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Perceptions and Competence of Turkish Pre-service Science Teachers with regard to Entrepreneurship

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Abstract: The aim of this study is both to determine the perceptions of pre-service science teachers towards the concepts of entrepreneurship and entrepreneurial characteristics and to investigate the perceptions of pre-service science teachers regarding transferring the entrepreneurial characteristics to students. This study is designed as a qualitative study and a phenomenological research approach is used. A total of 12 pre-service science teachers from grades 5 to 8 participated in the study. Data were gathered through the use of semi-structured interviews. The data were evaluated through both descriptive and content analysis. The results show that the perceptions of the 12 pre-service science teachers indicated a limited and inadequate understanding of the concept of entrepreneurship, based on their interviews. From these results, it can be said that there is a need to develop educational content in such a way as to increase pre-service science teachers' knowledge and experience with regard to entrepreneurship in science teacher training.

Introduction

Throughout the world, it is clear that increasing importance is placed on a term relating to the gaining of new skills on the part of individuals, in parallel with scientific and technological developments. Such skills are concerned with an individual's ability to adapt to change in terms of the extremely fast access to information in the environment. These skills are generally composed of characteristics such as critical thinking, decision-making, the ability to solve complex interdisciplinary problems, solving open-ended questions, creative thinking, entrepreneurial thinking, communication and collaboration, being innovative in terms of using information and opportunities and taking responsibility for financial, health and citizenship aspects (Partnership for 21st Century Skills, 2008). It is noteworthy that these characteristics of entrepreneurship were recently introduced into the education curriculum.

Different countries follow different strategies regarding entrepreneurship education. For example, some countries, such as Belgium, Denmark, Estonia and Lithuania, have specific strategies in place for entrepreneurship education. These countries work on their entrepreneurship education strategy in collaboration with several different government departments, such as education, culture, economy and agriculture and economic affairs and communications. Other countries, for example Bulgaria, the Czech Republic, Hungary, Austria, Poland and Turkey, have more general strategies towards entrepreneurship education. These countries consider entrepreneurship education to be a lifelong educational learning experience. In 2007, the Czech Republic established

a set of lifelong learning strategies intended to improve competencies in functional and financial literacy. However, the concept of entrepreneurship education was not mentioned (European Commission, 2012). It was stated that a few countries noticed the importance of entrepreneurship education in terms of primary and middle school education (grades 1-8) curricula (European Commission, 2012). These countries expressed their entrepreneurship objectives as being transversal, horizontal or cross-curricular rather than being explicitly mentioned as part of a particular subject. For instance, although entrepreneurship education was not clearly mentioned as part of the curriculum in the Netherlands, schools could refer to a subsidy to improve their own entrepreneurship curricula or courses (European Commission, 2012). In Turkey, the concept of entrepreneurship was introduced into the most recent version of the middle school science curriculum for grades 5-8 in 2013.

It has been thought that some concepts explained will be useful before its importance in the context of science education. Concepts related to entrepreneurship include entrepreneur, enterprise, entrepreneurship, and entrepreneurship education. An entrepreneur is an individual who performs business activities for profit, either alone or with the help of others and who is engaged in taking risks to a certain extent (Finnish Enterprise Agencies, 2014). An enterprise consists of economic units created by entrepreneurs in order to make a profit (Bozkurt, 2011). Entrepreneurship is a process by which entrepreneurs start seeing opportunities and try to create something new (Fisher & Reuber, 2010). Entrepreneurship education has been referred to as activities that cultivate enterprising or entrepreneurial individuals, and increase their understanding and knowledge of entrepreneurship and enterprise (Heinonen & Poikkijoki, 2005). On the other hand, entrepreneurial characteristics most highlighted for grades 5-8 students listed as: being opportunities, taking risk, being innovative, team work, ability to act independently, communicate effectively, creative thinking, adapt to change, self-confidence and use time effectively (California Department of Education, 2013; Güven; 2009; McKinney, 2013; National Content Standards for Entrepreneurship Education, 2004).

In the objectives of science education in all educational institutions and all levels of education, it has been stated that the need to strengthen the links among science, creativity, entrepreneurship and innovation (European Commission, 2015). Moreover, in the twenty-first century it has been emphasized that through science education needs to be improved entrepreneurial characteristics (Achor & Wilfred-Bonse, 2013). In addition to, attention has been drawn to the fact that entrepreneurship education has an important role to play with regard to science education, since it allows students to see the various career options that exist in the field of science (Deveci & Çepni, 2014). A number of studies have focused on science education, possibly because the main qualifications gained by individuals in entrepreneurship education are similar to those gained through science education. It is acknowledged that experiential learning is more effective at developing entrepreneurial characteristics and attitudes than traditional methods such as lectures (European Commission, 2008). Pedagogy implemented in science education is also experiential, which indicates another parallel between entrepreneurship education and science education. Studies have shown that active learning and the constructivist approach should be used in entrepreneurship education (Koopman, Hammer & Hakkert, 2013). It is known that the fundamental philosophy of science education involves active learning and hence the constructivist approach is adopted in preparing curricula. This is another example of the parallels between entrepreneurship education and science education.

In addition, it has been specified that students can gain and develop characteristics, including skills and abilities related to entrepreneurship, especially

through science laboratories, workshop applications and both internal and external curricular activities (Adeyemo, 2009). For example, Nwakaego and Kabiru (2015) suggest that chemistry education plays an important role in terms of finding answers to various human and socio-economic problems. In this sense, it could be said that those involved in chemistry education can benefit from entrepreneurship education. As a matter of fact, it has been suggested that the chemistry education curriculum designed for tertiary institutions should be integrated into entrepreneurship education (Ezeudu, Ofoegbu & Anyaegbunnam, 2013). For example, students could make and sell detergents, soaps, pomades, perfumes, beads, etc., or they could produce dyes, colourings and spices for sale (Ezeudu, Ofoegbu & Anyaegbunnam, 2013). Furthermore, it can be seen that physics, transportation, aviation, medicine, industry, warfare, peace, entertainment and electrification are all important topic areas in terms of solving a lot of problems in daily life (Onwioduokit, 2013). In this regard, Arion (2013) pointed out that entrepreneurship education is a substantial bridge between the core physics curriculum and the practical skills that are needed in the real world. Moreover, it has been pointed out that biology education provides a lot of opportunities in various areas that can be used to develop the entrepreneurial characteristics of students (Ejilibe, 2012). According to Nayak (2003), some of these topics include combating pests in order to increase agricultural productivity, growing and selling crops on the domestic market and horticulture in the form of fruit and vegetables. These subjects can all be used to develop eco-tourism, given that this is the most rapidly developing tourism field, in which the students will be able to introduce bio-diversity to both foreign and domestic tourists (Ejilibe, 2012). So, it can be said that science teachers have an important role as concerning benefitted from entrepreneurship in the educational process related to science education.

It has been demonstrated by the results of research science teachers do not have sufficient knowledge and experience about entrepreneurship at both national and international level (Bolaji, 2012; Bacanak, 2013; Habila-Nuhu & Pahalsen, 2014). In this sense, it can be said the need to determine the perceptions pre-service science teachers about entrepreneurship before starting their career as science teachers. The purpose of this study was to investigate the perceptions of pre-service science teachers with regard to the concepts of entrepreneurship and entrepreneurial characteristics and to determine to what extent they feel themselves ready to teach them. In this regard, the four research questions of this paper were:

1. What were the perceptions of pre-service science teachers concerning the concept of entrepreneurship?
2. What were the perceptions of pre-service science teachers on the entrepreneurial characteristics which they think that entrepreneurial individuals have?
3. What were the perceptions of pre-service science teachers with regard to the entrepreneurial characteristics they themselves have?
4. What were the perceptions of pre-service science teachers concerning transferring the entrepreneurial characteristics to middle school students?

Literature Review

The positive results obtained in studies conducted in science education in combination with entrepreneurship education have supported its importance. When considered from this point of view, it has attracted the attention of researchers looking

into ways in which entrepreneurship education can integrate into science education. For instance, it has been seen that science courses could be used to create innovative learning models through entrepreneurship education (Koehler, 2013). Likewise, it has been emphasised that entrepreneurship could be converted into practice in science education (Deveci & Çepni, 2014; Ugwu et al., 2013). Moreover, Bolaji (2012) found that science teachers have a positive perception concerning entrepreneurship education and how it might integrate into science education. Bacanak (2013) concluded that science teachers believe that effective student-centred methods and techniques can be introduced into middle school science courses in connection with entrepreneurship. In another study, Amos and Onifade (2013) indicated that pre-service teachers trained in the field of science education have more positive perceptions of entrepreneurship compared with other academic fields.

Most of the studies conducted in this field have focused on how science education demonstrates a better understanding of the manner of application and the importance of entrepreneurship education (Adeyemo, 2009; Abdu, 2011; Achor & Wilfred-Bonse, 2013; Deveci & Çepni, 2014; Buang et al., 2009; Ezeudu, Ofoegbu & Anyaegbunnam, 2013; Ejilibe, 2012; Nwakaego & Kabiru, 2015; Ugwu, La'ah & Olotu, 2013). However, some researchers have investigated the opinions of science teachers regarding entrepreneurship education (Aşıcı & Aslan, 2010; Argon & Selvi, 2013; Bolaji, 2012; Bacanak, 2013; Hsiao, 2010; Koehler, 2013). Other researchers have investigated the views of secondary teachers or students in the fields of chemistry or physics about entrepreneurship and production skills (Agommuoh, Patience & Akanwa, 2014; Njelita, Egolum & Ezeokeke, 2014). On the other hand, some studies have examined documents just as textbooks, lecture notes used in the teaching process in terms of entrepreneurship (Brown, 2000; Erarslan, 2011; Güven, 2009; Güven, 2010; Koehler, 2013). Moreover, a study by Armstrong and Tomes (2000) concentrated on the opinions of scientist-entrepreneurs who were not exclusively scientists and who had acquired entrepreneurial characteristics. A study by Kleppe (2002) described a special course that was designed and taught to a group of high school mathematics and science teachers, which covered subjects related to invention, innovation and entrepreneurship. Bikse and Riemere (2013) investigated the development of entrepreneurial competencies on the part of pre-service teachers in mathematics and science subjects. Furthermore, in the study conducted by Amos and Onifade (2013), they surveyed the opinions of pre-service physics and chemistry teachers on the need for entrepreneurship education in teacher training curriculum. Chigozie (2014) investigated productive skill competency levels of secondary school chemistry students in relation to entrepreneurship.

A review of the relevant literature has shown that there have been no studies examining pre-service science teachers' perceptions on entrepreneurship in Turkey (Aşıcı & Aslan, 2010; Deveci & Çepni, 2014; Bacanak, 2013; Erarslan, 2011; Güven, 2009; Güven, 2010). In this regard, it has been stated that the perceptions of pre-service science teachers towards preparing students to be responsible and innovative citizens is important (European Commission, 2015). In this sense it would be beneficial to determine the opinions of pre-service science teachers in terms of both their existing knowledge about entrepreneurship and the extent to which they feel themselves sufficiently equipped to deliver such an education before they start to teach this topic. Therefore, by determining the views of pre-service science teachers about entrepreneurship, action plans can be prepared for the correction of incorrect perceptions and for filling in gaps in teachers' knowledge on this topic. It is believed that this would contribute to the literature in a number of different ways. First, the existing knowledge of pre-service science teachers in grades 5 to 8 on this topic can be determined. Second, it can shed light on deficiencies in

this subject. Third, it can enable a close look at the perceptions of pre-service science teachers, focusing closely on entrepreneurship.

Method

This study has been designed taking into account phenomenological research based on qualitative research designs. There are two reasons for using the phenomenological approach. First, phenomenological research is based on closely examining the experiences of the participants and trying to explore their perceptions (Johnson & Christensen, 2008). Second, phenomenological research contains rich description of the participants' lives or lived experiences (Creswell, 1998). Thus, researchers try to find out the meanings behind particular experiences from the standpoint of the participants. This way, researchers learn that there are different ways of interpreting the same experiences. Finally, researchers prefer ways in which they can obtain extensive data about the experiences of the participants by respecting the diversity and complexity of their experiences. For this reason, this study has tried to uncover the perceptions of pre-service science teachers with regard to entrepreneurship through the use of interview techniques (Lodico, Spaulding & Voegtle, 2006). On the other hand, phenomenological research has limitations just as it has sample size is always smaller, generalizability results of study is not applicable (Creswell, 2007; Yin 1989).

Participants

The study was conducted in 2014. The participants consisted of 12 pre-service science teachers (two male and 10 female) enrolled in the Education Department of a state university in Turkey. Having a greater number of female pre-service science teachers is among the limitations of the study because the number of female pre-service science teachers is quite high. The participants are in the third year of the programme and have a mean age of 21. Third-year participants were chosen because they have acquired extensive knowledge and experience. The pre-service science teachers in the first and second year of the university have not yet completed the educational courses for science education. The fourth-year pre-service science teachers are preparing to exams to be appointed as teachers and thus were reluctant to do interviews. Hence it was decided to choose participants from among the third-year students. The selection of the participants was carried out by means of purposeful sampling. The third-year pre-service science teachers consist of 55 pre-service teachers. Twelve students were randomly chosen from among the third-grade pre-service science teachers. In fact, it has been initially planned to interviews with 26 teachers randomly selected from the attendance list. But, the fourteen pre-service science teachers did not want to join the research. So, these twelve pre-service science teachers from among the third-year pre-service teachers who are eager and willing to participate in research. One of the limitations of the study is that participants were only selected from one university due to the difficulty of access to other universities.

Data Collection Tools

It is stated that the most appropriate data collection technique is interview technique for phenomenological research method (Ary, Jacobs, Sorensen & Razavieh, 2010). Moreover, it has seen that interview technique was used most of the research

conducted related to entrepreneurship in the context of in teacher training (Armstrong & Tomes, 2000; Brown, 2012; Bacanak, 2013; Çelik, et al., 2015; Hamid, 2013; Oplatka, 2014; Suryanti, 2013). So, data was collected by interview technique through the interview form, which was composed of four open-ended questions. These open-ended questions had been prepared taking into consideration the concept of entrepreneurship and entrepreneurial characteristics and their development within a science education context. The interview form was developed by the researcher. In terms of the content validity of the interview form, the researcher consulted three experts - one assessment and evaluation expert in science education, one curriculum development expert in science education and one expert in the field of entrepreneurship education. The open-ended questions are as follows:

1. What do you understand by the term Entrepreneurship?
2. Which entrepreneurial characteristics does an individual entrepreneur have? Please explain by example...
3. Which entrepreneurial characteristics do you have? Why? Please explain by example...
4. Do you feel yourself capable of improving the entrepreneurial characteristics of middle school students under the current circumstances? Yes or no? Please explain why...

Researcher's Role and Interview Process

The researcher firstly gathered information on the concepts of entrepreneurship and entrepreneurship education using the following databases: the Education Resources Information Centre (ERIC), Education Research Complete, Academic Search Premier (EBSCO), Teacher References Center, MathEduc, JSTOR, Oxford Journals, Project Muse, PsycArticles (ProQuest), ScienceDirect and Web of Science. The above-mentioned research questions were then composed by the researcher, with the assistance of experts in the field. The researcher then prepared an interview plan containing the interview place and time.

The interviews were conducted in a lecture classroom at the University where they trained. The time normally allotted to each interview from 18 minutes to 8 minutes. In the interview process, the questions were asked in the same style and same order to each pre-service science teacher. The conversations were recorded on audio recorders during the interviews with the permission of the participants. The participants were not informed about the subject until the interview time. Moreover, each participant was warned that they should not speak to the other participants after the meeting. In this way the participants were prevented from making preliminary preparations before the interview, which may influence the interviews and the quality of the data.

Analysis of Data

The data obtained as a result of the interviews were exhibited as codes in tables. Direct quotations also illustrated the opinions of the participants. Descriptive content analysis is preferred for the analysis of data obtained in qualitative research studies. The researcher developed an encoding process, giving a name to repetitive or similar ideas. Direct quotations were used to illustrate the parameters of each code, with the participants' original opinions given in the findings section. Examples of statements

reflecting the views of the pre-service science teachers are presented in quotation marks. In order to preserve the privacy of the participants and their opinions, codes such as P1, P2, P3, etc. were used. For example, P2 refers to the second participant.

Moreover, as is well known, it is very difficult to ensure the reliability and validity of qualitative research (Fraenkel & Wallen, 2006). Thus, in this study, several measures were taken in order to ensure reliability and validity. In terms of *internal validity (persuasiveness)*, after the research report was finished, two participants were asked to express their thoughts regarding the accuracy of the data. In terms of *external validity (transferability)*, the raw data were directly transferred to the reader through the frequent use of direct quotations. In terms of *internal reliability (consistency)*, the processes of obtaining, encoding and reviewing the data were checked repeatedly by the researcher to confirm consistency. In terms of *external reliability (transmissibility)*, the researcher compared the raw data and the analysed data. In this way, the researcher found that the results were confirmed by the raw data.

Results

The pre-service science teachers' opinions regarding the concept of entrepreneurship are given below in Table 1.

Codes	Participants	Frequency (f)
Being active	P7, P10, P11	3
Suggesting creative ideas	P5, P8, P9	3
Being curious	P7, P10	2
Being an individual entrepreneur	P1,P6	2
Starting a new job	P3, P8	2
Creating a new thing	P2,P6	2
Being social	P12	1
Establishing a business	P2	1
Marketing something new	P6	1
Participating in various activities	P4	1
Researching	P7	1

*P7: This number means the seventh participant.

Table 1: Pre-service Science Teachers' Perceptions Concerning the Concept of Entrepreneurship

As can be seen in Table 1, the pre-service science teachers explained the concept of "entrepreneurship" with expressions consisting of codes relating to entrepreneurial characteristics. The most common expressions used by the pre-service teachers were being active, putting forward creative ideas and being curious. For example, P7 expressed her view as: "*a person's being active*", whereas P5 suggested her opinion as: "*providing new creative thinking on a topic or a piece of work*" and P10 explained her view as: "*people who are willing to do anything, people showing interest in a specific topic*". Other statements mentioned were being an individual entrepreneur, starting a new job and creating a new thing. For example, P1 stated her opinion as: "*the individual who comes into prominence for a situation or topic*", P3 expressed her point of view as: "*So it means starting a new business*", whereas P6 expressed it as: "*Actually it can have a purpose in terms of creating something, finding something new and launching it onto the market*". Some of the student teachers mentioned concepts such as being social, establishing a business and marketing something new. For instance, P12 explained his views as: "*someone who's not an introvert in social environments*", P2 described his point of view as: "*it is like setting up a business or building a company*". Finally, some of

the pre-service teachers also used expressions such as participating in different activities and carrying out research. P4 expressed her opinion on this topic as “*entrepreneurship isn’t related only to school. I believe one also needs to do different things outside of the school*”, while P7 expressed it as “*doing research on a subject*”. Table 2 shows the perceptions of the pre-service science teachers with regard to the entrepreneurial characteristics that they think entrepreneurial individuals have.

Codes	Participants	f
They are very ambitious and decisive	P2, P3, P6, P8, P9, P10, P12	7
They are individuals who have self-confidence	P1, P2, P4, P8, P9, P11	6
They are very curious	P2, P3, P7	3
They are individuals who like to research	P2, P7, P10	3
They are individuals who have different perspectives	P4, P5, P7	3
They are social individuals	P1, P11, P12	3
They are able to communicate effectively	P1, P4, P5	3
They are enterprising individuals	P4, P11, P12	3
They act courageously	P2, P5, P11	3
They are successful individuals	P9, P11, P12	3
They are avid individuals	P9, P11	2
They are risk-taking individuals	P2, P3	2
They are individuals who have knowledge of many subjects	P5, P9	2
They are open to criticism by others	P7	1
They are individuals who can empathise	P7	1
They are individuals who can motivate themselves	P8	1
They are individuals who like to plan	P3	1
They are individuals who like to create something	P4	1
They are individuals who develop themselves	P4	1
They are individuals who like to be at the forefront	P5	1
They are individuals who are able to predict the future	P5	1
They are individuals with leadership qualities	P6	1
They are creative individuals	P6	1
They are highly intelligent	P6	1
They are loved by the community members	P12	1

Table 2: Perceptions of Pre-Service Science Teachers on the Entrepreneurial Characteristics That They Think Individual Entrepreneurs Have

When we look at the explanations of the pre-service teachers regarding the characteristics of individual entrepreneurs, it is seen that some of the characteristics expressed by the pre-service teachers belong directly to entrepreneurial individuals. Seven pre-service teachers expressed that individual entrepreneurs are very ambitious and decisive individuals. For example, P8 expressed it as: “*When they start a task, they will surely finish the task*” and P10 stated it as: “*they must be determined; when they are confronted with an obstacle they do not give up*”. Six of the pre-service science teachers stated that individual entrepreneurs are those who have self-confidence. For instance, P4 expressed it as “*They have a lot of confidence in themselves*” and P11 described his point of view as: “*for example, they have self-confidence*”. Some of the pre-service teachers specified that individual entrepreneurs are very curious, that they are individuals who like to research and that they are individuals who have different perspectives. For example, P2 explained his point of view as: “*they are curious*”, P4 stated: “*They are individuals who like doing research, questioning individuals*” and P4 stated her opinion as: “*They think broadly and they look at life from different perspectives*”.

Moreover, other pre-service science teachers expressed the view that individual entrepreneurs are social individuals, who are able to communicate effectively and are enterprising. For example, P1 expressed it as: “*they are more social individuals*”,

P5 explained her views as: *“they can communicate effectively”* and P12 explained his opinion as: *“these individuals display enterprising behaviour”*. The pre-service teachers also explained that individual entrepreneurs act courageously, they are successful individuals, they are avid individuals and they are risk-taking individuals. For instance, P11 stated his views as: *“they are ambitious and want to be successful”*, P9 expressed it as: *“these individuals are successful; they get what they want”* and P3 stated her thoughts as: *“those individuals who are able to take risks”*.

Only a few of the pre-service teachers expressed the view that individual entrepreneurs are those who have knowledge of many subjects, are open to criticism by others, can empathise and can motivate themselves. For instance, P5 expressed it as: *“These people have knowledge about everything”*, P7 defined her views as: *“entrepreneurs need to be open to criticism”* and *“these individuals should be able to empathise”* and P8 explained her opinions as *“they can motivate themselves”*.

A few of the pre-service teachers thought that individual entrepreneurs like to plan, they like to create something, they develop themselves, they like to be at the forefront and they are able to predict the future. For instance, P3 stated her views as: *“these people are good at planning”*, P4 expressed it as: *“They do productive work and they always create something”* and *“they constantly improve themselves who interest are interested in many different areas?”*, P5 defined her opinion as: *“these people like to remain in the forefront of everything”* and *“they can make predictions about what might happen”*.

On the other hand, it can be seen from the expressions of the pre-service science teachers that they think individual entrepreneurs are those with leadership qualities, are creative, highly intelligent and loved by the community members. For instance, P6 explained her views as: *“these people have leadership spirit and they must be creative. They are also smart people”* and P12 specified his opinions as: *“they are usually loved by people”*. Table 3 shows the findings in terms of the entrepreneurial specifications that pre-service science teachers believe they have.

Codes	Participants	f
Undeterred	P8, P9, P10, P11	4
Creative	P4, P5, P6, P9	4
Self-confidence	P2, P4, P11	3
A good planner	P8, P10	2
Curious	P7, P2	2
Participates in activities	P5, P4	2
A leader	P10	1
Communicates effectively	P4	1
Ability to persuade others	P1	1
Optimistic	P11	1
Ambitious	P11	1
Visionary	P9	1
Makes predictions	P5	1
Desire to succeed	P4	1
Interested in many areas	P2	1
Does not think that they have any entrepreneurial characteristics	P1, P3	2

Table 3: Pre-service Science Teachers’ Perceptions with Regard to Entrepreneurial Characteristics They Themselves Have

The most common entrepreneurial characteristics that the pre-service science teachers believe they have are being undeterred and being creative. For example, P9 stated her opinion as *“If I trust my idea, I can stand behind it and support it till the end of time”*, P10 stated her views as: *“I am a determined person”*, P5 explained her opinion as:

“I can suggest solutions about any topic” and P6 expressed her views as: “I’m a creative person”.

Some pre-service science teachers believe themselves to have entrepreneurial characteristics such as self-confidence, being a good planner, being curious and participating in activities. For instance, P2 stated his views as: “I think I have self-confidence”, P8 stated her views as: “I am organised and like to work in a planned way”, P7 stated her opinion as: “I am a rather curious person” and P5 stated: “I like to participate in and be included in actions”.

Only a few of the pre-service teachers believe that they have the entrepreneurial characteristics of being a leader, communicating effectively, the ability to persuade others and being optimistic. For example, P10 stated her views as: “I am seen as a leader among my group of friends”, P4 explained her opinion as: “I absolutely know where I would talk and how I could talk”, P1 stated her views as: “If I have enough knowledge about any subject, I could convince the other person” and P11 specified her views as: “I’m an optimistic person”.

Moreover, some pre-service teachers explained their entrepreneurial characteristics as being ambitious, being visionary, making predictions, the desire to succeed and being interested in many different areas. For example, P11 stated her opinion as: “I am an ambitious individual”, P9 stated her opinion as: “When I put forward an idea, I can feel that it will be logical and successful”. P5 explained her views as: “I can make a prediction about it checking my previous knowledge”, P4 expressed her opinion as: “I want to be successful and I want to do something” and P2 defined his views as: “I have a variety of interest areas and I follow them consistently”.

On the other hand, two pre-service science teachers indicated that they do not directly have any entrepreneurial features. P1 stated her opinion as: “my personal properties aren’t suitable for entrepreneurship” and P3 expressed it as: “I am a bit shy; I’m not an entrepreneur. I can’t take any risks; I’m excitable and I want everything to be fast. That’s a bad thing, you know”. Table 4 shows the pre-service science teachers’ perceptions of their competence in terms of building the entrepreneurial characteristics in students.

Themes	Codes	f		Codes	Participants	f
Efficacy	I do not feel ready	11	because	I do not have these characteristics	P1	1
				I do not have knowledge and experience in this regard	P1, P2, P3, P5, P6, P7, P9, P8, P10, P11, P12	10
	I feel myself ready	1		I have knowledge and experience in this regard	P4	1

Table 4: Pre-service Science Teachers’ Perceptions Concerning Transferring the Entrepreneurial Characteristics to Students

The vast majority of the pre-service teachers stated that they feel up to the task of transferring entrepreneurial characteristics to students. Amongst the pre-service teachers who expressed such an opinion was P1, who stated her view as: “I don’t feel qualified in this subject”, whereas P7 stated her opinion as: “No, I don’t think I can teach them”. The reason why pre-service science teachers feel lacking on this issue is largely based on their lack of knowledge and experience about entrepreneurship. For example, P11 explained his opinion that they have not acquired those skills yet by saying, “First of all, how can we get the students to apply it? How can we involve them in this process? We haven’t got enough knowledge and experience yet on these subjects”, whereas P2 stated his view as:

“It seems there will not be a course related to entrepreneurship when we look at our life experiences. The fact of the matter is that it is difficult to transfer something (seminars, conferences, etc.) to my students in a field that I have never experienced”. “Only if I do research and ask questions can I learn something”. Another reason is given by a P1 pre-service teacher, who expressed the view: “Firstly I need to have that knowledge so that I can be aware what to transfer to my students; I don’t think I have those features yet”, thereby confirming that she did not yet have that skill.

On the other hand, only one pre-service science teacher felt self-sufficient on this subject. This particular pre-service teacher stated that she had knowledge and experience of entrepreneurship thanks to the fact that she participated in voluntary non-governmental organisation projects. For example; P4 stated her opinions as: *“I can’t say that I can do it entirely, but I can try. I think I can teach. My life used to be fixed by the same routines, going to school and returning home... I volunteered outside of school. I tried to do a lot more - as much as I could. For example, I volunteered for “kizilay” and the “Bursa xxx Council”... I started to do something, not only for myself, but also for the environment and people around me. I think this is entrepreneurship. I had knowledge and experience regarding entrepreneurship in those organisations. We learn by our own efforts. Friends here constantly try to create projects; actually I recognised that I was not aware of most of the things; I learnt when I started to go there. I started working as a volunteer in other places by means of the place in which I work right now. Friends here are very active. We even went abroad...”*

Discussion and Conclusions

In this article, the perceptions of pre-service science teachers at a Turkish university were examined in relation to entrepreneurship and entrepreneurial characteristics. It has been determined that they can clarify the concept of an entrepreneur regardless of entrepreneurship. We know that the concept of entrepreneurship is a process by which entrepreneurs see new opportunities and try to create something new (Fisher & Reuber, 2010). Based on the views of the pre-service science teachers who participated in this research, it can be said that they are very conscious of the need to be active and to put forward creative ideas and are curious about the concept of entrepreneurship. However, it can be observed that the direct expressions used by the pre-service teachers to define the concept of entrepreneurship simply as starting a new business, creating something new, establishing a business and marketing something new, are very few in number. This result shows that pre-service science teachers have insufficient perceptions regarding the concept of entrepreneurship. Research findings conducted by Bacanak (2013) have supported this. Bacanak concluded that middle school science teachers at a state university in Turkey did not have the necessary knowledge about entrepreneurship. In this context, it can be said that the 12 pre-service science teachers who participated in the current research had insufficient knowledge about entrepreneurship, as was the case with the serving science teachers in Bacanak’s study. In the current study, the science teacher training curriculum does not provide the knowledge and experience of entrepreneurship education that is necessary for pre-service science teachers, as has been shown by these results.

On the other hand, when the pre-service teachers’ opinions are analysed with regard to entrepreneurial characteristics, it can be seen that they express their ideas in terms of being determined, having self-confidence, being curious, enjoying research, having different perspectives, being social, communicating effectively, etc. Moreover, other pre-

service science teachers state their opinions directly, using entrepreneurial characteristics such as being enterprising, being successful, being brave, risk-taking, etc. – all attributes that individual entrepreneurs have. One of the most striking results showed that the two pre-service science teachers just said characteristic of risk taking among entrepreneurial characteristics. At the beginning, it has been emphasised that pre-service teachers need to have knowledge and experience about entrepreneurial characteristics (European Commission, 2004). However, just one pre-service science teacher mentioned leadership as being among the main characteristics that entrepreneurial individuals have. On the other hand, it was seen that no pre-service teacher talked about the characteristics of being innovative and seeing opportunities. In science and technology education, the importance of entrepreneurship for innovativeness in terms of creating new job opportunities has been emphasised (Ugwu et al., 2013). In addition, only one pre-service science teacher talked about the creative characteristic. These results indicate that pre-service science teachers do not really have a very detailed knowledge of the main characteristics of an entrepreneurial individual.

Examining the views of pre-service science teachers with regard to the entrepreneurial characteristics that they think they themselves have, it can be seen that they perceive themselves to have limits. In this sense, some of the pre-service teachers stated that they have entrepreneurial characteristics in terms of being undeterred, creative, self-confident, a good planner, being curious, participating in activities and being a leader. Other pre-service teachers identified entrepreneurial characteristics such as communicating effectively, the ability to persuade others, being optimistic, being ambitious, being visionary, making predictions, the desire to succeed and being interested in many different areas. It can be said that the statements made by the pre-service science teachers are not directly related to entrepreneurial characteristics such as risk-taking, seeing opportunities and being innovative. This may be because pre-service science teachers really do not think that they have these characteristics. Moreover, this is because pre-service science teachers do not have a clear understanding of what entrepreneurial characteristics are. In particular, it has been noted that there are no courses to develop information and skills for pre-service teachers on entrepreneurship and innovation in primary and secondary teacher training (Kleppe, 2002). Finally, it could be stated that pre-service science teachers see themselves as deficient in terms of entrepreneurial characteristics. Two pre-service teachers said directly that they lack any entrepreneurial characteristics. Nwoye (2012) found that physics students have low levels of entrepreneurial characteristics to allow for self employment. Similarly, in research conducted on university undergraduate students by Wang and Wong (2004), they concluded that university students feel unprepared to take risks. There may be two reasons for these results. Firstly, it can be attributed to the fact that entrepreneurship is a new concept in the field of education and hence it has not yet become part of the education curriculum in higher education training. Secondly, it can be attributed to the fact that pre-service teachers have insufficient or limited knowledge and experience with regard to entrepreneurship, due to entrepreneurship education only being provided in recent years.

In another finding of this study, it was seen that most of the pre-service science teachers feel inadequate with regard to encouraging students to develop entrepreneurial characteristics under current conditions. This is because pre-service science teachers seldom have the pedagogical knowledge and experience required to engage in entrepreneurship education. One pre-service teacher directly stated that he thinks he would face difficulties with this, justifying himself by stating that he did not have these entrepreneurial characteristics yet. In this sense, Nab and Pilot (2010), who investigated

strategies used for identifying opportunities for scientists selected from applied sciences (science) in the Netherlands, explained that they tried to give chances to students by providing them with the opportunity to move out of areas that they are used to, enabling the assessment of their business ideas. Similarly, Sipon, Pihie, Rahman and Manaf (2015) pointed out that teachers should acquire pedagogical content knowledge related to entrepreneurship education. Hence, it can be said that it could be beneficial for pre-service science teachers to follow a similar path in terms of gaining knowledge and experience. On the other hand, in the current study it was found that only one pre-service science teacher felt sufficiently able to transfer the entrepreneurial characteristics to students. This pre-service teacher believed that she had acquired sufficient knowledge and experience due to having worked in non-school organisations. This result could be attributed to the experience gained working with different institutions, stakeholders and experts. Thus, it has been expressed that teacher training institutions should establish good connections and cooperation with businesses and community organisations (European Commission, 2013).

Finally, it has been determined that the perceptions of the pre-service science teachers who participated in this research are insufficient with regard to both the concepts of entrepreneurship and entrepreneurial characteristics and how they put them into practice. In fact, these results are normally seen in terms of the absence of the entrepreneurial readiness of pre-service science teachers. In this sense, it has been stated that in-service training should be offered up-to-date information to pre-service teachers about implementation of entrepreneurship education (Birdthistle et al., 2007; Deakins et al., 2005; Hannon, 2006; Seikkula- Leino et al., 2010). Currently, it is known that many teacher training institutes lack an entrepreneurship education curriculum and, even if there is such a curriculum, there are no expert trainers who can implement entrepreneurship education. For instance, Kleppe (2002) found that there are no courses that will increase the understanding of pre-service teachers in the subjects of innovation and entrepreneurship in K-12 teacher training. He also found that there was a limited amount of written material on how to integrate entrepreneurship education into traditional training programmes. However, despite these results, it is expected that examples of good practice will emerge in the literature in the coming years. Bolaji (2012) suggested that this should be applied to in-service training and continuing education programmes for teachers who are implementing the science curriculum concerning the development of entrepreneurial characteristics. Similarly, Baranović and Stibric (2007) proposed that entrepreneurship education should be included in the training of both classroom teachers (primary school) and subject teachers. On the other hand, Ezeudu, Ofoegbu and Anyaegbunnam (2013) pointed out that the importance of entrepreneurship education must be better understood, if graduated pre-service teachers grown their profession effectively manages in science, technology and mathematics education.

Implications

Depending on these results and recommendations, it can be said that course and content development is required in order to increase the understanding of entrepreneurship education in terms of science teacher training in Turkey. Through such a development of courses and content we can pave the way for pre-service science teachers to gain entrepreneurial characteristics. Moreover, the results of this study have shown that pre-service science teachers need to be supported for improving their perceptions towards entrepreneurship education. Examples of activities could also be provided for pre-service

science teachers in order to allow them to acquire knowledge and experience regarding how to develop the entrepreneurial characteristics of students in middle school science courses. On the other hand, it could be suggested that the number of participants can be increased for similar researches. In addition, it can be conducted researches examined perceptions of pre-service teachers in other teacher training programs just as mathematics, music, art, language et al.

References

- Abdu, B. (2011). Chemistry education and entrepreneurial development in Nigeria: Issues and challenges. *Coconut volume*, 4(1), 107-114.
- Achor, E.E., & Wilfred-Bonse, K.U. (2013). The need to integrate entrepreneurship education into science education teachers' curriculum in Nigeria. *Journal of Science and Vocational Education*, 7, 111-123.
- Adeyemo, S.A. (2009). Understanding and acquisition of entrepreneurial skills: A pedagogical re-orientation for classroom teacher in science education, *Journal of Turkish Science Education*. 6(3), 57-65.
- Agommuoh Patience, C., & Akanwa, U.N. (2014). Senior secondary school physics teachers assessment of enterpreneurial skills needed for global competitiveness. *IOSR Journal of Research & Method in Education*, 4(1), 25-29. <http://dx.doi.org/10.9790/7388-04152529>
- Amos, A., & Onifade, C.A. (2013). The perception of students on the need for entrepreneurship education in teacher education programme. *Global Journal of Human-Social Science Research*, 13(3), 75-80
- Argon, T., & Selvi, Ç. (2013). The relationship between entrepreneurship values of primary school teachers and their perceived social support levels. *International Journal of Social Science*, 6(1), 179-206. http://dx.doi.org/10.9761/jasss_452
- Arion, D.N. (2013). Things your adviser never told you: Entrepreneurship's role in physics education. *Physics today*, 66(8), 42. <http://dx.doi.org/10.1063/PT.3.2083>
- Armstrong, P., & Tomes, A. (2000). Entrepreneurship in science: Case studies from liquid crystal application. *Prometheus*, 18(2), 133-147. <http://dx.doi.org/10.1080/713692057>
- Ary, D., Jacobs, L., C., Sorensen, C., & Razavieh, A. (2010). *Introduction to research in education* (8th ed.). Belmont, C. A. :Wadsworth Cengage Learning.
- AŞICI, H., & Aslan, S. (2010). The views of primary school 6th, 7th and 8th year students and teachers regarding entrepreneurship. *Procedia-Social and Behavioral Sciences*, 9, 1731-1735. <http://dx.doi.org/10.1016/j.sbspro.2010.12.391>
- Bacanak, A. (2013). Teachers' views about science and technology lesson effects on the development of students' entrepreneurship skills. *Educational Sciences: Theory & Practice*, 13(1), 622-629.
- Baranović, M., & Stibric, M. (2007). The development of entrepreneurial competence in Croatian compulsory education. Meeting in related to Key competencies Skills for life 2007 London, Velika Britanija. Retrieved from <http://bib.irb.hr/prikazirad?lang=en&rad=320729> at 07.02.2015
- Bikse, V., & Riemere, I. (2013). The development of entrepreneurial competences for students of mathematics and the science subjects: The Latvian experience. *Procedia-Social and Behavioral Sciences*, 82, 511-519. <http://dx.doi.org/10.1016/j.sbspro.2013.06.301>

- Birdthistle, N., Hynes, B. and Fleming, P. (2007). Enterprise education programmes in secondary schools in Ireland: A multi-stakeholder perspective. *Education & Training*, 49(4), 265-76. <http://dx.doi.org/10.1108/00400910710754426>
- Bolaji, O.A. (2012). Intergrating entrepreneurship education into science education: Science teachers perspectives, *Journal of Science, Technology, Mathematics and Education (JOSTMED)*, 8(3), 181-187.
- Bozkurt, Ç.Ö. (2011). *Dünyada ve Türkiye 'de girişimcilik eğitimi: Başarılı girişimciler ve öğretim üyelerinden öneriler*. Ankara: Detay Yayıncılık.
- Brown, C. (2000). *Curriculum for entrepreneurship education: A review*. CELCEE Digest, Ewing Marion Kauffman Foundation, Kansas City, MO. Center for Entrepreneurial Leadership. Reports - Descriptive Los Angeles, CA. ERIC-ED452 897.
- Brown., M.J.M. (2012). *Entrepreneur aducation assessment in secondary schools*. Thesis of Master, Gordon Institue of Business Science, University of Pretoria, Pretoria.
- Buang, N.A., Halim, L., & Meerah, T.S.M. (2009). Understanding the thinking of scientists entrepreneurs: Implications for science education in Malaysia. *Journal of Turkish Science Education*, 6(2), 3-11.
- California Department of Education, (2013). *Common core state standards, for english language arts & literacy in history/social studies, science, and technical subjects, for california public schools kindergarten through grade twelve*, ISBN 978-0-8011-1740-4, Adopted by the California State Board of Education August 2010 and modified March 2013.
- Chigozie, S.N.N. (2014). *Assessment of productive skill competency levels based on gender among senior secondary school chemistry students for entrepreneurship*. Thesis of Doctorate Degree, Faculty of Education, Mnamdi Azikiwe University, Awka.
- Creswell, J.W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.
- Creswell, J.W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*, (2th Edition). Thousand Oaks, California: Sage Publications.
- Çelik, H., Gürpınar., C. Başer., N., Erdoğan. S., (2015). Öğrencilerin yaratıcı düşünme ve girişimcilik becerilerine yönelik fen bilgisi öğretmenlerinin görüşleri. *The Journal of International Education Science*. 2(4), 277-307. <http://dx.doi.org/10.16991/INESJOURNAL.88>
- Deakins, D., Glancey, K., Menter, I., & Wyper, J. (2005). Enterprise education: The role of the head teacher. *International Entrepreneurship and Management Journal*, 1(2), 241-63. <http://dx.doi.org/10.1007/s11365-005-1131-9>
- Deveci, İ., & Çepni, S. (2014). Entrepreneurship in science teacher education. *Journal of Turkish Science Education*, 11(2), 161-188.
- Ejilibe, O.C. (2012). Entrepreneurship in biology education as a means for employment. *Knowledge Review*, 26(3), 96-100.
- Erarslan, L. (2011). Entrepreneurship teaching at primary education curriculum (sample of life science lesson). *Gazi Üniversitesi Endüstriyel Sanatlar Eğitim Fakültesi Dergisi*, 27, 82-94.
- European Commission, (2004). *Helping to create an entrepreneurial culture A guide on good practices in promoting entrepreneurial attitudes and skills through education*, Unit B.1: Entrepreneurship (SC27 3/4)Directorate-General for Enterprise, B-1049 Brussels
- European Commission, (2008). *Entrepreneurship in higher education, especially within non-business studies: Final report of the expert group*, Brussels, Belgium.

- European Commission, (2012). *Entrepreneurship education at school in Europe, national strategies, curricula and learning outcomes*. Brussels: Published by the Education, Audiovisual and Culture Executive Agency
- European Commission, (2013). *Entrepreneurship education: a guide for educators*. June 2013. European Union, Bruxelles: Entrepreneurship and Social Economy Unit.
- European Commission, (2015). *Science education for responsible citizenship. Report to the european commission of the expert group on science education*. Luxembourg: Publications Office of the European Union.
- European Commission. (2015). *Science education for responsible citizenship. Report to the european commission of the expert group on science education*. Luxembourg: Publications Office of the European Union.
- Ezeudu, F.O., Ofoegbu, T.O., & Anyaegbunnam, N.J. (2013). Restructuring STM (Science, Technology, and Mathematics) education for entrepreneurship. *US-China Education Review A*, 3(1), 27-32.
- Finnish Enterprise Agencies, (2014). *Guide: Becoming an entrepreneur in Finland*. Suomen uusyrittyskeskukset ry texts: uusyrittyskeskusverkosto graphic design: Unikuva / Mats Vuorenjuuri Update of information: Asiatieto Oy / Tuulikki Holopainen © The Finnish Enterprise Agencies 2014.
- Fisher, E., & Reuber, R. (2010). *The state of entrepreneurship in Canada. small business and tourism branch industry canada chris parsley, manager sonja djukic, economist*. Publishing and Depository Services Public Works and Government Services Canada Ottawa ON K1A 0S5. Cat. No. Iu188-99/2010E-PDF ISBN 978-1-100-14889-2 60719.
- Fraenkel, J.R., & Wallen, N.E. (2006). *How to design and evaluate research in education*, (Sixth Edition), Avenue of the Americas, New York: Published by McGraw Hill.
- Güven, S. (2009). New primary education course programmes and entrepreneurship. *Procedia-Social and Behavioral Sciences*, 1(1), 265-270. <http://dx.doi.org/10.1016/j.sbspro.2009.01.048>
- Güven, S. (2010). An analysis of life science course curricula from the perspective of the entrepreneurship characteristics. *E-Journal of New World Sciences Academy* (Nwsa), 5(1), 50-57.
- Habila-Nuhu., C.M.D & Pahalsan, C.A.D. (2014). Entrepreneurship Education for Science Teachers as a Means of Achieving National Transformation. Pahalsan et al *Int. Journal of Engineering Research and Applications*, 4(3), 153-156.
- Hamid, M. A. (2013). *Entrepreneurship education: The implementation in Year 1 primary school curriculum in Malaysia. A case study of one district in East Peninsular Malaysia*. Doctor of Philosophy in Education, The University of York, The University of York, Malaysia.
- Hannon, P.D. (2006). Teaching pigeons to dance: Sense and meaning in entrepreneurship education. *Education & Training*, 48(5), 296-308. <http://dx.doi.org/10.1108/00400910610677018>
- Heinonen, J., & Poikkijoki, S. (2005). An entrepreneurial-directed approach to entrepreneurship education: Mission impossible? *Journal of Management Development*, 25(1), 80-94. <http://dx.doi.org/10.1108/02621710610637981>
- Hsiao, A. (2010). *Nanomaterials in Newfoundland: Designing a lab kit for grades 9-12 to bridge the gap between science and engineering*. Proceedings of the Canadian Engineering Education Association. 7-9 June, Canadian.
- Johnson, B. & Christensen, L. (2008). *Educational research: Quantitative, qualitative, and mixed approaches* (Third Edition), Los Angeles: SAGE Publication.

- Kleppe, J.A. (2002). Teaching invention, innovation, and entrepreneurship to Northern Nevada high school science and math teachers. *Antennas and Propagation Magazine - IEEE*, 44(5), 115-119. <http://dx.doi.org/10.1109/fie.2001.963853>
- Koehler, J.L. (2013). *Entrepreneurial teaching in creating third spaces for experiential learning: a case study of two science teachers in low-income settings*. For The Degree of Doctor of Philosophy in Curriculum and Instruction In The Graduate College of the University of Illinois at Urbana-Champaign, Urbana, Illinois.
- Koopman, R., Hammer, M., & Hakkert, A. (2013). Teaching teachers in effectual entrepreneurship. *2nd Effectuation Conference*, June 3rd - 4th 2013, Lyon, France.
- Lodico, M.G., Spaulding, D.T., & Voegtler, K.H. (2006). *Methods in educational research: From theory to practice*. San Francisco: Published by Jossey-Bass
- McKinney, S. W. (2013). 4 reasons entrepreneurship is crucial to a middle school education. September 17, 2013. Momentum for Growth. Retrieved from <http://blog.safeguard.com/index.php/2013/09/17/4-reasons-entrepreneurship-is-crucial-to-a-middle-school-education/> at 01.02.2015.
- Nab, J., & Pilot, A. (2010). Strategies for teaching opportunity identification at science students. Experiences of expert teachers. Paper presented at the annual conference of the Internationalizing Entrepreneurship Education and Training (July 5 - 8).
- National Content Standards for Entrepreneurship Education, (2004). *Preparing youth and adults to succeed in an entrepreneurial economy, accelerating entrepreneurship everywhere*, Retrieved from http://www.entre-ed.org/Standards_Toolkit/Helpful%20Downloads/NCSEE%20Website.pdf. At 25.03.2014.
- Nayak, R. (2003). Teaching Commercial, Aspect of biology. *43rd proceedings of cet STAN*. HEBN. 209-201.
- Njelita, C.B., Egolum, E.O., & Ezeokeke, K.N.C. (2014). Identification of Production Skills Possessed By the Chemistry Teachers and Those Acquired By Students for Wealth Creation. *International Refereed Journal of Engineering and Science*, 3(3), 15-19.
- Nwakaego, O.N., & Kabiru, A. M. (2015). The need to incorporate entrepreneurship education into chemistry curriculum for colleges of education in Nigeria. *Journal of Educational Policy and Entrepreneurial Research*, 2(5), 84-90.
- Nwoye, A.N. (2012) *Assessment of resources and the level of entrepreneurial skills acquired by secondary school physics students in anambra state*. A Thesis Presented To The Department of Science Education, Faculty of Education, Nnamdi Azikiwe University, Awka.
- Onwioduokit, F.A. (2013). *The ordeal of science teaching in the contemporary society: A need for paradigm shift for the new generation*. A professorial inaugural lecture (series 36 th) delivered on January, 31. Nigeria, University of Uyo press limited.
- Oplatka, I. (2014). Understanding teacher entrepreneurship in the globalized society: Some lessons from self-starter Israeli school teachers in road safety education. *Journal of Enterprising Communities: People and Places in the Global Economy*, 8(1), 20-33. <http://dx.doi.org/10.1108/jec-06-2013-0016>
- Partnership for 21st Century Skills, (2008). *21st Century skills, education & competitiveness a resource and policy guide*. 177 N. Church Avenue, Suite 305, Tucson, AZ 85701, 520-623-2466.
- Seikkula-Leino, J., Ruskovaara, E., Ika`valko, M., Mattila, J., & Rytko`la`, T. (2010). Promoting entrepreneurship education: The role of the teacher? *Education & Training*, 52(2), 117-27. <http://dx.doi.org/10.1108/00400911011027716>

- Sipon, M., Pihie, Z.A.L., Rahman, F.A., & Manaf, U. K.A. (2015). Teacher's entrepreneurial pedagogical content knowledge roles in human resource development. *International journal of management and applied research*, 2(1), 35-44. <http://dx.doi.org/10.18646/2056.21.15-003>
- Suryanti, H. H. S. (2013). The problem based learning (PBL) based entrepreneurship learning model development to improve the life skills of the teacher training students in private universities throughout solo raya. Dewantara, *International Journal of Education*, 1(1), 1-15.
- Ugwu, A.I., La'ah, E., & Olotu, A. (2013). Entrepreneurship; performance indicator for innovative/skill acquisition: imperative to science and technology education (STE). *World Conference on Science and Technology Education*, 29 September - 3 October, Sarawak, Borneo, Malaysia.
- Wang, C.K., & Wong, P.K. (2004). Entrepreneurial interest of university students in Singapore. *Technovation*, 24(2), 163-172. [http://dx.doi.org/10.1016/s01664972\(02\)00016-0](http://dx.doi.org/10.1016/s01664972(02)00016-0)
- Yin, R.K. (1989). *Case study research design and methods*, *Applied Social Research Methods*. California: Sage, Newbury Park.

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