Effect of Guided Inquiry-Based Learning Integrated with Enterprise Education on the Entrepreneurial Competencies of Middle School Students

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Abstract

This research was designed to examine the effect of guided inquiry-based learning (GIBL) integrated with enterprise education (EE) entrepreneurial competencies (perseverance, creativity, professionalism) on the part of 74 eighth grade Turkish students. A quasi-experimental design was used for conducting this research. The intervention process was carried out during the teaching of the eighth grade "liquid and solid pressure" unit. The current teaching curriculum was applied to the comparison group (CG) students. The GIBL approach integrated with EE was applied to the experimental group (EG) students over a five-week period. The research data were collected using an instrument entitled the "Entrepreneurship Skills Scale". Independent samples t-test, paired sample t-test, and a one-way ANCOVA test were used to analyze the research data. As a result, it was determined that GIBL integrated with EE, had a positive effect on the general entrepreneurial competencies of the students. It was also found that the GIBL integrated with EE had a positive effect in the professionalism sub-dimension of the EG. However, it was found that the GIBL integrated with EE had no effect on the creativity and perseverance sub-dimensions of the EG. In future research, researchers can examine the impact of the GIBL integrated with EE on different entrepreneurial competencies in a science course.

Keywords: guided inquiry-based learning, enterprise education, entrepreneurial competencies, science education

Introduction

New skills and new capacities are needed to cope with the rapid changes affecting all human life (European Commission, 2015a). In this sense, entrepreneurship is one of the eight competences associated with lifelong learning (Official Journal of the European Union, 2018). Entrepreneurship is also one of lifelong learning skills which is thought to be gained by students in basic education in the European Union and in the Organisation for Economic Co-operation and Development [OECD] countries, in Finland, in Sweden and in Turkey [Elo, 2016a;

Berglund & Holmgren, 2013; Republic of Turkey Ministry of National Education (RTMNE), 2018]. Similarly, Wardani et al. (2019) state that entrepreneurial skills should be integrated into the whole learning process from primary school through to university. Thus, in many countries, entrepreneurship and enterprise education (EE) are now part of the primary and middle school curriculum (McMullan & Long, 1987; RTMNE, 2018; Lackéus & Sävetun, 2019).

Various studies have emphasized that the lower the age at which EE is taught, the more positively the participants are affected by the education provided (Brüne & Lutz, 2019; Koban et al., 2020). Moreover, Hassi (2016) points out that teaching for improving students' entrepreneurial competencies is suitable for 11–12-year-old students. Therefore, over the last two decades, there has been an increasing emphasis on EE or entrepreneurial education at all levels of education (Leffler, 2009; Li et al., 2003; Summer, 2019). In fact, one of the most important reasons for this is the need for entrepreneurial and innovative individuals in the future (European Commission, 2012; OECD, 2009). So how, and in what subject teaching areas, can we provide such an education to students? In this sense, it is interesting to speculate in which subject area EE can most readily be incorporated. As far as EE is concerned, according to Allolinggi (2017), teachers do not need to plan various activities outside the normal teaching hours, because EE can be integrated into any subject. Hietanen et al. (2014) also stated that further research is needed to establish the practical and theoretical foundations for EE in different subject areas as part of basic education.

In the literature, it is possible to see studies in which EE is incorporated into various teaching fields such as music education (Garnett, 2013; Hietanen et al., 2014; Hietanen & Ruismäki, 2016), mathematics education (Palmér & Johansson, 2018; Wang, 2019), visual arts (Elo & Kaihovirta, 2017), crafts (Elo, 2016b; Rönkkö & Lepistö, 2016), primary and middle school science (Deveci & Çepni, 2014; Deveci et al., 2015; Deveci & Seikkula-Leino, 2016; Elo & Kurtén; 2020), biology (Andriani & Ahda, 2019; Ejilibe, 2012; Ojone, 2017; Umeh & Achufusi, 2011), chemistry (Ezeudu et al., 2013), and physics (Agommuoh & Akanwa, 2014; Egbo, 2011). Thus, the systematic review study performed by Deveci and Seikkula-Leino (2018) indicated that the studies conducted on entrepreneurship in teacher education were mostly conducted in the field of science education. Moreover, the European Commission (2015b) suggested that the concept of enterprise should be included in science education, both in America and Europe (European Commission, 2015b). Ogunleye (2019) reports that science teachers' entrepreneurial knowledge and skills have an important contribution to make in terms

of their classroom practices. In this sense, it can be said that the potential for applying EE within science education is quite high.

As a matter of fact, Ogunleye (2019) states that science teachers should teach science curricula with strategies that can improve students' entrepreneurial competencies. Thus, it is possible to see that teachers have positive views on the place of EE in educational practices (Elo, 2015; Zangeneh et al., 2020). However, how to implement enterprise training, which is a new experience for teachers, will not be so easy. For example, many researchers state that teachers have difficulty when it comes to finding content and methods to implement entrepreneurship education (European Commission, 2009; Elo, 2015; Fiet, 2000a; Seikkula-Leino, 2008; Solomon, 2007; Umar et al., 2020). On the other hand, in EE, teachers are faced with challenges in transforming curricular content into practice (Fejes et al., 2019; Figueiredo-Nery & Figueiredo, 2008; Mattila et al., 2009; Sarac and Yıldırım, 2019). In addition, some teachers state that the exams and curriculum applied in the education system prevent the allocation of time to EE (Deveci & Seikkula-Leino, 2016; Ismail & Buang, 2019). Consequently, there is a need for research to enable teachers to see how EE can be integrated into science subjects. Such research is important in terms of ensuring that science teachers understand which approaches or methods are preferred for establishing a link between EE and science education. Thus, it is of great importance to understand how teachers transform EE into teaching practice. Moreover, in the 21st Century, there is a need for individuals to possess entrepreneurial competencies such as being creative, perseverance and professionalism. Ogunleye (2019) states that this need can be easily achieved with science students as part of science education.

Enterprise Education

Enterprise and entrepreneurship are terms that are often used interchangeably, and this causes much confusion (Jones & Iredale, 2010). Entrepreneurship education and GE approaches are different, but there is also significant overlap in the way they are designed and implemented (Preedy et al., 2020). In general, one of the most important common aspects is that both education approaches basically aim to encourage an entrepreneurial mindset on the part of individuals. The concept of entrepreneurship refers to entrepreneurial practice that leads to the creation of a new enterprise, and the creation of new businesses and value (Watts & Wray, 2012). Entrepreneurship education is based on the logic of starting a business, and aims to develop the competencies that students need to start a business and become an entrepreneur (Lackéus & Sävetun, 2019). Thus, entrepreneurship education is primarily suitable for a small minority in higher education who are interested in entrepreneurship (Lackéus & Sävetun,

2019). On the other hand, the concept of enterprise expresses employability, that promotes an innovative, creative, resourceful and opportunistic approach to learning in life and work (Watts & Wray, 2012). The Quality Assurance Agency for Higher Education states that enterprise is the application and generation of ideas, which are set within practical situations with regard to a given project [The Quality Assurance Agency (QAA), 2018]. From this perspective, EE is defined as a development process aimed at providing students with the behaviors, qualifications and competencies, the realization of which will increase their capacity to generate ideas (QAA, 2018). In this sense, EE aims to develop the skills, attitudes, abilities, attributes, and competencies that individuals will need in the future (Dal et al., 2016; Pepin, 2012). In addition, EE aims to provide individuals with the mentality required to come up with original ideas in response to identified needs and shortcomings and, in short, having ideas and making them happen (QAA, 2018). For example, EE aims to develop entrepreneurial competencies that are accepted as "entrepreneurial" such as creativity, self-efficacy, innovation, initiative, proactivity, uncertainty tolerance, and perseverance (Lackéus & Sävetun, 2019). In the current research, the EE approach has been adopted, and the term "enterprise education" has been used throughout the text.

When it comes to entrepreneurial competencies, it is possible to see numerous examples of competences in the literature. Some entrepreneurial competencies can be expressed as being in the form of teamwork, creativity, perseverance, resource management, professionalism, financial literacy, risk management, self-efficacy, ability to persuade, self-esteem, building networks, managing uncertainty, planning for future insights into the market, seeing opportunities, decisiveness, resource marshalling, independence etc., (Moberg et al., 2014; Mojab et al., 2011; Ocak & Didin, 2018; Ezeanokwasa et al., 2014; Ghafar, 2020; Greene, 2011; Kyndt & Baert, 2015). Therefore, in this current research, the EE approach was preferred because it is aimed at younger age groups, with the aim of developing competencies such as professionalism, creativity, and perseverance.

According to Van-Gelderen (2012), perseverance involves continuing to strive for a goal in the face of adversity. For someone to be successful in any entrepreneurial activity requires perseverance (Van-Gelderen, 2012). Although perseverance is seen as one of the success factors relating to entrepreneurship activities, it has not been taken into consideration in research on entrepreneurship (Lamine et al., 2014). Professionalism is one of the components at the center of quality education (Adams, 2003). Professionalism arises from routine processes that enable the individual to become an expert in his/her field (Ventura & Milone, 2000). In addition, according to Soans (2018), professionalism refers to the skills, competencies, and

behaviors that an individual exhibits in a wider context for a particular profession. Soans (2018) also defines professionalism as the skill or behavior that goes beyond what an ordinary person would have. According to Amabile (1996), creativity is an original and beneficial manifestation that occurs during the development of a business. Creativity is always associated with entrepreneurship because of its close relationship with innovation (Lourenço & Jayawarna, 2011). Creativity is seen as an important component of the entrepreneurship process, characterized by limited resources and high levels of uncertainty (Lourenço & Jayawarna, 2011). In addition, both inquiry learning and EE aim to develop students' innovative and creative thinking skills (Hietanen & Järvi, 2015; Moberg, 2014; Barrow, 2010; Osborne et al., 2003). As a result, in the literature, there is no research investigating the effect of GIBL integrated with EE on students' competencies in the form of creativity, perseverance and professionalism.

Inquiry-based Learning Integrated with Enterprise Education

Entrepreneurial learning is a process of generating value, learning by doing, involving experiential interaction between learners and their environment (Corbett, 2005, 2007; Henry et al., 2005; Fiet, 2000b; Pepin, 2012). Thus, for EE at different age levels, it is possible to see that various methods, techniques and models such as project-based learning (Koban et al., 2020), inquiry-based learning [IBL] (Elo & Kurtén, 2020; Pittaway, 2009), experiential learning (Noworatzky, 2018), and science-based EE (Deveci et al. 2015), and entrepreneurial projects (entrepreneurship, science, technology, engineering, and mathematics [E-STEM]) integrated with STEM education (Deveci, 2019) are used. In general, discovery-based learning is central to all of these educational practices. In this sense, entrepreneurial learning involves exploratory learning that focuses on a process of discovery and interpretation to find and implement ideas (Wang & Chugh, 2014).

IBL is used a great deal in science education (Pittaway, 2009). IBL is also a student-centered approach that allows students to control their own learning (Spronken-Smith et al., 2011). Confirmation, structured, guided, and open inquiry are four different forms of IBL based on the roles of teachers and students (Banchi & Bell, 2008). Guided inquiry-based learning (GIBL) has been taken into consideration in the current research, because GIBL is preferred in most of the research that has been conducted on middle school students in grades 5 to 8 (Almuntasheri et al., 2016; Mutlu, 2020; Sandoval & Harven, 2011; Trundle et al., 2010). GIBL is a practical application of the inquiry-approach that is applied to improve students' learning in K-12 education (Harada & Coatney, 2014). Moreover, GIBL allows students to become somewhat more independent than does structured inquiry as part of the inquiry process, thus

allowing students to enter the inquiry process with less teacher support (Spronken-Smith & Walker, 2010). According to Banchi and Bell (2008), with GIBL, the teacher gives the students only the research question/problem situation. The students then try to find solutions for the problem situation (Banchi & Bell, 2008). In addition, students also design the experiment or the research process themselves. Finally, the students arrive a solution by themselves (Banchi & Bell, 2008).

There are many studies which indicate that GIBL has a positive effect on middle school students' conceptual understanding (Almuntasheri et al., 2016; Jasperson, 2013; Trundle et al., 2010), on scientific process skills (Mutlu, 2020), on science attitude (Kim, 2011), on science content knowledge (Kim, 2011), and on motivation (Jasperson, 2013). Moreover, middle school students do not think that the guided inquiry experience is difficult, and they also saw the inquiry tasks being more interesting and useful than the discussion tasks (Sandoval & Harven, 2011). As a result, research with regard to GIBL generally focuses on conceptual understanding, attitude, motivation and scientific process skills.

On the other hand, it can be said that the number of pieces of research related to the concept of GIBL and EE examined together, is quite limited. Thus, Mbanefo and Eboka (2017) stated that elementary school science teachers also need an awareness of approaches to inquiry-based learning in order to promote students' entrepreneurial competencies. In the field of EE, it is stated that the main interest of science students tends to be basic science, and they are not interested in the commercialization process which follows a scientific discovery (Pittaway, 2009). In terms of EE, inquiry-based learning leads students to learn basic concepts such as discovery, invention, innovation and commercialization through the research process (Pittaway, 2009). On the other hand, Säljö (2010) claims that EE is the solution or is something that is created for a particular problem. In this sense, there is a similar initial process between inquiry-based learning and EE, to the point of producing solutions to problems. In addition, Elo and Kurtén (2020) state that these two phenomena are based on similar learning processes. Moreover, the inquiry process, which collaboratively turns ideas into action, is the basis of EE (Elo, 2016a, 2016b; Jones & Iredale, 2010; Pepin, 2012). Therefore, by using inquiry-based learning, we can transform the solutions to problem situations given to students, into desired outcomes in EE. Moreover, it is stated that EE can be integrated with various active learning approaches such as courses, case studies, special projects, even field trips to real world enterprises, in order to develop an entrepreneurial mindset on the part of individuals (Pihie & Sani, 2009). Due to the growing interest in EE in middle school science education, research has emerged in recent years examining the impact of curriculum integrated with EE on middle

school students. Among these studies, experimental studies are very limited. The research question is: Does GIBL integrated with EE have an impact on the entrepreneurial competencies of middle school students? Based on this research question, the sub-research questions are as follows:

- Is there a statistically significant difference between the pre-test and the post-test mean scores of the experimental group (EG) in which the GIBL, integrated with EE, is implemented, and the comparison group (CG) in which regular instruction is implemented?
- Is there a statistically significant difference between the pre-test and post-test mean scores of both the EG and the CG?
- Is there a statistically significant difference between the post-test mean scores of the EG and those of the CG?

Method

This research followed a quantitative quasi-experimental (pre-test post-test) design to determine whether an activity or materials made a difference in results for participants (Creswell, 2012). Therefore, this research examined the effect of the GIBL integrated with EE on students' entrepreneurial competencies. Quasi-experimental designs are preferred in cases where the researcher could not randomly assign participants due to the fact that they cannot form groups artificially (Creswell, 2012; Shadish & Luellen, 2006). A major problem with quasi-experimental design is that two groups are not necessarily the same before any intervention takes place (Gribbons & Herman, 1997). Thus, the EG and CG of this research consists of classes that were previously formed during the official registration process. Therefore, instead of randomly distributing, a CG as similar as possible to the EG was chosen. Since it was not possible to use random allocation (Muijs, 2004). For quasi-experimental design, the dependent variable of this research was entrepreneurial competency, and the independent variable was the GIBL integrated with EE.

Research Participants, Intervention Process, and Context

This research was conducted in the 2018 fall semester. The middle school in which the research was conducted is a public school in the province of Kahramanmaraş in Turkey. The convenience sampling technique, which allowed the use of accessible data sources (Newby, 2014), was used for sample selection. Thus, a total of 74 8th grade students participated in the study, with ages ranging from 13 to 14 years. The research intervention process is summarized in Table 1.

Table 1

The Research Intervention Process

Groups			The EG (n=37)	The CG (n=37)
			Pre-test	Pre-test
Intervention process	**Curricular activities/content**: The subject was physical events; the unit is "pressure", variables affecting solid pressure, variables affecting liquid pressure	+	**Extracurricular activities** Cycle of GIBL integrated with EE **Week 1**: Problem situations **Week 2**: Produce ideas, and decide on one of the ideas **Week 3**: Drawings of ideas **Week 4**: Design of ideas, and its cost **Week 5**: Slogans for the design/product and to present solution or design	**Curricular activities/content**: The subject was physical events; the unit is "pressure", variables affecting solid pressure, variables affecting liquid pressure
			Post-test	Post-test

The EG used in the research consisted of 37 students who undertook both the pre-test and the post-test. Similarly, the CG consisted of 37 students who also undertook the pre-test and the post-test. In this research, the researcher randomly appointed one of the groups at the beginning of the academic period as the EG, and the other as the CG. This random assignment is not in accordance with the true experimental design procedure because students in two eighth grade classes (for example, class 8A and 8B) in the school where the research was conducted were in classes created during the official enrollment into the school. The case where the random selection was made is only to determine which of the two eighth grade classes (8A or

8B) already present could be the EG and which the CG. Therefore, a quasi-experimental procedure was followed since it was not possible to be sure whether these classes were randomly created during the official enrollment of the students into the school. In this sense, Muijs (2004) states that in quasi-experimental studies, CGs and EGs should be as similar as possible in terms of factors such as parental socio-economic status, gender, ethnicity, and ability. In terms of these issues, it was ensured that the EG and the CG were from the same school, from the classes taught by the same teacher, and from a similar socio-economic environment.

During the intervention process, the teaching curriculum was taught to both the EG and the CG by the same science teacher. The subject was "*physical events*" which include concepts of physics, while the unit was "*pressure*". Thus, students were taught pressure, variables affecting solid pressure, and variables affecting liquid pressure. Lessons based on the contents of a science textbook were prepared according to the current science curriculum and were used with the CG. The science textbooks used in almost every region of Turkey have been designed to adopt a student-centered constructivist approach. The students in the EG were exposed to the GIBL integrated with EE as an extra-curricular activity in addition to the same lessons as the CG. According to Preedy et al. (2020), extracurricular activities take place outside of scheduled teaching time, and are different from in-curricular activities due to their voluntary nature. Extracurricular activities have been used as one of preferred activity types in enterprise or entrepreneurship education (Preedy, 2018). As a result, the intervention process applied in this study consisted of extra-curricular activities based on volunteering. Moreover, the researcher took part in the process by which GIBL integrated with EE was applied. The stages followed in this process were carried out by the researcher. Thus, simultaneously with the process in which the contents were taught to the EG, the students began to produce solutions to problem situations related to the use of these concepts in daily life. During this period, the students worked in groups of 3 or 4. In the intervention process, problem status and progressing processes were carried out according to stages given in Figure 1.

Figure 1

Cycle of the GIBL integrated with EE

The GIBL approach integrated with enterprise education was conducted with the EG participants over a five-week period. These intervention processes were explained in more detail in the following sections.

Problem Situations

In the first stage, the students were provided with problem situations to consider and were asked to find solutions. This process took two weeks. For example, *problem situation 1*: Ayşe, an eighth grade student, lives in a small village with her family. Ayşe loves her village and her school. However, in winter, in rainy weather, the road to the school is thick with mud, so Ayşe's feet sink into the mud. But Ayşe has to get to school. In this situation, what shoes can be designed to allow Ayşe to walk without sinking into the mud? *Problem situation 2*: This year, Zeynep's teacher is preparing to move to the school to which she has been appointed. She and people she had employed had all her stuff loaded into a truck. However, the employees left after moving the stuff into the house. However, she saw that a heavy parcel had been forgotten and had been left outside. But that box was very heavy, and Zeynep's teacher could not carry it up the stairs. What kind of a tool could the teacher design using the principle of pressure conduction in liquids? *Problem situation 3*: Ali's favorite toy is his truck. Ali plays in the sand with his truck until evening. While Ali is playing with his toy, he saw it sinking into the sand. What wheel can Ali design by using pressure transmission in solids, so that his van does not sink into the sand? *Problem situation 4*: When Ahmet comes home from school, he wants

orange juice. But there is no orange juice extractor at home. In this situation, how could Ahmet design an orange juice extractor by utilizing the principle of pressure transmission in solids?

Produce Ideas, and Decide on One of the Ideas

At this stage, the students were asked to produce solutions/ideas related to their selected problem situation. During this stage the students discussed and brainstormed the problem as much as possible. They produce multiple solutions and were directed by the researcher to the most useful and feasible ideas.

Drawings of Ideas

After the students have clarified their ideas, they were asked to draw their solutions on paper. During this period, the students continued brainstorming. They were then asked to decide what tools they would use or need. At this stage, students were reminded of the need to pay attention to the need for new designs. It was emphasized that if it was a design that had been made before, they should definitely add an innovative dimension to it.

Design of Ideas, and their Cost

After the students drew their designs, they were warned not to spend too much money on tools for the prototype. During this period, students brainstormed the situation once more. First, they were reminded that they should use tools they do not use in their homes. At this stage, the students' designs/products were examined by the researcher. Guidance was given to those who could not complete their designs. On the other hand, students whose designs were complete, made cost calculations based on the cost of the tools they used. Thus, the students set a sale price for their product/design. The students were asked about how their design would work. They were also asked to indicate how their design would work in daily life. All groups were able to design in a concrete way.

Target Group

At this stage, students were made to think about whom to sell their designs to. They were reminded that the larger the target audience of their design, the more likely their ideas would be accepted in society. During this period, students brainstormed the situation. They tried to ensure that their designs were capable of being used in different contexts, and they thought about this aspect.

Find Slogans for the Design/product

At this stage, students were asked to produce slogans for their design. They were reminded that this should be a catchy advertising slogan. As part of this process, students were asked to examine a number of brochures for different products. Thus, students were provided with an idea of how to introduce their ideas.

Present Solution or Design

At this stage, the students were asked to think about their ideas/designs in terms of certain dimensions (aim, equipment, how it works, target group, costs). Finally, the students presented their project ideas to each other by preparing a poster presentation on cardboard. Intervention processes were finalized in this way. Information about the data collection tool used before and after the intervention was given below.

Data Collection Tool

In this study a scale entitled "Entrepreneurship Skills Scale" developed by Ocak and Didin (2018) was used. This scale contains 21 items. This scale uses 5-point Likert type responses (never, sometimes, rarely, often, always) aimed at measuring middle school students' entrepreneurial competencies. Specifically, this scale included three sub-dimensions in the form of professionalism (10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, and 21 items), perseverance (7, 8, and 9 items), and creative thinking (1, 2, 3, 4, 5 and 6 items). Examples of some of the items included in the scale are as follows: Item 1: *I can produce new ideas in daily life*, Item 9: *I work hard to succeed*, Item 11: *Collaborative work leads to more new ideas*, Item 14: *I successfully fulfill my responsibilities*. Item 17: *I endeavor to plan my work*. Ocak and Didin (2018) found the Cronbach alpha coefficient of the measurement tool to be 0.85, while the Cronbach alpha coefficient for the current study was 0.86. This scale was also used by Konuş (2019) and its Cronbach alpha coefficient was found 0.79. Therefore, it can be said that the measurement tool used is valid and reliable.

Data Analysis

In terms of the interpretive statistical findings of this study, the significance level was determined as being 0.05. Then, a normality test was carried out before analyzing the data obtained. In this sense, Razali and Wah (2011) stated that the Shapiro-Wilk test is one of the most powerful normality tests. Thus, this test was used to determine the assumption of normal distribution with regard to the data collected. The normality test results for both EG (Shapiro-Wilk test for pre-test, $p=0.20$; for post-test, $p=0.23$) and CG (Shapiro-Wilk test for pre-test, $p=0.31$; for post-test, $p=0.14$) were found $p>0.05$. All the variables are normally distributed. Based on the Shapiro-Wilk Test results, parametric statistics were used in the analytical process. Thus, the independent samples t-test was firstly used to test the statistical significance of the relationship between the pre-test mean scores of the EG and CG. Then, the paired sample t-test was used to test the statistical significance of the relationship between the pre-test and post-test mean scores. Finally, one-way ANCOVA analysis was used to compare the post-test mean scores of the EG and CG in the research, which allows the pre-test scores to be controlled.

Covariance (ANCOVA) analysis enabled the examination of the mean differences between groups by controlling another variable (the covariate variable) that may explain some reasons for the mean differences between groups (Randolph & Myers, 2013). In addition, according to Kline (2004), in an analysis of ANCOVA, the effect of the pre-test is analyzed by statistically subtracting it from the results variable. Thus, ANCOVA calculates the mean differences between groups based on the covariate effect (Randolph & Myers, 2013). Meanwhile, some assumptions as prerequisites for one-way ANCOVA analysis have also been met. In one-way ANCOVA analysis, pre-tests were assigned as the covariate variable and post-tests as the dependent variables. In terms of the first assumption, the correlation coefficient between the dependent variable and the covariate variables should be high, thereby proving a linear relationship (Randolph & Myers, 2013) between the dependent variables and the covariate variables (Table 2). In terms of the second assumption, the homogeneity of the variances was examined, and it was determined that all values were p>.05. These results showed that the variances were homogeneously distributed for all dependent variables (Table 2).

Table 2

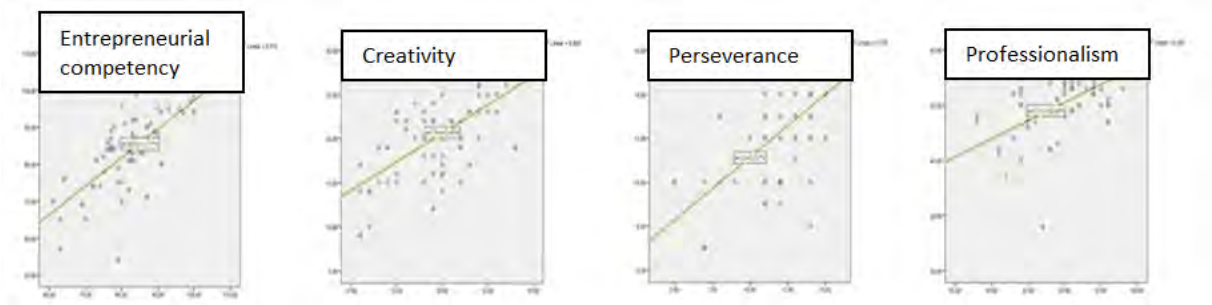
Indicators for the assumptions of one-way ANCOVA analysis

Assumptions	**Dependent variables**	**Covariate variables (Pre-tests)**
Linear association (Person Corelation)	GEC	r=0.66
	Creativity	r=0.64
	Perseverance	r=0.62
	Professionalism	r=0.53
Homogeneity of variances (Levene's test)	GEC	p=0.50; p>0.05
	Creativity	p=0.66; p>0.05
	Perseverance	p=0.67; p>0.05
	Professionalism	p=0.20; p>0.05
Homogeneity of regression (Test of between subject effects)	GEC	p=0.43; p>.05
	Creativity	p= 0.54; p>.05
	Perseverance	p= 0.16; p>.05
	Professionalism	p= 0.21; p>.05

In terms of the third assumption, the slopes of the regression lines (homogeneity of regression) were examined, and it was determined that the slopes for each group (Randolph & Myers, 2013) are equal (p>.05) and the lines are parallel to one another (Table 2). Finally, graphical outputs between the dependent variables and the covariate variable supported that there is a linear relationship between these variables (Figure 2). As a result, it can be said that all the assumptions of the analyzes performed in the research are met.

Figure 2

Graphical Outputs Between Dependent Variables and Covariate Variables



Ethical Considerations

From an ethical point of view, all students and their families were informed about the study before starting the intervention. Thus, they were informed verbally or in writing, and students and parents signed an informed consent document. Furthermore, it was stated to the students that they may opt out of the study at any time during the intervention process. On the other hand, as part of the research process and after the research has been completed, there was no information that could reveal the identity of the students in the research report. Finally, an ethical approval report was obtained from the Ethics Committee of Kahramanmaras Sutcu Imam University (number: E-92405296-100-15623) where the researcher worked, indicating that the current research could be performed.

Results

In this section, interpretive statistical results obtained by analyzing data relating to the pre-tests and the post-tests are given. Initially, Table 3 shows the results of the pre-test mean scores of the EG and the CG.

Table 3

Pre-test results for the EG and the CG Students Entrepreneurial Competencies

Pre-tests	Groups	Mean	S.D.	Independent samples t-test	
				t	p
GEC (n=37)	EG	82.89	7.79	0.80	0.42**
	CG	81.27	9.44		
Creativity (n=37)	EG	20.18	4.50	1.22	0.22**
	CG	18.86	4.81		
Perseverance (n=37)	EG	12.97	1.72	2.94	0.00*
	CG	11.51	2.47		
Professionalism (n=37)	EG	49.72	5.42	-0.93	0.35**
	CG	50.89	5.29		

**p<0.05; **p>0.05*

Table 3 shows there was no statistically significant difference between the general pre-test mean scores of the experimental and the CG (p>0.05). There was also no statistically significant difference in the creativity and professionalism sub-dimension pre-test scores (p>0.05). On the other hand, there was a significant difference in favor of the EG in the sub-dimension of perseverance (p<0.05). Table 4 shows the results of the pre-test and the post-test mean scores of the groups.

Table 4

Pre-test and Post-test Results for EG and CG

Groups	Tests		Mean	S.D.	Paired sample t-test	
					t	p
EG	GEC (n=37)	Pre	82.89	7.79	-3.04	0.00*
		Post	86.35	9.57		
	Creativity (n=37)	Pre	20.18	4.50	-1.81	0.07**
		Post	21.45	4.58		
	Perseverance (n=37)	Pre	12.97	1.72	0.07	0.94**

		Post	12.94	2.01		
	Professionalism (n=37)	Pre	49.72	5.42	-2.86	0.00*
		Post	51.94	5.09		
CG	GEC (n=37)	Pre	81.27	9.44	0.29	0.77**
		Post	80.91	10.02		
	Creativity (n=37)	Pre	18.86	4.81	-0.33	0.73**
		Post	19.08	5.21		
	Perseverance (n=37)	Pre	11.51	2.47	-1.88	0.06**
		Post	12.05	217		
	Professionalism (n=37)	Pre	50.89	5.29	1.30	0.20**
		Post	49.78	6.20		

**p<0.05; **p>0.05*

Table 4 shows there was a statistically significant difference between the pre-test and the post-test mean scores of the EG ($p<0.05$). Moreover, there was a statistically significant difference between the pre-test and the post-test mean scores in the professionalism sub-dimension of the EG ($p<0.05$). However, there was no statistically significant difference between the pre-test and the post-tests for the creativity and perseverance sub-dimensions in the EG ($p>0.05$). On the other hand, in the CG, there was no statistically significant difference between the pre-test and the post-test mean scores, both in GEC and sub-dimensions. Analysis of covariance (one-way ANCOVA) was used on the post-test of the EG and the CG as illustrated in Table 5.

Table 5

One-way ANCOVA Results on Post-tests of EG and CG

Source	**Mean Square**	**F**	**p**	**Adjusted R Squared**
GEC	3472.947	56.761	.000*	0.47
Grup	419.413	6.855	.011*	
Creativity	742.254	49.361	.000*	0.41
Grup	40.107	2.667	.107**	
Perseverance	121.831	34.810	.000*	0.36
Grup	1.129	.323	.572**	
Professionalism	907.613	34.895	.000*	0.34

Grup	211.343	8.125	.006*

**p<0.05; **p>0.05*

As can be seen from Table 5, the one-way ANCOVA results shows that there was a statistically significant difference between the GEC the post-test mean scores of the experimental (86.35) and the comparison (80.91) groups (F=6.855; p=.011<0.05). When examined in terms of sub-dimensions, the one-way ANCOVA results shows that there was no significant difference in the post-test results with regard to the creativity competencies of the experimental (21.45) and the comparison (19.08) group students (F=2.667; p=.107>0.05). There was also no statistically significant difference between the perseverance competencies sub-dimension post-test mean scores of the experimental (12.94) and the comparison (12.05) groups (F=0.323; p=.572>0.05). On the other hand, there was a statistical difference between the professionalism competencies sub-dimension in the post-test mean scores of the experimental (51.94) and the comparison (49.78) groups (F=8.125; p=.006<0.05).

Discussion

The aim of this research was to examine the effects of the GIBL integrated with EE on eighth grade students' entrepreneurial competencies. The pre-test results indicate that there were no statistically significant difference in the general entrepreneurial competencies between the EG and CG. In fact, this situation showed that the general entrepreneurial competencies of the EG and CG students were similar at the beginning of the intervention. Similarly, students' creativity and the professionalism pre-test scores from the EG and the CG were not significantly different, which showed that students had a similar level prior to intervention in terms of these dimensions. However, the perseverance results showed that the EG students display a more persevering competency than the CG students. This may be due to the inability of students to be randomly assigned to groups as a limitation of quasi-experimental research. However, to overcome this limitation, one-way ANCOVA analysis, which is a powerful analysis that allows equalization of the pre-tests, was used to compare the scores between the posttests of the EG and CG.

General Entrepreneurial Competency

When examined in terms of general entrepreneurial competence, the post-test scores of the students in the EG and CG, which included the most important findings in the study, showed that there was a significant difference in favor of the EG. This result shows that the GIBL integrated with EE positively affected the entrepreneurial competencies of the students. In the related literature it is possible to see that enterprise-oriented studies involve focusing on a

number of different variables. For example, Wardani et al. (2019) found that the role-based entrepreneurial pedagogy approach had a positive effect on the development of the entrepreneurial values of fifth grade students. Moreover, Koban et al. (2020) concluded that the project-based learning model based on local food forces, specifically local food potencies, has a positive effect on the entrepreneurial attitudes of primary school students. Furthermore, Ball and Beasley (1998) offered an example of how entrepreneurial awareness can be developed among primary school students. They concluded that EE and the parental role positively affect entrepreneurial awareness and attitudes towards enterprise at primary school level.

Perseverance

When examined in terms of the perseverance sub-dimension, it was found that the GIBL integrated with EE has no effect on students' perseverance competency. In fact, it was observed that there was a slight decrease between the pre-test (12.97) and the post-test mean scores (12.94) of the EG in terms of perseverance. This result may have resulted from the process of finding ideas and designing the ideas, which students had most difficulty in intervention process. Middle school students in Turkey are not fully familiar with the process of generating entrepreneurial ideas. In the current practice, this situation was clearly observed. In this sense, it is a very difficult task for students to generate innovative ideas for problem situations. According to Van-Gelderen (2012), perseverance is required to initiate and run a venture. In the current research context, it can be said that perseverance is required for students to come up with ideas and start the design process. However, in Turkey, student-centered understanding cannot be fully integrated into the system, and students are constantly preparing for exams consisting of multiple-choice questions. Thus, students have always wanted to see one of the options, as in responses to multi-choice questions. Since students are accustomed to multiple-choice questions, they tend to give up immediately when they are asked to generate innovative ideas about problem situations, as in the current research. This may explain why the EG students' competency in the form of perseverance, decreased in the current study. On the other hand, it has been claimed that developing perseverance strategies and putting them into practice can be useful in dealing with obstacles in engaging in entrepreneurial activities (Koch et al., 2006; Callon, 1984). In this sense, in the current research, it can be said that the students have insufficient knowledge and experience of developing perseverance strategies when they encounter obstacles. As one of the perseverance strategies, when a student encounters an obstacle, she/he can breathe comfortably, take a break, focus on alternative solutions, and get help from peers or teachers (Van-Gelderen, 2012). The situation they were faced with may

have caused students to experience difficulties in this regard, since the current research was perhaps the first experience of the students of EE.

Creativity

It was also found that there was no significant difference between the creativity post-test mean scores of the groups. This result shows that GIBL integrated with EE has no effect on the EG students' creative competency. The science curriculum in Turkey aims to develop such skills as creativity and innovative thinking (RTMNE, 2018). In this sense, it can be said that the science textbooks that have been published the meet the demands of the science curriculum also include content aimed at developing creativity and innovative thinking skills. Thus, it is not surprising that the CG students could be increased their creativity with current practices. In fact, the surprising result is that GIBL integrated with EE did not increase to a statistically significant extent, the creativity skills of the EG, because in the GIBL integrated with EE situation, the students were asked to find solutions to problem situations. During this process, students used brainwashing to solve problems. The group members also discussed the situation among themselves. For the solution, they were provided with a design that worked in everyday life. They were then asked to find ways of advertising their design, part of which was coming up with a creative slogan for their design. As a result, why is it that all these processes did not positively affect creativity? In fact, the answer to this question was partially found in the relevant literature. Regarding this issue, Pepin and St-Jean (2019) mentioned that EE-based practices do not give effective results when applied just once. According to Pepin and St-Jean (2019), when the same groups are subject to much more training of this kind, more positive results will emerge. Similarly, Koban et al. (2020) determined that the creativity of the students decreased slightly after the pre-tests in the interventional process based on project-based learning carried out with primary school students. Koban et al. (2020) also determined that the creativity of the students increased in the repeated measurements during the intervention period.

Professionalism

The current research results show that GIBL integrated with EE has a positive effect on the students' professionalism competency; whereas the CG results did not reveal such an effect. In this sense, EE requires the development of expertise on the part of the students (Ventura & Milone, 2000) and must provide opportunities for individuals to demonstrate their skills (Soans, 2018), an aspect which may affect student professionalism. On the other hand, one of the reasons why the GIBL integrated with EE did not show a statistically significant difference in the dimensions of students' creativity and perseverance may be the quality of the teaching.

This claim can be attributed to the fact that this education program (the GIBL integrated with EE) is a new program that has been piloted with a small sample, rather than criticizing the implementation quality of the implementer.

Conclusion

As a result, it was concluded in this study that GIBL integrated with EE improves students' entrepreneurial competencies (perseverance, creativity, professionalism) in general. In addition, when the research results were examined in more detail, it was concluded that GIBL integrated with EE improved students' professionalism competency the most.

Limitations

These conclusions are valid with some limitations. In this research, the materials used by the students in the design process were limited to the possible materials they could access. In addition, the research was limited to five weeks. In addition, entrepreneurial competencies considered were limited to professionalism, perseverance, and creativity, because there are too many entrepreneurial competencies in the literature for practical consideration. Another limitation of the research was that, as in real experimental designs, the researcher could not randomly assign the participants to the groups (Creswell, 2012). A lack of random assignment was a limitation of the research, since it was not possible due to school administrative and official obligations.

Implications for Future Research

This research was focused on eighth grade science concepts such as pressure, variables that affect solid pressure, and variables that activate liquid. In future research, work on GIBL integrated with EE could be carried out on different science subjects or concepts. On the other hand, the researcher examined the effect of GIBL integrated with EE on the students' perseverance, creativity, and professionalism competencies. In future research, the impact of GIBL integrated with EE on entrepreneurial competencies such as teamwork, financial literacy, risk management, self-efficacy, ability to persuade, self-esteem, building networks, planning for the future, insights into the market, seeing opportunities, decisiveness, and independence could also be examined. This study also determined that the GIBL integrated with EE process had no effect on students' perseverance and creativity competencies. In this sense, in future research, researchers might benefit from considering Van-Gelderen's (2012) perseverance strategies in terms of innovative ideas and design-oriented research. Before the intervention, students could usefully gain knowledge and experience about these strategies. Finally, the intervention process used this study was limited to a five-week application carried out on a science subject. In future studies, researchers could examine the long-term effects of the

practice by repeating EE-oriented practices with regard to different science topics. In addition, teaching processes related to EE may not be limited to a single application. In order for students to acquire an entrepreneurial mindset, such practices can be done a second or even a third time, and thus any change in results could be examined. Moreover, in future research, researchers could examine the impact of GIBL integrated with EE on different entrepreneurial competencies.

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