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Effectiveness of the project-based 6E learning model

Research Article

Şeyma Şahin[1*], Abdurrahman Kılıç[2]

[1]Ministry of National Education (Duzce, Turkey), seyymasahin@gmail.com
[2]Duzce University (Duzce, Turkey), abdurrahmankilic@duzce.edu.tr

Abstract: This research aims to determine the effectiveness of the Project-based 6E (engagement, exploration, explanation, elaboration, extension and evaluation) Learning Model. The researchers created the model by combining the basic features of project-based learning with an understanding of the learning cycle. The pre-test/post-test semi-experimental design, in which no control group is included, was used in the study. The study group in the research consisted of junior students studying at the Turkish Teaching and English Language Teaching departments of the Faculty of Education, Düzce University, in the fall semester of the academic year 2020–2021. The experimental process was structured according to the Project-based 6E Learning Model. Two different types of data, namely, qualitative and quantitative, were collected to determine the effectiveness of the experimental process. It was concluded that the students found the model efficient, effective and attractive. The model positively changed students' perceptions of values and values education. It was also seen that the model enables students to realise their values, review and question the values, reinforce them, complete their deficiencies and gain new values. Due to the effect of the learning model, students positively experienced significant changes in their teaching perception.

Keywords: *Value; Values education; Character and values education course; Project-based 6E learning model; Project competencies*

Introduction

Today, education aims to raise individuals who can solve problems, adapt their knowledge to real life and engage in lifelong learning (Hains & Smith, 2012). Students should be able to transform their knowledge into practice to solve real-life problems. They should have high-level competencies such as communication, collaboration, creativity, critical thinking and problem-solving, known as 21st-century skills (Tan et al., 2015). This situation enables adopting a student-centred education approach that focuses on students' individual needs and preferences and ensures students' participation in decision-making processes (Benson, 2012). The use of models develops the talents, curiosity and productivity of individuals; encourages diversity; and broadens the minds of all students, providing them the opportunity to go beyond what they have been taught (Bass, 1997).

For this purpose, many learning models have been designed. One of these learning models is project-based learning. Project-based learning is a student-centred teaching approach that organises learning around projects and encourages students' high-level thinking and active collaboration (Wahyuni, 2014; Aksela & Haatainen, 2018). In project-based learning, students need to find answers to real-life problems by performing problem determination, research and investigation; developing various strategies for solving the problem; producing products based on cooperation; and exhibiting the products (Thomas, 2000). Students need to work collaboratively to identify problems, formulate them, solve them and develop concrete actions (Abishova et al., 2020). This model provides an in-depth understanding of topics and concepts; improves the permanence of knowledge and skills; and promotes the ability to use this knowledge and skills in new situations (Solomon, 2003). Active participation of students in the project process enables them to shape their ideas and reveal their perspectives (Zoller, 1991).

In the literature, many studies have shown that project-based learning has positive effects on students' achievements (Chen & Yang, 2019; Santyasa et al., 2020; Syakur et al., 2020), on their participation in the course (Gömleksiz & Fidan, 2013), on their attitudes towards the course (Beier et al., 2019; Şahin et al., 2020; Ulukaya Öteleş & Ezer, 2020), on project competencies

* E-mail: seyymasahin@gmail.com

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(Şahin et al., 2011; Özer & Özkan, 2012; Yılmaz, 2015; Belwal et al., 2020; Khandakar et al., 2020) and on their communication with their peers (Belwal et al., 2020).

However, when studies using project-based learning in Turkey were examined (Sokur, 2018; Taşkın, 2018; Çalış, 2019; Demircioğlu, 2019; Sezer, 2019; Türkmen, 2019; Adalı Bakıoğlu, 2020; Ulukaya Öteleş & Ezer, 2020), in general the following problems were encountered. While the curriculum was applied in the control group, it was not applied in the experimental group and projects independent from the curriculum were used. While the courses were taught in accordance with the outcomes specified in the curriculum, the projects were carried out outside the course independent of the outcomes. The subjects were shared among groups instead of all students working according to all outcomes. During the implementation period (4–5 weeks), the students worked on the subject of the project for a single or few acquisitions. The projects did not meet the acquisitions that should have been given during that period. Additionally, generally only one unit was covered, the whole semester/year was not planned and students made a single presentation at the end of the term. Moreover, the activities during the course were perceived as a project. All of these show that the model cannot be integrated into the course; it is considered an application outside the course; and project-based learning is understood as a 'project assignment' given to the students.

Sumarni (2013) found that it is not easy to guide students' studies when project-based learning is applied in crowded classrooms. Tonbuloğlu and Aslan (2013) identified one of this model's limitations as the difficulty faced in monitoring students' work. Öztuna Kaplan and Diker Coşkun (2012) stated in their study that teachers have problems with time and space in project-based learning. All of these show some difficulties in integrating project-based learning into the courses. These problems have become more apparent in the distance education process, and the issue of guiding students has emerged as a more critical problem. The study by Şahin et al. (2020) determined that students had problems in terms of 'communication' during the distance project-based values education course. In the distance education process, it has been observed that students need the guidance of the teachers while carrying out their projects, and they want to be in 'communication' with them to a greater degree.

Effective learning designs have gained even more importance in the critical distance education process faced by the world and our country. According to the meta-analysis by Russel (1999), when distance education is structured correctly, face-to-face education will have no significant difference. Considering that the learning and teaching processes of distance education require students and teachers to work without being in the same place and without the supervision of the teacher, it is crucial to use effective models in the planning of the lesson in order to achieve the following: maximise the learning potential of each student; create positive effects on student participation and student attitudes; and ensure effective learning.

We decided to remodel project-based learning as a 'learning cycle' and created the 'Project-based 6E Learning Model' (consisting of engagement, exploration, explanation, elaboration, extension and evaluation steps) to find solutions to the problems mentioned above, integrating project-based learning into the courses, ensuring integrity by structuring the entire course according to the same understanding, guiding students more effectively by determining what the students and teachers will do at each step, increasing student–student and student–teacher interaction and adapting project-based learning to distance education when necessary.

Project-Based 6E Learning Model

We created a model by combining the basic features of project-based learning with the understanding of the learning cycle. The learning cycle is a research-based teaching strategy based on students' prior knowledge. It shifts the emphasis from the teacher to the student and the active role played by the student in the learning process. It promotes learning through research and application-based activities (Sam et al., 2018). In learning cycles, students actively participate in each learning stage organised in a planned and sequential manner to structure their learning and gain learning competencies (Sharma & Sankhian, 2018). It improves the attitudes towards the course and improves students' reasoning skills and critical thinking (Sam et al., 2018; Racheal, 2019). By combining the powerful features of the learning cycle with project-based learning, each step of the students' activities, such as problem determination, research analysis, data collection, data analysis, development of various strategies for solving the problem and product creation are effectively structured with the individual, group and classroom activities of the course. Thus, we aimed for students to gain high-level thinking skills.

This model was created to be used in different disciplines. It is thought that students can gain skills such as problem determination, research analysis, data collection, analysing data and developing various

strategies for solving the problems, as well as knowledge, skills and values related to the subject area effectively. The model can be easily adapted to both face-to-face and distance modes of education. The model is shown in Figure 1.

The Project-based 6E Learning Model is designed as a 'learning cycle' completed in two stages. At each stage, 'individual work,' 'group work' and 'class work' follow each other in respective order. At each stage, the students carry out individual studies before group work. Then, students do group work at the time they prefer before the lesson/classwork. They can choose face-to-face or synchronous (online) communication. Classwork also can be arranged according to face-to-face or synchronous distance (online) education methods according to the situation while designing the class.

- **Individual:** In democratic learning environments, students need to work individually to gain personal experience and bring their experiences to a lesson (Gollob et al., 2010). Since successful cooperation starts with individual abilities, individual responsibility and motivation, individual learning is both a prerequisite and a complement to cooperation. In addition, individual learning is a requirement for individual responsibility (Yadin & Or-Bach, 2010).
- **Group:** In democratic educational environments, group work is as important as individual work. Interactions with peer groups in the learning process positively affect students, being open to diversity, critical thinking and active learning. In such environments, students also gain values such as cooperation, trust, responsibility and democratic behaviour (Nagda et al., 2003).
- **Class:** In the classroom, students not only share their own knowledge with the class but also learn new information in addition to their individual and group learning. Interactions and experiences in the classroom environment strengthen the social development of students. It provides opportunities for students to communicate with people different from themselves and to learn about different cultures, lifestyles and people (Ahmad et al., 2015; Jacobs & Power, 2016).

Since we wanted the model cycle to be completed in two phases/weeks and to include individual, group and class work in each phase, we decided that the model should consist of six steps. The steps were organised based on the steps of the 5E and 7E models.

The 5E model has five steps, which are as follows: 1) engagement, 2) exploration, 3) explanation, 4)

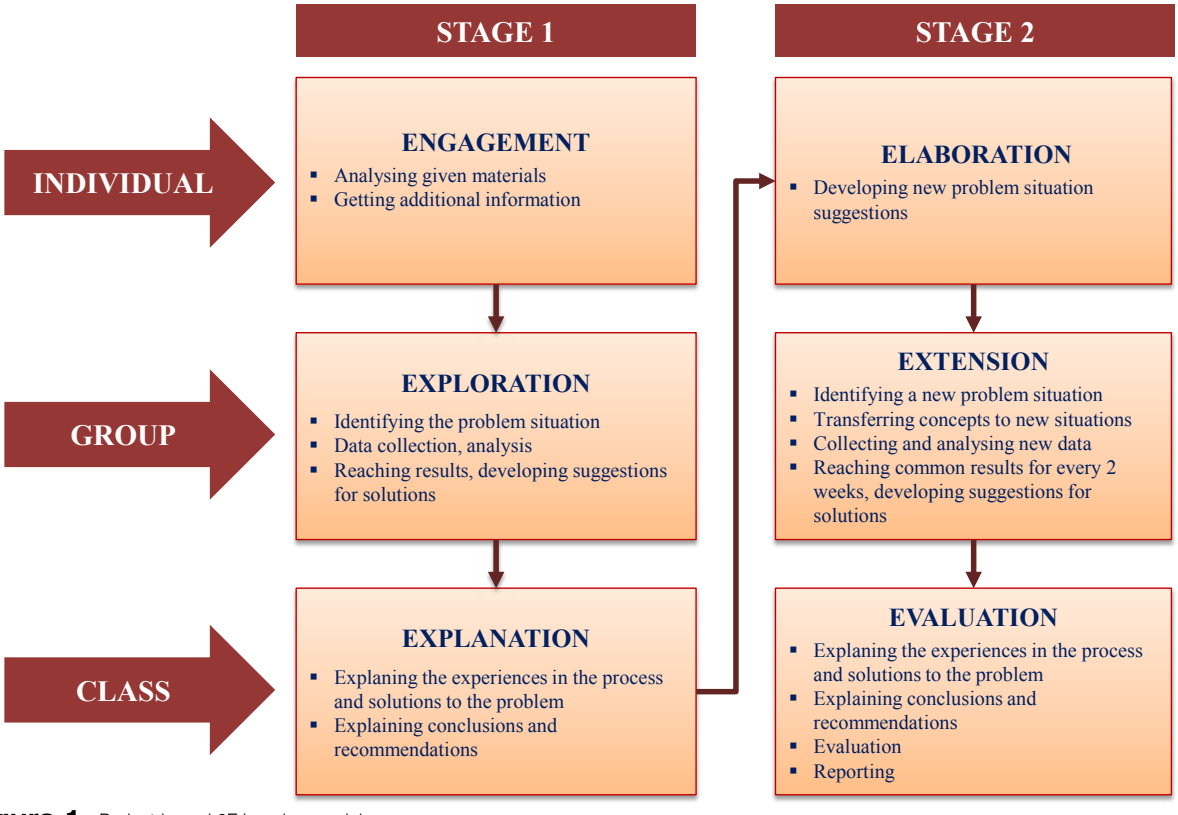


Figure 1. Project-based 6E learning model.

elaboration and 5) evaluation (Biological Sciences Curriculum Study [BSCS], 2006). In the 7E cycle, the 'engagement' step of the 5E learning cycle is expanded to 'elicitation' and 'engagement.' Thus, more emphasis is put on activating previous knowledge for learning. The 'evaluation' step is changed to 'evaluation' and 'extension,' and thus, emphasis is placed on the transfer of knowledge. Thus, the 7E cycle consists of seven steps, which are as follows: 1) elicitation, 2) engagement, 3) exploration, 4) explanation, 5) elaboration, 6) evaluation and 7) extension (Eisenkraft, 2003).

In the Project-based 6E Learning Model, unlike the 5E Model, there is an 'Extension' step. Unlike the 7E Model, there is no 'elicitation' step. Moreover, the 'extension' step comes before the 'evaluation' step. The steps of the 6E Model are 1) engagement, 2) exploration, 3) explanation, 4) elaboration, 5) extension and 6) evaluation. The engagement, exploration and explanation steps in the first stage are followed in the second stage by elaboration, extension and evaluation.

Project-based learning is a process that progresses through the following steps: 1) determining problems; 2) collecting data; 3) analysing data; 4) solving problems; and 5) concluding the project with a presentation (Blumenfeld et al., 1991; Wolk, 2001; Westwood, 2006). These steps of project-based learning are embedded in the model.

The Project-based 6E Learning Model's steps are explained in the following sections.

The First Stage

- **Engagement:** The engagement step is carried out as 'individual work.' This step aims to draw the student's attention to the subject and reveal their readiness. First, materials related to the subject (article, report, column, and so on) are sent to the students. Students analyse the materials according to the questions 'What did I learn about this topic?' and 'What can I learn differently?'. Then, they are expected to seek answers to the question 'What can I learn differently?', obtain additional information in this direction and report this information.
- **Exploration:** The exploration step is carried out as 'group work.' In this step, students are expected to identify and solve a problem situation. Students produce various ideas by discussing them with the knowledge they have acquired during the engagement step and identify a common problem situation as a group. Then, they collect and analyse data for problem-solving, reach various conclusions based on the analysis results and generate ideas for a solution.
- **Explanation:** The explanation step is carried out as 'classwork.' In this step, students need to explain their experiences in the solution process, reveal their solutions and strategies regarding the problem, and explain their results and solution proposals. Students must reveal their knowledge and perceptions about the concepts, explain and define them and create new definitions.

The Second Stage

- **Elaboration:** The elaboration step is carried out as 'individual work.' This stage aims for students to develop a more in-depth understanding of the problem. Students individually develop suggestions to identify new problem situations.
- **Extension:** The extension step is carried out as 'group work.' In this step, students identify a new problem related to the first problem, transfer concepts to new situations, collect/analyse new data – if necessary, reach new results and generate ideas for solutions as a group. Students are expected to reach common conclusions and recommendations for the problems of both stages/weeks.
- **Evaluation:** The evaluation step is carried out as 'classwork.' In groups, students present their experiences in the process, solutions to the problem and strategies. Students explain their results and solution suggestions for this stage/week and the common results and solution suggestions for both stages/weeks. The instructor ensures that the explanations are enriched and misconceptions are eliminated through the evaluations made at the end of the course. In this step, students individually evaluate the presentations of other groups. At the end of both stages, the groups submit their reports.

Purpose of the Research

An essential feature of values is that they do not come from birth but are acquired in life. Values education begins with the individual being sent to the realm of existence. The individual gains the values that will determine his/her personality, point of view and the direction of his/her behaviour in the future while living. The education given in the family by paying attention to the harmony of mind, heart and body constitutes the basis of the values of education. Although the impacts of the family, social environment and the school in value formation are intertwined, schools play the most influential role in the period when the characters of the

individuals are shaped. Thus, schools are environments where the values gained in the family are internalised, applied and reinforced, and even new values are acquired (Kılıç et al., 2016; Şahin et al., 2016).

Values education was implemented in the curriculums at the beginning of the 20th century, and different approaches were implemented for this purpose (Kirschenbaum, 1995). Teaching methods that focus on memorising knowledge to acquire values will not work. It is essential to ensure that students use their reasoning skills through discussion and collaboration in democratic classroom environments (Lickona, 1991; Şahin et al., 2020). Providing students with research and analysis opportunities, creating a space where they can express their discourse by comparing various views and perspectives and providing an environment where they can interact encourages them to question and think critically (Simó et al., 2016). For this reason, as in all educational activities, in the practical values education method, process-based, student-centred and inquiry-oriented models that improve students' critical thinking and problem-solving skills and encourage group learning, collaboration and student interaction should take precedence (Schwartz et al., 2013). Interactions in the learning process allow students to establish relationships with people different from themselves and learn about different cultures, lifestyles and people. Thus, it may be possible for students to recognise, appreciate and embrace values (Subba, 2014; Ahmad et al., 2015; Jacobs & Power, 2016).

In 2004, with the changes made in the curriculum in Turkey, values education began to be directly included in courses such as Science and Technology, Life Sciences, Religion Culture and Moral Knowledge, and especially the Social Studies course. The goal is to teach students some human and moral values within the framework of the particular purposes of these courses. However, everyone knows that this does not go beyond a theoretical wish because, until now, within the field of education, there has not been an understanding and consideration regarding enabling students gain these values in schools. It is thought that this gap can be filled with the 'Project-based 6E Learning Model.' The model can be successfully applied in values education and can be an example. Through the model, students are expected to use their individual and collaborative reasoning, critical thinking and problem-solving skills, compare various views and perspectives by conducting research and analysis and realise and adopt values.

In this context, this research aims to determine the effectiveness of the 'Project Based 6E Learning Model' on students' character and on the Values Education course. In this direction, answers to the following problems were sought:

- What are the students' views about the Project-based 6E Learning Model?
- What is the effect of the Project-based 6E Learning Model on students' learning competencies?
- What is the effect of the Project-based 6E Learning Model on students' values?

Method

Research model

The experimental method was used in the research. The pre-test/post-test design, in which no control group was included, was adopted, and analysis was conducted using a semi-experimental design. The symbolic appearance of the pattern is given in Table 1.

Table 1. Pre-test/post-test experimental design without control group

Group	Pre-test	Procedure	Post-test
D	O1	X	O2

D, experimental group; O1, pre-test; O2, post-test; X, experimental procedure.

Working group

Undergraduate groups who took the Character and Values Education course at the Faculty of Education, Duzce University, in the fall semester of the academic year 2020–2021 were selected as the study group in line with the research purpose. The instructor had two undergraduate groups, students of the Turkish Teaching and English Language Teaching Departments. Consequently, researchers included both departments in the study group. A total of 82 students constituted the study group of the research. In the Turkish Teaching group, there were 53 students (38 females and 15 males), and in the English Teaching group, there were 29 students (19 females and 10 males).

Research process

The learning process was conducted according to the 'Project-based 6E Learning Model.' The research/course process was carried out by distance education. In the first 2 weeks, an introduction was made about the course, and pre-tests were applied. The model was put into practice as of the 3rd week. The students were placed in groups of 4–6 people according to their preferences. There were six and 10 groups in the English and Turkish sections. In order to conduct and organise group work, students were asked to elect a group president for each group. The president served for 2 weeks, and each group member became president.

Individual studies were carried out before group work. Materials related to the subject were sent to the students every Friday for individual studies. The group work was carried out in a face-to-face or synchronous/online manner, and the students determined the time before the classwork. The classwork was done synchronously/online for the English group from 13.00 to 14.00 hours and for the Turkish group from 14.30 to 15.30 hours every Thursday on the university's distance education platform.

The learning steps of every 2 weeks continued within the limits of the unit topics. The unit topics are listed in Table 2.

At the end of the cycle or at 2 weeks, each group prepared a single report and uploaded it to Google Classroom as a single Word file until 24:00 hours on Friday. The head of the group was responsible for the preparation and sending of the reports. The reports from the students were evaluated by the researchers, notified to the students and stored in the electronic student portfolios. The students filled in the self-assessment and peer-assessment forms prepared by the researchers at the end of the semester. The post-test was applied the week after the end of the semester.

Data collection

Research data were collected using the Student opinion form, the Project-based Virtual Learning Competencies Scale and the Human Values Scale. Information about each tool is given below.

Student opinion form

A student opinion form was used to determine students' attitudes towards the course. The form included the following three questions:

1. What are your positive or negative thoughts and opinions about the work carried out within the Character and Values Education course?
2. How did the Character and Values Education course affect your 'teaching perception'?
3. How did the Character and Values Education course affect your values and perception of value?

Project-based Virtual Learning Competencies Scale

The Project-based Virtual Learning Competencies Scale developed by Tuncer and Yılmaz (2013) was used to measure the model's effectiveness on students' scientific research skills. The scale's Cronbach's alpha reliability coefficient was found to be 0.864. The scale dimensions and items are listed in Table 3.

Human Values Scale

The Human Values Scale, developed by Dilmaç (2007) and consisting of 42 items, was used to measure the model's effectiveness on students' values. This scale has six dimensions, namely, responsibility (seven items), friendship (seven items), peacefulness (seven items), respect (seven items), tolerance (seven items)

Table 2. Chapter topics

Week	Topics
1	Meeting
2	Briefing about the course
3	Basic concepts, classification of values, formation of values and historical process
4	
5	Factors affecting values
6	
7	Curriculum and values
8	
9	Teaching materials, technologies and values
10	
11	Teacher–student relationship and values
12	
13	Teachers' professional responsibilities, their relations with their colleagues and administration, and values
14	

Table 3. Project-based Virtual Learning Competencies Scale: dimensions and items

Dimension	Item
Introduction	I can get information for project work. I can do a literature review for project work. I can work by myself. I can choose appropriate project topics.
Working with a group	I can take an active role in the project subject. I can communicate with my project group friends. I can guide project group mates. I can distribute the work of the project work. I can work with a project group. I can create a discussion environment about the project topic.
Self-control	I can work patiently. I can tolerate criticism of my work. I can use time wisely.
Execution	I can analyse the information obtained through project work. I can develop appropriate strategies while trying to solve the problem situation. I can synthesise information obtained through project work. I can notice complications between the resources I scan. I can work for a long time without worrying about solving problems.
Concluding	I can present project work. I can publish project work. I can report project work. I can evaluate the work of my project group and other groups.

and honesty (seven items). The scale's Cronbach's alpha reliability coefficient was found to be 0.92. The articles were translated into English by Guzel and Oral (2018).

Data analysis

Quantitative data were analysed using the Statistical Package for the Social Sciences (SPSS) programme. In order to examine the normality of the data, the Kolmogorov–Smirnov test was performed, and since it was seen that the data were normally distributed, the *t*-test, one of the parametric tests, was used in the analyses.

The qualitative data analysis process was carried out in three stages (Kılıç et al., 2019): organising data, summarising data and associating/interpreting. First of all, the data were organised. The forms of the Turkish Language Teaching students were coded as TLS1, TLS2, …, TLS53, and the forms of the English Language Teaching students were coded as ELT1, ELT2, …, ELT29. Content analysis was used in summarising the data. The content analysis enables researchers to understand social reality in a subjective but scientific way (Zhang & Wildemuth, 2009) by expressing a data reduction process aimed at determining fundamental consistencies and meanings and by handling voluminous qualitative material (Patton, 2002). In the content analysis process, first, the data were coded by the researcher; then, categories were created by examination of the codes. In the associating/interpretation phase, the data were interpreted by establishing relationships between the categories.

Validity and reliability

Cronbach's alpha coefficients of the scales were calculated for the reliability of the quantitative data. The Cronbach's alpha coefficient of the Project-based Virtual Learning Competencies Scale was found to be 0.940 for the pre-test stage and 0.980 for the post-test stage. The Cronbach's alpha coefficient of the Human Values Scale was found to be 0.884 for the pre-test stage and 0.890 for the post-test stage. Values between 0.80 and 0.95 indicate a high level of reliability (Kline, 1986; Coaley, 2010). In this case, it can be said that the scale is highly reliable.

Prolonged involvement is a recommended strategy to establish a relationship of trust between the researcher and the participants. This includes spending enough time observing various aspects of an environment, developing relationships and engaging with members of the target audience (Pandey & Patnaik, 2014). In this study, the researchers carried out both the application and the research part, and long-term interaction was ensured with the participants. A detailed description includes providing sufficient information to the reader about all research processes from the data collection stage to the production of the final report (Pandey & Patnaik, 2014). This study illustrates the research

process in detail, and the data collection and analysis process is explained in detail and transparently. To get a constant observation, the researcher repeatedly reads and analyses the data and creates and reconstructs categories. The researcher looks at the collected data with a critical eye, questions the adequacy of these data in answering the research questions and examines the data until the data gain depth (Korstjens & Moser, 2018). In this study, the researchers read and coded the data repeatedly, and combining the codes in the categories was carried out meticulously. The relationships between the categories were constantly examined throughout the analysis process, and the results were meticulously organised and interpreted. The data were interpreted objectively, and the researcher's biases were not reflected in the research. Examining the research with various dimensions by an expert is one of the measures that can be taken in terms of credibility (Anney, 2014). In this study, expert opinion was obtained by associating the research data with the results. Objectivity confirmability in qualitative research refers to the degree of impartiality in research results. It is about clearly determining that the results and interpretations are not the product of the researcher's imagination but are obtained from the data (Korstjens & Moser, 2018). In this study, the researchers tried to reflect the research environment of the study with direct quotations from the data collected from the forms. The raw data of the study were stored for review when necessary.

Results and Discussion

The effect of the model on students' learning competencies

The results from the *t*-test analysis of the students' pre-test and post-test scores on the Project-based Virtual Learning Competencies Scale are given in Table 4.

Table 4 shows that there are significant differences in the scores of the students in the post-test stage in the following sub-categories: total score (t =–3.602, p =0.000), introduction (t =–2.840, p =0.005), execution (t =–3.101, p =0.002), conclusion (t =–4.479, p =0.000), working with a group (t =–3.282, p =0.001) and self-control (t =–2.038, p =0.043).

Research skills such as identifying problems, collecting data, and analysing and reporting data too require high cognitive skills. These skills that make an individual a good researcher are also the skills required in student-centred learning. Teaching that enables students to develop these skills also forms the basis of lifelong learning (Yeoman & Zamorski, 2007). Regardless of their undergraduate major, students should experience research-based approaches to develop information literacy and research skills. Although project-based learning can successfully improve student engagement, not structuring the process can increase students' cognitive load and cause problems in learning. It is essential to structure the process well to reduce the

Table 4. Project-based Virtual Learning Competencies Scale: pre-test and post-test results

Factor	Test	N	Mean	Std. deviation	t	p-value
Total	Pre-test	86	81.80	12.668	–3.602	0.000
	Post-test	71	90.07	16.093		
Introduction	Pre-test	86	15.83	2.347	–2.840	0.005
	Post-test	71	17.01	2.896		
Execution	Pre-test	86	18.16	3.511	–3.101	0.002
	Post-test	71	20.00	3.906		
Conclusion	Pre-test	86	14.08	3.152	–4.479	0.000
	Post-test	71	16.28	2.953		
Working with a group	Pre-test	86	22.43	3.966	–3.282	0.001
	Post-test	71	24.69	4.662		
Self-control	Pre-test	86	11.30	2.087	–2.038	0.043
	Post-test	71	12.08	2.719		

cognitive load and thus improve research skills (Loveys et al., 2014). The fact that the students gained these scientific research skills as a result of the tool used in this study shows that the Project-based 6E Learning Model is successful.

The positive effect of the model on students' self-control skills is also a significant result. Self-regulated learners are active participants in the learning process and take appropriate responsibility and control for their learning. They can observe and control their behaviours (Pilling-Cormick & Garrison, 2007). Self-control is critical in deciding what is worth learning and how to approach the learning task (Garrison, 1997). Especially in e-learning environments, students must exercise control over their learning. A successful pedagogical design should effectively decide the appropriate learning activities and help students choose the most suitable one (Lee & Dron, 2008). In this context, the fact that students have acquired this skill is quite positive regarding the model's effectiveness.

Students' views on the model

Students' views on the model are presented in Table 5.

Table 5 shows that the students' opinions are grouped under six categories: course design, individual study, group work, problem-solving, presentation and reporting. Students think that there are positive and negative sub-categories under each category.

Regarding the design of the lesson, the students found the course efficient, effective, engaging and

Table 5. Students' views on the model

Categories	Codes	
	Positive	**Negative**
Design of the course	Efficient/instructive/important/effective Interesting/beautiful/enjoyable Permanent learning by experience Student at the centre/active, teacher guide Never experienced before Getting easier over time	Tiring/difficult/complex/intense Teacher passive/no narration Inefficient/not permanent Boring/monotonous Less teacher–student interaction Lesson time is short, the classroom is crowded
Individual study	Discovering new knowledge/learning Research/advancement in investigation Enjoyment Associating old and new knowledge	Tiredness/strain The 'What else can I learn' part is unnecessary
Group study	Interacting with friends/socialisation Funny/have a good time Reduction of the workload Providing motivation Providing peer learning	Failure to fulfil responsibilities Difficulty getting together Large number of people in the group Lack of group consciousness Negatively affected group score
	Gaining skill: Collaboration/group work Planned study Leadership	
	Gaining value: Patience Responsibility/cooperation Tolerance/empathy Unity and solidarity Being open to criticism Different perspectives	
Problem-solving	Gaining research skills Learning to identify the problem Learning data collection and data analysis Gaining the ability to produce results Gaining different perspectives Gaining multidimensional thinking skills Enjoyment	Difficulty in determining the problem Difficulty in collecting data
Presentation	Learning from others' presentations Gaining presentation/speaking skills Gaining teaching experience Gaining self-confidence Finding peer assessment effective Gaining evaluation skills Having a fun time	Inability to listen and focus on presentations Difficult and stressful presentation each week No specific feedback for groups Insufficient presentation time
Reporting	Learning to write articles, theses and reports Realise own mistakes Creating products	Being tiring and frequent Not providing examples Short delivery time

enjoyable. They got permanent learning by experiencing, were satisfied with being in the centre and active during the course and thought that the course became easier over time. Negatively, they thought that the process was intense, complex and tiring. The students were not satisfied since the teacher was not lecturing, they complained about the lack of interaction and some students found the process tedious and thought that they could not get efficiency.

We think that the process is intense and challenging for the students because they are not used to student-centred models that require them to learn from their own experiences. Taking responsibility for their learning is not easy. In educational environments, while some students are eager to take responsibility for their learning, some students may develop resistance to change. They may not be willing to make the necessary effort and involvement in managing their learning. Even students who want to take an active role in their learning need help to develop the necessary skills (Carpenter & Pease, 2013). As in our country (Turkey), it is quite natural and expected that this situation is even more challenging for students who are used to receiving teacher-centred education. Supporting this situation, Üstünoğlu (2009) concluded in his study conducted with 960 university students in Turkey that students do not perceive themselves as autonomous enough, are unwilling to take responsibility and continue to see the teacher as a dominant decision-making figure in the classroom. Ayish and Deveci (2019) conducted a study at a university in the United Arab Emirates. They also concluded that most students are aware of taking responsibility for their learning. However, a significant majority do not act on this awareness. We can say that some students' complaints about the lack of interaction are that the teacher is not in the centre and does not interfere with the process much. This happens due to not being used to student-centred understanding. In addition, we can say that distance education also affected this situation.

In general, the students were satisfied with the tasks that they performed in the individual step of the model. They thought that they learned new information, improved research and analysis, and enjoyed the process. On the other hand, some students found this job difficult and tiring.

Individual studies are essential for students to gain personal experience and come to the course with their individual experiences. There are also many studies showing that homework before the course increases students' active participation and success in the course (Yamane, 2006; Frydenberg, 2012; Herold et al., 2012; Talbert, 2012; Ronkainen, 2015; Garcia, 2018).

The group work category shows that the students were generally satisfied with this step. They thought that it provided the opportunity to interact and socialise with friends, they gained a different perspective and their workload lightened. They found that group work is effective in gaining skills and values. However, some students complained about others not fulfilling their responsibilities in group work, having difficulty coming together and having too many people in the group.

These results support the quantitative results that students gain the ability to work in groups. The study of Şahin et al. (2020) concluded that students found group works very positive in interacting with their friends, exchanging ideas and producing common and successful products. Hartman et al. (2013) state that high team cohesion supports higher levels of problem-based coping, emotion-based coping and team goal achievement. Carpenter and Pease (2013) state that students in practical collaboration activities with their peers achieve better academic results, establish more robust relationships and are psychologically healthier. However, in line with the results of this study, Gül and Konu (2008) state that although some students see group work as beneficial, others have negative opinions about it. This situation shows that the students have acquired collaborative working skills. Supporting this result, Carpenter and Pease (2013) state that cooperation is not easy. Students cannot always be ready for cooperation.

We found that the students improved themselves in collecting data, analyzing them, and producing results and solutions steps of the study, gained different perspectives and multidimensional thinking skills, and enjoyed the problem-solving process. However, some students stated they had difficulties identifying problems and collecting data.

These results are in agreement with the quantitative results of the study. Both quantitative and qualitative results show that students have improved their scientific research skills. The results also show that the students enjoyed this process. İlhan et al. (2016) found in their study conducted with associate and undergraduate students that students' attitudes towards research are at a low level. The study of Wishkoskia et al. (2022) replicated previous findings indicating anxiety and negative attitudes surrounding research method-related courses. The model is successful in this context because undergraduate students generally do not have positive attitudes towards scientific research processes.

We found that the presentations made by the students provide them with teaching experience, presentation skills, and self-confidence, and they think it is helpful to listen to other groups' presentations.

However, we also found that making presentations every week caused stress for some students; not giving feedback to each group after their presentations negatively affected them, and some students could not focus on others' presentations.

The students were not willing to prepare a presentation about their research results. We think they preferred the information to be presented to them ready-made and they did not want to take responsibility for their learning. However, Sugeng and Suryani (2018) state that presentation-based learning enables students to engage actively in their learning process. It also provides a chance to students to exercise their self-regulated learning towards being a more independent learner. It increases their confidence to speak and participate in the class forum. An essential function of formative assessment is to provide continuous feedback to students within the scope of teaching (Bennett, 2011). In this context, we gave students collective/general feedback after each presentation. By giving collective feedback, it was aimed not to disrupt the integrity of the course and to prevent the personalisation of the feedback given. We think students requested direct feedback because they did not want to synthesise the relevant part of the explanation and wanted to obtain the information without putting effort into it. In other words, they wanted to avoid structuring evaluations.

We found that the students thought they had learned how to write reports and articles and were satisfied with producing products. However, they found it tiring to prepare a weekly report and criticized the lack of examples.

Guo and Yang (2012) state that the emergence of a final product in the form of a design, model, device, application/activity and written/oral report used to present the product and result produced are very important for the effectiveness of project-based learning.

Some direct quotes from students' opinions under these categories are as follows:

TÖ6: *'I think the course is one that every teacher candidate and even others from different professions should take. I think it is a beneficial and needed lesson. However, I can say that presentations in the course every week broke my will for the course a bit.'*

İÖ8: *'My personal views within the scope of this course were negative at the very beginning because the teaching of the course was different, and I had a prejudice. However, as the course progressed and I started to adapt to the activities we did, I realized that our teachers were trying to give good information to us with a different method.'*

TÖ11: *'I think doing group homework in the course is also a part of this awareness because we may encounter various problems while doing group homework. Additionally, I think we learned many values without being aware of doing so.'*

İÖ29: *'Although at the beginning, the course was quite complex and difficult, I understood the purpose of the course better and started to enjoy it. Working individually and in a group, collaboration was very convenient for the character and values education course.'*

TÖ32: *'Obtaining the information by researching ourselves became more permanent in the memory. However, sometimes it was tiring because of the systematic intensity of the courses and the preparation of reports every week.'*

The effect of the course on students' values

The results from the *t*-test analysis of the students' 'Human Values Scale' pre-test and post-test scores are given in Table 6.

Table 6 shows that there are no significant differences in the scores of the students in the following sub-dimensions; total score (t=–0.879, p=0.380), responsibility (t=–1.312, p=0.191), friendship (t=–0.762, p=0.447), being peaceful (t=–1.002, p=0.318), respect (t=–1.836, p=0.068), tolerance (t=1.738, p=0.084) and honesty (t=–0.123, p=0.902).

While there are some insignificant increases in the scores in the dimensions other than tolerance, there is a decrease in the tolerance scores. We think that the decrease in the tolerance scores of the students can be a result of their reaction to group work. This may be because development of students' 'working together' and 'adaptation' skills was insufficient.

The students' views on the effects of the model on their values and value perceptions are presented in Table 7.

Table 7 shows that the opinions of the students are grouped under five categories, namely, values information, values overview, values education at a glance, own values and teaching perception.

We found that students' knowledge about values within the scope of the course has increased. Students gained awareness of values, understood the importance and function of them, and realized value problems and solutions. The students' perspectives on values education have also changed. They understood that values are teachable. They realized the importance and necessity of values education and the importance of school in gaining values. They realized the importance

Table 6. Human Values Scale: pre-test and post test results

Factor	Test	n	Mean	Std. deviation	t	p-value
Total score	Pre-test	86	159.83	16.738	–0.879	0.380
	Post-test	72	162.21	17.163		
Responsibility	Pre-test	86	25.38	4.134	–1.312	0.191
	Post-test	72	26.21	3.681		
Friendship	Pre-test	86	27.71	4.725	–0.762	0.447
	Post-test	72	28.31	5.092		
Being peaceful	Pre-test	86	27.41	3.948	–1.002	0.318
	Post-test	72	28.03	3.790		
Respect	Pre-test	86	27.03	3.563	–1.836	0.068
	Post-test	72	28.15	4.089		
Tolerance	Pre-test	86	29.42	3.016	1.738	0.084
	Post-test	72	28.57	3.108		
Honesty	Pre-test	86	22.87	3.803	–0.123	0.902
	Post-test	72	22.94	3.524		

Table 7. The effect of the course on the value perceptions of students

Categories	Codes
Values information	Learning the concept of value Learning the types of values Learning formation of values and its historical process Learning the factors that affect values Learning values education approaches Learning methods and techniques of gaining value
Values overview	Gaining awareness towards values Recognising the sources of values Understanding the importance and functions of values Understanding the importance of values Understanding that different values should be respected Recognising value problems and solutions
Values education at a glance	Understanding the importance and necessity of values education Understanding that values can be learned/taught Understanding what values should be given to students Understanding the importance of the school in gaining values Noticing the interaction of student, family and school in values education Understanding that values should be given implicitly Understanding that values education should be supported by activities Understanding that values education should be interdisciplinary
Own values	Reviewing and questioning own values Understanding the factors that affect own values Being aware of the values to have and not to have Reinforcing own values Making up missing values Gaining new values
Teaching perception	Understanding the meaning of teaching Having a positive attitude towards the teaching profession Gaining experience towards the teaching profession Understanding the difficulties of the teaching profession Understanding that teachers need to be well trained Recognising the teacher's responsibility and place in student life Understanding the importance of the teacher and recognising him/her as a model in gaining values Recognising the values that the teacher has and should have Having a change in how to consider students Understanding the importance of teachers' relationship with students and parents Gaining motivation to give positive value to students Gaining motivation to be a good teacher

of interaction with students, family, school, and environment in values education.

Results show that the Project-based 6E Learning Model positively affects students' value perceptions. These changes in students' perceptions are significant because perception involves the way one sees the world (Mcdonald, 2012). That is why we think that this change in students' perceptions will have an impact on the values they have.

We found that the students noticed their values, reviewed and questioned, reinforced, realized their missing values, completed their deficiencies, and gained new values.

The results show that this inquiry-based model affects students' values since it enables students to interact with each other and their environment and express their opinions by comparing various views and perspectives. The model also lets them gain the skills of reasoning, critical thinking, and problem-solving through discussion, collaborative environments, and so on to recognise, appreciate and embrace values. Some studies show the effectiveness of different models with such features on values. At the end of the values education programme, Erikli (2016) found that students' values improved positively. As a result of the moral development programme, Krop (2006) observed a significant effect on the responsibility values of the participants. Izgar (2013) noticed that the democratic attitudes and behaviours of students were positively affected after applying his values education programme to the students. The values education programme implemented by Perry and Wilkenfeld (2006) was also effective in value acquisition by students. We think that the lack of a significant difference in student values in quantitative results is because of the fact that rather than gaining new values that they never had, students recognise, reinforce and complete the deficiencies of their values.

We found that there had been a significant change in students' perception of teaching. Students' experiences have changed in subjects such as understanding the meaning of teaching, gaining a positive attitude towards the teaching profession, gaining experience in the teaching profession, realizing the responsibility of being a teacher, understanding the importance of the teacher in value acquisition, realizing the values that the teacher has and should have, and gaining motivation to add value to the students.

We think that changes in students' perceptions were significant. Because educational beliefs and practices of the teachers are fundamentally interrelated (Guerra & Wubbena, 2017), pre-service teachers' perceptions of values, values education and teaching will affect how they carry out their profession in the future and thus how they raise students; this, in turn, will have a significant impact on the education system.

Some direct quotes from students' opinions under these categories are as follows.

İÖ10: '*As I said in the previous question, we have fallen into an ocean of values, and in this ocean of values, we have somehow found ourselves on another level. I can say that we added new things to ourselves.*'

TÖ16*:* '*It made me realize what values I have and what values I should have.*'

İÖ23: '*I used to want to be a good English teacher, but I realized that teaching English before being a good teacher is useless. People can learn English in some way in their lives, there are many ways for this, but I think it is a teacher's job to teach values.*'

TÖ33: '*As a teacher candidate, I think I should have all these values. Because I will establish society by educating students, in this respect, for me, the Character and Value[s] Education Course has become a subject and course of great importance. I have gained many positive things professionally for myself.*'

TÖ53: '*I realized that being a teacher is not just teaching something, but it is a way of life, and an active role model in the character and value development of the student. I learned how important teaching is in the formation and spread of values.*'

Conclusion

We found that the Project-based 6E Learning Model improved students' research skills. The students improved themselves in collecting data, analysing them and producing results and solutions. The students thought that they had learned how to write reports and articles and were satisfied with making products. The students found the model efficient, effective, exciting and enjoyable. They got permanent learning by experiencing. The model had a positive effect on students' self-control skills, multidimensional thinking skills and problem-solving skills.

The students were satisfied with the tasks that they performed in the individual step of the model, and they achieved efficiency. The model gave students the ability to work in groups, a positive attitude towards group work, and various skills and values. In class works, presentations provided the students with teaching experience, presentation skills and self-confidence.

The Project-based 6E Learning Model provided students with various types of information about values. The students gained awareness of values, understood their importance and function and realised value problems and solutions. The students' perspectives on values education have also changed. They understood that values are teachable. The model enabled students to recognise values' importance, review, question, strengthen, complete their deficiencies and gain new ones. Finally, students experienced significant changes in their perception of teaching. They realised the meaning of teaching and the responsibility of being a teacher. They gained a positive attitude towards the teaching profession and developed motivation to add value to the students.

On the other hand, some students were not satisfied since the teacher was not lecturing, so they could not get efficiency. Some students thought that the process was intense, complex and tiring. Some students stated that they had difficulties in identifying problems and collecting data. We believe the process is intense and challenging for the students because they are not used to student-centred models and taking responsibility for their learning. They do not want to make the necessary effort and involvement in managing their knowledge.

In group work, some students complained about friends not taking care of their responsibilities, having difficulty coming together and having too many people in the group. Students may not find interacting with their peers from different backgrounds easy. It requires cooperation skills. Therefore, educators must design experiences for students that support the development of this skill.

Some students found it tiring to prepare a report and make presentations every week. But in project-based learning, a final product is significant for its effectiveness. Some students complained about not giving specific feedback to each group after their presentations. We thought that this would reduce not only the workload of the lecturer but also improve the students' ability to analyse and synthesise their share of the evaluation and prevent the personalisation of the assessments. However, in the use of the model, giving specific feedback to each group can be considered.

We recommend applying the model to different branches, evaluating its effectiveness and generalising it.

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