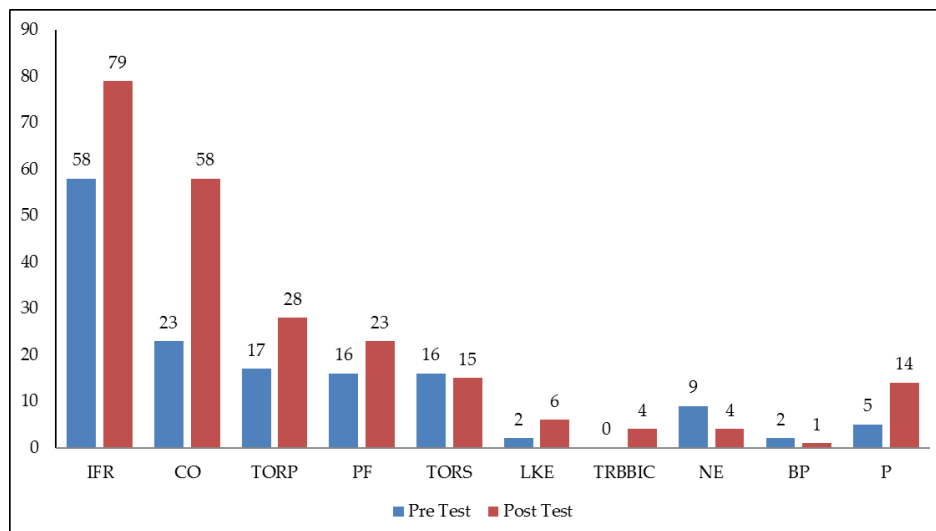
When Graphic 7 is examined, it shows that most of the preservice science teachers have the PTHNSNBU ($f=41$) code in the posttest to explain how to act with nature while making an attempt at entrepreneurship. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about the codes of NRSBUC ($f=9$) and ASBMTR ($f=6$) in the posttest. The findings obtained from the seventh question of the test, “how should an entrepreneur act while making a new business decision? Discuss with an example”, are shown in Graphic 8.



Researching a Successful Business Idea (RSBI), Choosing a Business Idea (CBI), Doing Business Idea Feasibility Research (DBIFR), Preparing a Business Plan (PBP), Setting Up the Business (SUB).

Graphic 8. Findings Obtained from 7th Question of ET

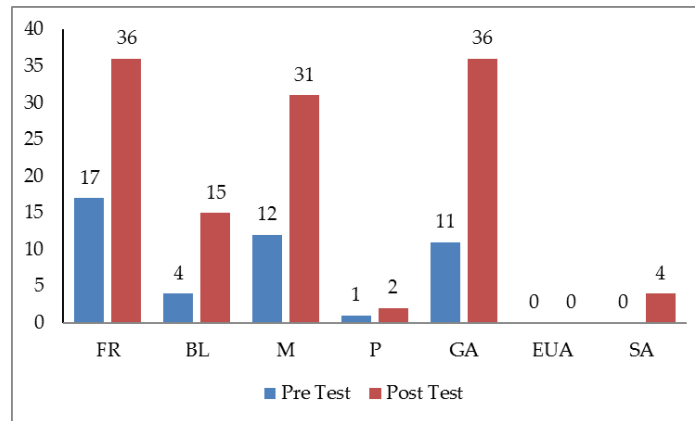
When Graphic 8 is examined, it shows that most of the preservice science teachers have the codes of RSBI ($f=32$), DBIFR ($f=21$), CBI ($f=16$), and PBP ($f=25$) in the posttest to explain how they should act while making a new business decision. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about the SUB ($f=10$) code in the posttest. The findings obtained from the eighth question of the test, “what are the obstacles in the business you will establish while making a new business decision? Discuss with an example”, are shown in Graphic 9.



Insufficient Financial Resources (IFR), Competitive Obstacles (CO), The Obstacles Related to Production (TORP), Psychological Factors (PF), The Obstacles Related to Staff (TORS), Lack of Knowledge and Experience (LKE), The Relationship Between Business Idea and Culture (TRBBIC), National Economy (NE), Bureaucratic Procedures (BP), Planlessness (P).

Graphic 9. Findings Obtained from 8th Question of ET

When Graphic 9 is examined, it shows that most of the preservice science teachers have the codes of IFR ($f=79$) and CO ($f=58$) in the posttest in terms of explaining the obstacles in the business you will establish while making a new business decision. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about TORP ($f=28$), PF ($f=23$), and P ($f=14$) codes in the posttest. The findings obtained from the ninth question of the test, “what are the incentives you will be given while making a new business decision?”, are shown in Graphic 10.



Financial Resources (FR), Bank Loans (BL), Motivation (M), Promotion (P), Government Aid (GA), European Union Aid (EUA), Sense of Accomplishment (SA).

Graphic 10. Findings Obtained from 9th Question of ET

When Graphic 10 is examined, it shows that most of the preservice science teachers have the codes of FR ($f=36$), GA ($f=36$), and M ($f=31$) in the posttest in terms of explaining the incentives in a new business decision. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about the BL ($f=15$) code in the posttest. The findings obtained from the 10th question, "You want to start a new business. You will prepare a business plan. Based on this situation, write the sections that should be in the business plans", are shown in Table 6.

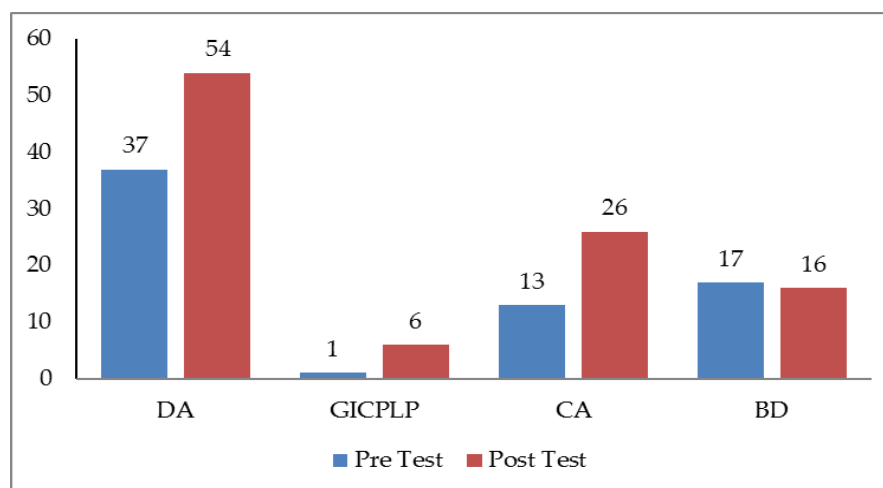
Table 6. Findings Obtained from 10th Question of ET

Section	Keywords	Pretest	Posttest
		<i>f</i>	<i>f</i>
1. General Information	1.1. Information on Entrepreneur	4	25
	1.2. Business Idea	19	58
2. Information about Entrepreneur/Partners and Business	2.1. The reason why you establish the business with a partner or alone, and if any, the importance of your partners in terms of the success of your business	2	9
	2.2. Business idea and the reason why it is chosen	7	19
	2.3. Mission and vision of the business	1	34
	2.4. Short-term goals (1 st year)	3	33
	2.5. Medium- and long-term goals (2 nd year and more)	0	28
3. Market Information and Marketing Plan	3.1. Size of Market, Targeted Market Share	2	10
	3.2. Market Profile	2	17
	3.3. Competitor Analysis	5	32
	3.4. Production/Marketing/Sales Targets	1	16
	3.5. Sectorial Developments, Assessments Related to Opportunities and Threats	-	4
	3.6. Predictions of Unexpected Situations	2	5
	3.7. Product/Service Promotion	3	19
	3.8. How the Product/Service Price Is Created	4	6
	3.9. Site Selection and Its Reason	17	10
	3.10. Access Channel to the Customer	5	12
	3.11. Product/Service Promotion Plan	1	7

Table 6. Continued

Section	Keywords	Pretest	Posttest
		<i>f</i>	<i>f</i>
4.Production/Service Plan	4.1. Stages of the Service/Production Delivery Process	-	5
	4.2. Workflow Diagram	2	6
	4.3. Standards, Documents, Licenses, and Permissions Required in the Production/Service Delivery Process	2	6
5.Management Plan	5.1. Organization Chart	2	5
	5.2. Quality, Duty, and Responsibilities of Staff	4	15
6.Financial Plan	6.1. Initial Costs and Other Initial Expenses	11	17
	6.2. Operating Expenses	1	8
	6.3. Cash Projections	4	26
	6.4. Breakeven Point	1	19
	6.5. Funding from Equity and/or Other Sources	13	21

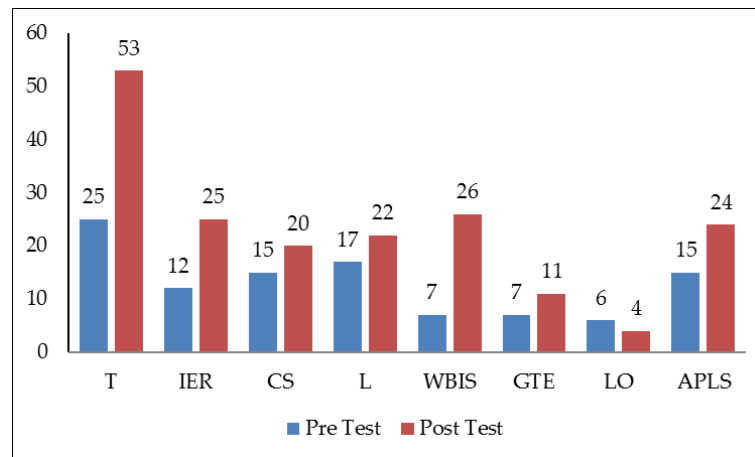
When Table 6 is examined, it shows that most of the preservice science teachers have conceptual information, including the codes of business ideas ($f=58$), the mission and vision of the business ($f=34$), short-term goals ($f=33$), and the analysis of competitors ($f=32$), while designing a business plan as a result of the experimental process. The findings obtained from the 11th question of the test, "what is the importance of product design in an enterprise? Discuss with an example", are shown in Graphic 11.



Draw Attention (DA), Giving Ideas to the Consumer with the Product, Logo and Packaging (GICPLP), Competitive Advantage (CA), Boost the Demand (BD).

Graphic 11. Findings Obtained from 11th Question of ET

When Graphic 11 is examined, it shows that most of the preservice science teachers have the codes DA ($f=54$) and CA ($f=26$) in the posttest in terms of explaining the importance of product design in an enterprise. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about the GICPLP ($f=6$) code in the posttest. The findings obtained from the 12th question of the test, "what are the features to consider while buying an existing business? Discuss with an example", are shown in Graphic 12.



Transportation (T), Income and Expense Ratio (IER), Customer Satisfaction (CS), Location (L), Why the Business Is Sold (WBIS), The Growth Trend of the Enterprise (GTE), Legal Obligations (LO), Annual Profit and Loss Statement (APLS).

Graphic 12. Findings Obtained from 12th Question of ET

When Graphic 12 is examined, it shows that most of the preservice science teachers have the codes of T ($f=53$), IER ($f=25$), WBIS ($f=26$), and APLS ($f=24$) in the posttest in terms of explaining the features to consider while purchasing an existing business. In addition, it is understood that a small number of preservice science teachers improved in generating ideas about the codes of CS ($f=20$), L ($f=22$), and GTE ($f=11$) in the posttest.

The results of the study can be summarized as follows. It is determined that the preknowledge of the candidates regarding the concept of entrepreneurship is insufficient before integrated entrepreneurship training. On the other hand, the candidates are able to explain the social, economic, and cultural foundations of entrepreneurship after integrated entrepreneurship training. The majority of the preservice science teachers emphasize the importance of creativity and product design and how to act with nature while making an initiative. However, it is seen that the conceptual knowledge of the majority of the candidates on business plan design does not improve satisfactorily. In general, it is seen that the lack of conceptual knowledge of the candidates on their business plans negatively affects the total score they receive on the posttest.

Discussion and Conclusion

Learning to be an entrepreneur for preservice science teachers will make it easier to turn the experiences gained in the university into business ideas. This kind of entrepreneurship education gives insight to preservice science teachers about the understanding of transforming these riches into value for the economy of the region and the country through scientific and technical innovations by comprehending both biological and cultural wealth (Hains, Hansen, & Hustedde, 2017). Our study provides various contributions to the relevant literature. First, this study is a model for the integration of theory and application, which is weak in the world and in Turkey regarding the process of developing the entrepreneurship knowledge of preservice science teachers. Some of the previous studies define only the entrepreneurial knowledge of science teachers and candidates (Amorim Neto, Rodrigues, & Panzer, 2017; Bolaji, 2012; Deveci, 2016). However, our study focuses on the educational experiences of preservice teachers at the university and describes the designs and conditions in which they can be involved in learning entrepreneurship. In addition, it is determined that the conceptual knowledge of entrepreneurship of preservice teachers has increased from the level that needs to be developed to a weakly acceptable level as a result of the experimental process. Hence, the understanding of transforming theoretical knowledge into practice in entrepreneurship, which is the main problem for preservice teachers, has been developed and contributed to the theory of human capital. Being involved in various entrepreneurship training helps preservice science teachers develop their entrepreneurial

knowledge; however, they must engage in practical experiences to implement their potential entrepreneurship completely.

We observe that the conceptual knowledge of the preservice science teachers about entrepreneurship differs significantly in favor of the posttest at the end of the experimental process of the study. It is determined that the conceptual knowledge of the candidates for entrepreneurial skills before integrated entrepreneurship training is at the level that should be developed. It is seen that the conceptual knowledge of the majority of the candidates for entrepreneurial ability increased to a poorly acceptable level at the end of the experimental process. The conceptual knowledge of a few candidates for entrepreneurial skills increased to reasonably and highly acceptable levels. The reason why the candidates can maintain their conceptual knowledge about entrepreneurial skills in the experimental process that includes integrated entrepreneurship education may be due to the insufficient level of prior conceptual knowledge of the candidates about entrepreneurship. This is because the lack of prior knowledge is a variable that makes conceptual learning difficult (Hewson, 1982; Otero & Nathan, 2008).

Entrepreneurial skills in secondary school science courses were taught implicitly by 2013 in Turkey. Moreover, the contents of undergraduate courses and programs were updated by 2018 in Turkey. Economics and entrepreneurship, which are elective courses, are included in science teaching undergraduate programs. However, the candidates also could not benefit from these updated undergraduate course contents. In summary, education programs can be shown as one of the reasons for the lack of prior knowledge of the candidates. In addition, it is very effective in the development of the conceptual knowledge of individuals in the family and the environment about entrepreneurship (Cabrera & Mauricio, 2017; Kimmitt, Munoz, & Newbery, 2020). All these factors cause a lack of prior knowledge. The integrated entrepreneurship training carried out within the scope of the purpose of the research includes both theoretical information about the concept of entrepreneurship and long-term training that includes business plan design, generation of business ideas, and marketing processes. This is because the development of business ideas, the preparation of the business plan, and marketing (Shane & Venkataraman, 2001) are outlines of the entrepreneurship process. It can be said that even the experimental training process that focuses on these concepts is insufficient to develop the conceptual knowledge of the candidates toward entrepreneurship well or very well. Studies conducted with university students show that correctly structuring the conceptual knowledge of entrepreneurship significantly affects business plan design processes (Fontana & Musa, 2017; Kocak, Carsrud, & Oflazoglu, 2017). However, it is important for third-grade preservice science teachers to develop their conceptual knowledge about entrepreneurship. Therefore, it can be said that they will try to improve the entrepreneurial skills of secondary school students by matching up this knowledge with science subjects when they start in their profession.

When the findings obtained from each ET question are examined, it is seen that the candidates have difficulty responding to the economic foundations of entrepreneurship, the importance of taking advantage of technology while making initiatives, how to act while making a new business decision, and the incentives that will be given while making a new business decision. Each individual should have conceptual information content about entrepreneurship (Malerba & McKelvey, 2019; Pyka, Kudic, & Müller, 2019; Sousa & Silva, 2019). This is because the lack of conceptual knowledge is among the biggest obstacles to setting up a business (Haldar, 2019; Ismail & Buang, 2019). Marangoz and Aydın (2018) reveal that students' lack of conceptual knowledge restrains their entrepreneurial tendencies in their study with students of the faculty of management. The fact that all candidates produce a business idea and design a business plan and that most of them have knowledge about key concepts in the relevant questions can be seen among the positive effects of the experimental process with the current study. The candidates produce business ideas, design business plans, exhibit their business plans, and market their products in the process of integrated entrepreneurship training as a team. While designing the business plan, they also write the contents of the sections of their plans. However, the excess headings that should be in the business plan may prevent candidates from writing the required titles. The fact that most of the teams make a profit at the end of the exhibition can be seen as an indication that their conceptual knowledge about entrepreneurship is improving.

Suggestions

The preservice science teachers present a conceptual learning framework for entrepreneurship in the context of the biodiversity of their geography in this study. It can be suggested that the training processes related to entrepreneurship education should be planned for a longer period. In addition, it should be ensured that preservice teachers have sufficient knowledge about entrepreneurship in science. Similar educational opportunities should be used for working groups in other contexts to experience and explore entrepreneurship. In particular, educational content should be created on the basis of regional agriculture and husbandry and should be included in programs to feed the entrepreneurial spirit of preservice teachers.

The Limitations of the Study

The research was conducted in the fall semester of the 2019–2020 academic years. The experimental process continues in parallel with the undergraduate education processes of the third grade pre-service teachers. Although the candidates participate in the research voluntarily and apply for the training themselves, the educational process of the candidates that continues at the same time might cause them not to focus on the experimental process as desired.

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