THE EFFECT OF LAYERED INQUIRY-BASED LEARNING MODEL ON STUDENTS' SKILLS, VALUES, AND ATTITUDES

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ABSTRACT

This research aims to determine the effect of the Research Methods Course organized according to the Layered Inquiry-Based Learning Model on students' skills, values, and attitudes. A pre-test and post-test quasi-experimental method without a control group were used in the research. The research has a mixed research feature in terms of data collection methods. The concurrent triangulation method, one of the mixed research methods, was used. The research study group was determined by the purposive sampling method. The study group consisted of 124 sophomore students studying at the Faculty of Education, Turkish Language Teaching and Elementary Education Mathematics Teaching Department in a state university in the spring semester of the 2020-2021 academic year. The course design was structured according to the Layered Inquiry-Based Learning Model. Research data were collected with the Critical Thinking Tendency Scale, Attitude Scale Towards Collaborative Learning, and Opinion Form. In the quantitative analysis, the Wilcoxon Signed Ranks Test was used for related measurements from non-parametric tests, and qualitative data were subjected to content analysis. At the end of the research, it is evident that the students gained personal and social skills, thinking skills and scientific research skills, and various values. At the end of the course, it was concluded that the students generally had positive attitudes towards the course, cooperative learning, and scientific research.

Keywords: Layered inquiry-based learning model, skill, value, attitude

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The primary purpose of the education system today is to raise individuals with 21st-century skills such as problem-solving, decision making, critical thinking, creativity, entrepreneurship, innovation, cooperation, and communication, who can think independently, can learn cooperatively, and have a developed sense of responsibility (Partnership for 21st Century Learning, 2015). Students should be able to apply their knowledge and skills to

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unknown and developing conditions. For this reason, students need a wide range of skills such as cognitive and metacognitive skills (e.g., critical thinking, creative thinking, learning to learn, self-regulation), social and emotional skills (e.g., empathy, self-efficacy, cooperation), and practical and physical skills (e.g., use of new information and communication technology devices). This wide range of skills will be mediated by students' personal, local, social, and global attitudes and values (for example, motivation, trust, respect for diversity, and virtue) (Organization for Economic Co-operation and Development, 2018).

Today, scientific research competencies are considered essential even in the early stages of undergraduate programs. Wilmore and Willison (2016) argue that "[t]he ability to use research skills to produce solutions to unpredictable and complex problems" (p. 1) is a defining feature of university graduates, and their research capacity is considered the most distinguishing feature of university graduates. It is easier for undergraduate students who have scientific research experience to understand better the work done by others and to grasp the underlying logic of research. Many students exposed to scientific research experience during their undergraduate years discover their passion for research and have the opportunity to become successful researchers in the future by continuing their graduate education. Since research studies are usually done in teams, they can gain first-hand experience in any workplace environment in the future (Madan & Teitge, 2013).

Undoubtedly, universities are among the most critical places to acquire these skills and values. Students must share their ideas through collaborative activities, think reflectively by working in groups, and seek answers to real-world problems (Brown & King, 2000). Today, employees who are skilled in communicating and contributing to their colleagues/teammates are sought and preferred in the business world (Bishop et al., 2014).

Especially in the future, it is of great importance that teacher candidates who are expected to provide the young generations with various skills and values acquire these skills and values effectively during their undergraduate education (Küçükoğlu et al., 2013). In our country, the Research Methods in Education course is one of the courses in the teaching programs for the teacher candidates to provide these skills. However, in the literature on the scientific research course, there are several studies indicating that this course is insufficient both in terms of content and method (Küçükoğlu et al., 2013). The literature also shows that there is not enough practice in the courses (Taşdemir & Taşdemir, 2011). Finally, the literature reveals that the course negatively affects the perspectives of teacher candidates about doing graduate education (Akgün, 2012). Some other studies also indicate that pre-service teachers taking this course do not perceive the concepts related to the scientific research process fully and accurately, and they cannot analyze a scientific research article as a whole (Taşdemir & Taşdemir, 2011). Additionally, their skills in forming and defining hypotheses, providing operational explanations, and designing the necessary research to solve a problem are low (Bahtiyar & Can, 2016).

In addition, when the studies on distance education in the literature are examined, it is seen that the contents used are simple, that practical methods and techniques were not used, and that measurements and evaluations were not done effectively (Eroğlu & Kalaycı, 2020). It is seen that teacher candidates have negative attitudes towards the course, they cannot have the students actively participate in the process, and they have communication problems (Karatepe et al., 2020; **Öztaş** & Kılıç, 2017; Tuncer & Bahadır, 2017).

In order to raise qualified teachers, it is necessary to have the teacher candidates gain the competencies of both the Research Methods in Education course and the other courses in the teaching programs. Considering that the students' learning experiences primarily determine the quality of learning outcomes, it is necessary to develop and use teaching approaches in which students can be active (Friesen & Scott, 2013; Jurković, 2005). For this purpose, approaches that try to develop individuals' abilities, curiosity, and productivity, that encourage diversity, and that provide students with the opportunity to go beyond what is taught to them to expand their minds come to the fore (Bass, 1997).

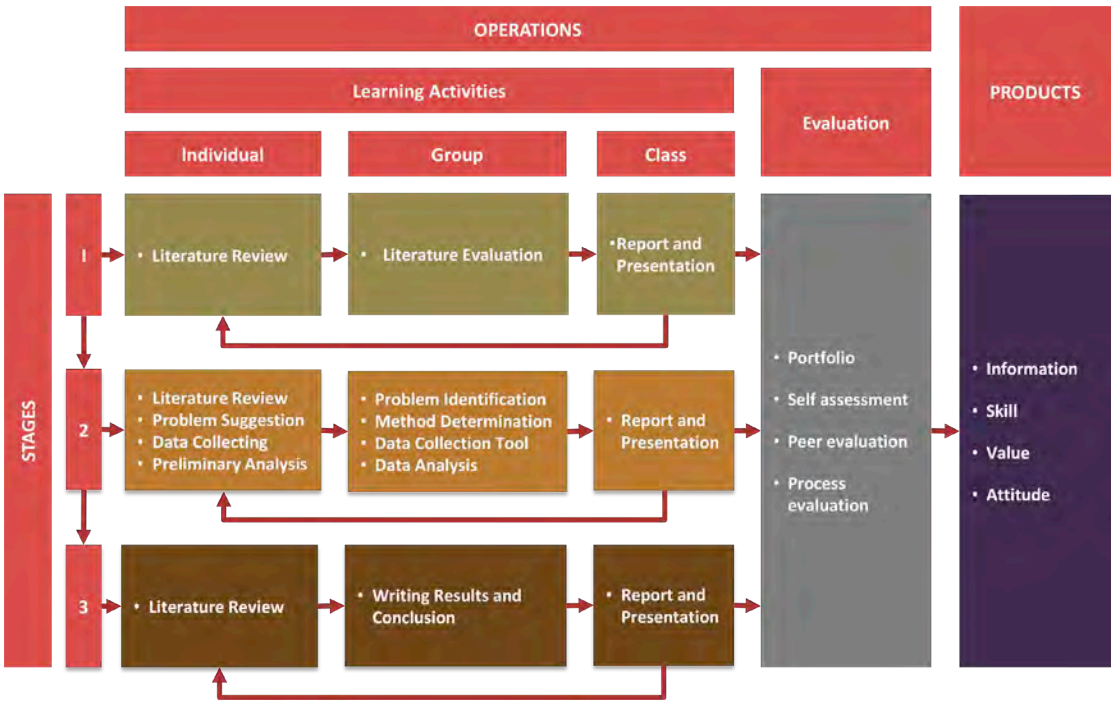
Inquiry-based learning, which is one of these approaches, is an approach that enables learners to absorb knowledge and transform it into practice through activities based on analysis, synthesis,

and evaluation (Susiani et al., 2018). Inquiry-based learning is a learning approach in which students are active in the whole process and take responsibility for learning, and the teacher supports students as a guide and a director (Harmon & Hirumi, 1996; Spronken-Smith et al., 2007; Wu & Hsieh, 2006). This model requires students to ask scientific questions, conduct research to find answers to these questions, collect and analyze data, make statements based on evidence, and share their ideas with others (Krajcik et al., 2000; Wu & Hsieh, 2006). As inquiry-based learning is an approach that forces students to understand and solve challenging real-life problems collaboratively, it also supports students' critical thinking (Ghaemi & Mirsaeed, 2017). Thus, it is aimed to provide meaningful and permanent learning (Llewellyn, 2002).

The literature states that inquiry-based learning contributes positively to students' scientific research skills (Deckert & Nestor, 1998), attitudes towards courses (Çalışkan & Turan, 2010), attitudes towards cooperative learning (Johnson & Lawson, 1997), and problem-solving and critical thinking skills (Wallace & Kang, 2003). However, when the literature is examined more closely, the model has some limitations. For example, it a long time to complete research-based activities (Cheung, 2007; Spaulding, 2001), and teachers have prejudices, namely, that some students will not be successful in the research process (Olson & Loucks-Horsley, 2000). Furthermore, Cheung (2007) and Spaulding (2001) would agree that material creation/supplying is complex. Keller (2001) and Spaulding (2001) highlight how difficulties it is to implement material in crowded classrooms, as well as teachers' inability to manage the process. Finally, Deters (2005) draws attention to teachers' lack of knowledge about how the assessment should be and that this assessment takes a long time (Deters, 2005). As can be seen, almost all of the problems arise from not knowing how to plan/model.

The literature does present different research-based learning models (Dewey, 1900, as cited in Hill, 2008; Short et al., 1996; Sincero, 2006; Suchman, 1962). However, although the research/problem-solving steps are listed in these models, the learning activities, the evaluation process, and the learning products expected to be obtained are not structured in detail. The aim should be to eliminate these limitations with the Layered Inquiry-Based Learning Model developed by the researchers. The model is shown in Figure 1.

Figure 1. Layered Inquiry-Based Learning Model



As seen in Figure 1, in the model, both scientific research processes (literature scanning, problem determination, data collection, data analysis, etc.) and the learning process (individual, group, class studies) are structured in detail. The model was organized in three stages so that all steps of the research were carried out practically by the students. The first stage's goal was for students to gain the hypothetic foundations of the research. The second stage's goal was for students to identify the problem, collect the data, and analyze the data, which are the steps of scientific research. Finally, the third stage's goal was for students to solve the problem, achieve the result, and gain the reporting steps. Teaching activities are designed in three parts, namely, individual works, group works, and classwork. These activities enable students to acquire and develop determined skills and values. The model is designed to be suitable for both distance and face-to-face education.

AIM OF THE STUDY

This study aims to determine the effect of the Research Methods Course organized according to the Layered Inquiry-Based Learning Model on students' skills, values, and attitudes. In this context, the research question is: *What is the effect of the Research Methods Course, which is organized according to the Layered Inquiry-Based Learning Model, on the students' skills, values and attitudes?* The sub-questions of the research are as follows:

1. What is the effect of the Layered Inquiry-Based Learning Model on students' skills?
2. What is the effect of the Layered Inquiry-Based Learning Model on students' social and personal skills?
3. What is the effect of the Layered Inquiry-Based Learning Model on students' thinking skills?
4. Is there a relationship between the Layered Inquiry-Based Learning Model and students' critical thinking skills?
5. What is the effect of the Layered Inquiry-Based Learning Model on students' scientific research skills?
6. What is the effect of the Layered Inquiry-Based Learning Model on the students' values?
7. What is the effect of the Layered Inquiry-Based Learning Model on students' attitudes?
8. What is the effect of the Layered Inquiry-Based Learning Model on students' attitudes towards the course?
9. What is the effect of the Layered Inquiry-Based Learning Model on students' attitudes towards cooperative learning?
10. Is there a relationship between the Layered Inquiry-Based Learning Model and students' attitudes toward cooperative learning?
11. What is the effect of the Layered Inquiry-Based Learning Model on students' attitudes towards scientific research?

METHOD

The research has a mixed research feature in terms of data collection methods. The concurrent triangulation method, one of the mixed research methods, was used (Creswell, 2003). Quantitative and qualitative data were collected and analyzed simultaneously, with priority being equal for both data types. Data analysis was performed separately, and merging was performed during the interpretation of the data.

A pre-test and post-test quasi-experimental method without a control group were used in the quantitative part of the research. The research hypothesis is as follows:

H1: There is a positive relationship between the Layered Inquiry-Based Learning Model and students' critical thinking skills.

H2: There is a positive relationship between the Layered Inquiry-Based Learning Model and students' attitudes towards cooperative learning.

The symbolic view of the pattern is given in Table 1.

Table 1: Pre-Test and Post-Test Pattern Without Control Group

	Pre-Test	Operation	Post-Test
E	O_1	X	O_2

E: Experiment Group, 01: Pre-Test, 02: Post-Test, X: Experiment Operation

In the qualitative part of the study, the effects of The layered Inquiry-Based Learning Model on students' social-personal skills, thinking skills, scientific research skills, values, attitudes towards the course, attitudes towards cooperative learning and attitudes towards scientific research were examined.

STUDY GROUP

The research study group was determined by the purposive sampling method. The Research Methods in Education course and the students attending this course were selected purposefully as the study group. The study group consists of 124 sophomore students studying in the Düzce University Education Faculty Turkish Language Teaching and Elementary Mathematics Teaching Department in the spring semester of the 2020-2021 academic year. There are 58 students, 43 women and 15 men in the Turkish Language Teaching department, and there are 66 students, 52 women, and 14 men in the Elementary Mathematics Teaching department.

RESEARCH PROCESS

The research lasted for 15 weeks. In the first week, a meeting was held, and information about the course was given. The application was started in the second week.

The application was carried out in distance education with four classes: Turkish-1, Turkish-2, Mathematics-1, and Mathematics-2. Students formed groups of three to five people. There were seven groups in the Turkish-1 class, six groups in the Turkish-2 class, seven groups in the Mathematics-1 class, and seven groups in the Math-2 class. Each week, a chairperson was selected and responsible for planning, conducting, finalizing the studies, and sending the reports. Each week, a different group member served as the chairperson. Each group was registered to Google Classroom with their group names, and the files and assignments to be sent to the students were tracked through this platform.

According to the Layered Inquiry-Based Learning Model, learning activities are designed to consist of three parts, individual, group, and class.

Individual Work

All students carried out individual work before the course. The students performed the determined tasks and reported by citing their sources, and the reports were sent to the head of the group before the group work.

Group Work

Group work consisted of application tasks performed based on individual works. Group studies were carried out with the method determined by each group at the time determined by each group before the class study, and all the studies performed as a group was reported.

Class Work

Classwork was carried out on the university's distance education live platform every Thursday, Turkish-I between 13.00-14.00, Turkish-II between 14.00-15.00, Mathematics-I between 15.00-16.00, and Mathematics between 16.00-17.00. In the class, the reports created in the group were presented. The presentations were arranged to be on average of five minutes. Each student listened to the presentations of the other groups and evaluated each group separately, and they sent their evaluations to the group chairperson. The lecturer made a general evaluation of the presentations at the end of the course. Each group made the necessary additions/corrections in the report they presented after the course. The group chairperson prepared the individual reports and the group report and uploaded them to Google Classroom as a single Word file until 24.00 on Friday.

The course design was structured according to the Layered Inquiry-Based Learning Model. The

individual and group tasks performed by the students at each stage are given in Table 2.

Table 2: Individual and Group Tasks

Stage	Week	Subjects	Applications	
			Individual	Group
	1	Introduction and informing about the course, forming groups		
Stage 1	2	Knowledge and Ways of Knowing Science, Nature, and Functions of Science	Research "Knowledge and Ways of Knowing" and "Science, Nature, and Functions of Science" from at least two sources.	Do an in-group discussion about "Knowledge and Ways of Knowing" and "Science, Nature, and Functions of Science" and summarize.
	3	Scientific Research and Features Assumption, Theory, and Law	Research "Scientific Research and Features," "Assumption, Theory, and Law" from at least two sources.	Do an in-group discussion about "Scientific Research and Features" and "Assumption, Theory, and Law" and summarize.
	4	Scientific Research Paradigms	Research "Scientific Research Paradigms" from at least two sources.	Do an in-group discussion about "Scientific Research Paradigms" and summarize. Compare qualitative research and quantitative research by making tables.
	5	Ethical Problems and Solutions Citation Principles	Research "Ethical Problems and Solutions" from at least two sources. Review the APA-6 citation guidelines.	Do an in-group discussion about "Ethical Problems and Solutions" and summarize. List the principles of citation.
Stage 2	6	Problem Statement Purpose and Significance of the Research	Research "Variables and Hypothes" from at least two sources. Examine two articles' (quantitative and qualitative) research problems. Write two research problem (one quantitative and one qualitative) proposals.	Select a qualitative and a quantitative research problem. Write down the problem situation, purpose, and significance of your research. Identify sub-problems of your research.
	7	Types of Scientific Research Research Model	Research "Types of Scientific Research" from at least two sources.	Design your own research qualitatively and quantitatively.
	8	Data Collection	Research "Data Sources, Sampling Techniques, and Sample Size" from at least two sources.	Identify data sources for your research problem. Identify your sample/study group to collect qualitative and quantitative data.
	9		Research "Qualitative Data Collection Techniques" from at least two sources.	Identify two techniques for collecting your qualitative data, and prepare your two data collection tools. Do a work-sharing plan to collect data.
	10		Collect your qualitative data using the two qualitative data collection tools. Research "Quantitative Data Collection Techniques" from at least two sources.	Identify two techniques for collecting your quantitative data, and prepare your two data collection tools. Do a work-sharing plan to collect data.
	11	Data Analysis	Collect your quantitative data using two quantitative data collection tools. Research "Qualitative Data Analysis Techniques" from at least two sources.	Analyze your qualitative data.
	12		Research "Quantitative Data Analysis Techniques" from at least two sources.	Analyze your quantitative data.

Stage 3	13	Validity and Reliability	Research "Validity and Reliability" from at least two sources.	Evaluate the validity and reliability of your article, and write sould be done.
	14	Findings/Results	Review the findings/results sections of two articles.	Write the findings/results section of your research.
	15	Discussion/ Conclusions and Recommendations	Review the discussion, conclusions, and recommendations sections of two articles.	Write the discussion, conclusions, and recommendations sections of your research.

As seen in Table 2, Stage 1 is planned as 4 Weeks, Stage 2 as 7 Weeks, and Stage 3 as 3 Weeks. In the first stage, the objective was to gain the theoretical foundations of the research; in the second stage, to determine the problem, collect data, and analyze the data; and in the third stage, gain the steps of solving the problem, reaching the result and reporting. All groups passed all stages.

The evaluation of the course was made in a way that the process and product evaluation were together.

Process evaluation was done in the form of the portfolio (60%), self-evaluation (10%), and peer evaluation (30%). 70% of the process evaluation has been added to the year-end grade. The portfolio process was in a staged e-portfolio and consisted of three stages. The portfolio process was organized so that it was impossible to proceed to the next stage unless the minimum score determined from the tasks in each stage was obtained. A maximum of 25, 50, and 25 points could be obtained in the first, second, and third stages. An arrangement was made so that the groups with a minimum of 10 points in the first stage could pass to the second stage, and the groups that received a minimum of 25 points in the second stage could proceed to the third stage. A Portfolio Scoring Form was created to evaluate the reports. The evaluation was done according to these forms weekly, and the scores were reported to the students. Each week, students were given feedback on the reports. Self and peer evaluations were done at the end of the process according to the Self and Peer Evaluation Forms.

Product evaluation was done at the end of the term. In the product file, the application studies carried out in the second and third stages throughout the term were presented in the form of an article by the students. The article was reviewed and graded by the researchers. 30% of the product evaluation has been added to the year-end grade.

DATA COLLECTION TOOLS

Research data were collected with the Critical Thinking Tendency Scale, Attitude Towards Collaborative Learning Scale, and Opinion Form.

Critical Thinking Tendency Scale developed by Semerci (2016) are metacognition, flexibility, systematicity, perseverance-patience, and open-mindedness. The scale consists of 49 items. The scale covers 49.161% of the variance. The test-retest correlation of the scale is 0.761, and the Cronbach Alpha coefficient is 0.963.

Attitude Scale Towards Cooperative Learning developed by ***Şahin*** et al. (2017) consists of 28 items and one dimension. Twenty-eight items explained 45.38% of the total variance. In the internal consistency study of the scale, the Cronbach's Alpha coefficient was found to be 0.95, and the two-half reliability was found to be 0.90.

The opinion form created by the researchers, opinions from two educational science experts were received, and the forms were arranged according to the feedback received. In the form, there were six questions about the works and operations carried out during the course, the problems encountered, and the contributions of the course process in terms of knowledge, skills, and values.

DATA COLLECTION

Quantitative pre-test data were collected at the beginning of the term between February 20 and February 24 2021, and post-test data were collected at the end of the term between May 28 and May 31, 2021 via Google Form voluntarily. A total of 118 people, 63 from the Mathematics Teaching and 55 from the Turkish Language Teaching, completed the critical thinking disposition scale. Ninety of the students are girls, and 28 of them are boys. A total of 116 people, 62 from the Mathematics Teaching and 54 from the Turkish Language Teaching, filled out the Attitude Scale Towards Cooperative Learning. Eighty-nine of the students are girls, and 27 of them are boys.

Opinion forms were collected through Google Form at the end of the term between May 29 and

May 31, 2021, again voluntarily. The students were asked to write down the work and procedures carried out during the course, the problems they encountered, and the contributions of the course process to them. In order to protect confidentiality and objectivity, names are not included in the forms. Opinion forms were taken from 107 students, 57 from the Mathematics Teaching, and 50 from the Turkish Language Teaching departments. Of the students whose opinion forms were taken, 23 were male, and 84 were female.

DATA ANALYSIS

First of all, editing processes of quantitative data were carried out in Excel. Participants in both the pre-test and post-test were identified and matched. Then the data was transferred to SPSS. A normality test was performed for quantitative data in order to decide on the type of analysis. Critical Thinking Tendency Scale pretest (df118, p=0.021) and posttest (df118, p=0.047) scores and Cooperative Learning Attitude Scale pre-test (df116, p=0.000) and post-test (df116, p=0.000) scores were not found to be normally distributed. Therefore, the Wilcoxon Signed Ranks Test was used for related measurements from non-parametric tests in the analyses.

Then the reliability of the data was checked. Cronbach Alpha values were checked to determine the internal consistency of coefficients of the scales. The Cronbach Alpha coefficients for the pre-test and post-tests of the scales are given in Table 3.

As seen in Table 3, the Alpha values of all scales are above 0.80 in both pre-tests and post-tests. Values between 0.80 and 0.95 indicate a high level of reliability (Coaley, 2010; Kline, 1986). In this case, it can be said that each scale is highly reliable.

Qualitative data analysis was carried out in three stages: organizing the data, summarizing the data, and associating/interpreting (Kılıç et al., 2019). First, the data was transferred from the Google form to Excel, and then the answers of all participants were combined under each question in Word and coded as T1, T2, …, T107. The data were summarized by content analysis. In the content analysis process, firstly, the data were coded, and then, the relationships between the codes were examined and categories were created. In the association/interpretation phase, tables were created by establishing relationships between categories, and the data were interpreted. The coding and categorization processes were carried out meticulously. The relations between the categories were constantly examined, and the findings were meticulously arranged, tabulated, and interpreted. The data were objectively interpreted. Objectivity was supported by direct quotations from the data collection forms. The raw data of the study were stored for review when necessary.

FINDINGS

The research findings of the Research Methods in Education course, which was organized according to the Layered Inquiry-Based Learning Model, were presented under three headings: *The Effect on Students' Skills*, *The Effect on Students' Values*, and *The Effect on Students' Attitudes*.

Table 3: Reliability Coefficients of the Scales

Scales	Pre-Test	Post-Test
Critical Thinking Tendency Scale	0,957	0,960
Attitude Scale Towards Cooperative Learning	0,953	0,941

THE EFFECT ON STUDENTS' SKILLS

At the end of the course, it was determined that the students gained social and personal skills, thinking skills, and scientific research skills.

Social and Personal Skills

After the analysis of the data collected with the opinion form, the social skills gained by the students at the end of the course were determined as *speaking/expressing oneself*, *discussion*, *listening*, *cooperative work*, and *making friends.* The personal skills acquired by the students are *self-knowledge*, *self-confidence*, *regular/disciplined work*, *self-control*, *effective use of time*, *computer use,* and *practicality skills.*

Some direct quotations from students' opinions under these categories are given below:

> *S3: "I became group friends with people I had never talked to before. And I got along very well with all of them. This course helped me make more friends."*
>
> *S9: "The computer taught me to use interview platforms. Added me the ability to work collaboratively. It taught me to be practical. I couldn't research an assignment for hours and develop a product, but now I think I've gotten over it. It added my listening skill."*
>
> *S10: "My self-confidence and ability to express myself have increased due to the presentations we make every week."*

Thinking Skills

After the analysis of the data collected with the opinion form, the thinking skills of the students at the end of the course were determined as *critical thinking*, *problem-solving*, *inquiry*, *developing a different perspective*, and *multi-dimensional thinking.*

Some direct quotations from students' opinions under these categories are given below:

> *S9: "It gave me critical thinking skills. We were already taking the course this semester. We had a chance to apply it here."*
>
> *S71: "It instilled us an inquiring and investigative spirit."*
>
> *S81: "It gave me the ability to be solution-oriented and multi-dimensional thinking."*
>
> *S105: "I think that the course has given me many comprehensive and critical thinking skills."*

Table 4 shows the pre-test and post-test results based on the analysis of the data collected by the Critical Thinking Tendency Scale with the Wilcoxon Signed Ranks test to determine the effect of the course on students' critical thinking skills.

Table 4: Wilcoxon Signed Rank Test Pre-Test and Post-Test Results

Factor		n	Rank Av.	Rank Sum	z	p
Total Score	Negative Rank	42	53.15	2232.50	-3.078	.002
	Positive Rank	73	60.79	4437.50		
	Equal	3				
	Total	118				
Metacognition	Negative Rank	38	47.43	1802.50	-2.889	.004
	Positive Rank	65	54.67	3553.50		
	Equal	15				
	Total	118				
Flexibility	Negative Rank	49	49.88	2444.00	-1.534	.125
	Positive Rank	59	58.34	3442.00		
	Equal	10				
	Total	118				
Systematicity	Negative Rank	0	.00	.00	-9.430	.000
	Positive Rank	118	59.50	7021.00		
	Equal	0				
	Total	118				
Perseverance-Patience	Negative Rank	42	46.14	1938.00	-2.312	.021
	Positive Rank	60	55.25	3315.00		
	Equal	16				
	Total	118				
Open Minded	Negative Rank	43	45.06	1937.50	-1.477	.140
	Positive Rank	53	51.29	2718.50		
	Equal	22				
	Total	118				

As seen in Table 4,there is a significant difference between the students' Critical Thinking Disposition Scale pre-test and post-test scores in favor of post-tests. The differences are (z=-3.078, p=0.002) in total score, (z=-2.889, p=0.004) in metacognition, (z= -9.430, p=0.000) in systematicity and (z=-2.312, p=0.021) in perseverance-patience sub-dimensions. Although there is an increase in the students' sub-dimensions of flexibility (z=-1.534, p=0.125) and open-mindedness (z=-1.477, p=0.140) scores, these increases are insignificant.

Scientific Research Skills

After the analysis of the data collected from the opinion form, it is seen that the students gained scientific research skills such as literature scanning/reaching correct information, reading/examining/interpreting articles, determining research problem, determining research methods, data collection, data analysis/interpretation, article/report writing, citing references, and making presentations.

Some direct quotes from students' opinions under these categories are given below:

> *S1: "I got good information about being able to choose a research problem and what to do in this process."*
>
> *S23: "It enabled me to focus on what to do while researching. It also enabled me to make data analysis and synthesis and be a researcher"*
>
> *S87: "I learned what needs to be done when I conduct a scientific research process? I*

learned how to do research, to analyze scientific articles as necessary, and to do research in every sense."

According to the analysis of the data collected from the opinion form, *Students' Statuses to Conduct Scientific Research* is given in Table 5.

Table 5: Students' Statuses to Conduct Scientific Research

Categories	Codes	f
Can Execute	Highly skilled/can perform Despite his shortcomings, he made progress/increased his proficiency Has basic knowledge/Knows the processes step by step 60% - 80% sufficient Has moderate proficiency Has some shortcomings Has some shortcomings but thinks he can improve Can perform with support Can perform with more training Can perform by doing research/ by experience Can perform with a group Can execute in an amateur manner Can perform with minor errors Can perform even if it is difficult	100
	Not Sure	3
	Can Not Execute	3
	Total	106

As seen in Table 5, the students' ability to conduct scientific research statuses are grouped under three categories: *can carry out, not sure*, and *not able to carry out.*

It is seen that students generally consider themselves sufficient in terms of scientific research processes in varying degrees. They think they made progress with the course even though they had deficiencies. It is seen that students have a high belief that they can do this job by getting support as a group, researching more, and by getting an education. Few students consider themselves inadequate in scientific research.

Some direct quotes from students' opinions under these categories are given below.:

S3: "I think I have made great progress even though I still have some deficiencies."

S16: "I think I can do this when I get more education."

S30: "If I write an article right now, I will have deficiencies, but I can do 80% of it correctly."

THE EFFECTS ON STUDENTS' VALUES

According to the results of the analysis of the data collected with the opinion form, at the end of the lesson, the students think that they gained values such as *love/friendship, unity/togetherness, respect for different opinions, being without prejudice, empathy, tolerance, sacrifice, helpfulness/sharing, responsibility, diligence/perseverance, patience/perseverance, justice, courtesy*, and *scientific ethics.*

Some direct quotations from the opinion forms on this subject are given below:

S32: "Even though I did group assignments in different classes since this course is long-term, I understood once again how important it is to value each other's ideas or to respect each other's ideas."

S60: "I learned the importance of sharing

and being united better."

S93: "Having group homework that we need to do weekly, made us work with group members in a group and may have contributed to the values of cooperation, solidarity, and responsibility."

THE EFFECTS ON STUDENTS' ATTITUDES

At the end of the course, it was observed that there were changes in students' based on the following categories: *Attitudes Towards the Course*, *Attitudes Towards Cooperative Learning*, and *Attitudes Towards Scientific Research*.

Attitudes Towards the Course

According to the analysis of the data collected by the opinion form, the effects of the Research Methods in Education course, organized according to the Layered Inquiry-Based Learning Model, on the students' attitudes towards the course are presented in Table 6.

As seen in Table 6, students' attitudes towards the course are categorized under five categories, which are *responsibility/guidance, effectiveness, attractiveness, intensity/difficulty*, and *clearness/ regularity.*

It is seen that the students have positive attitudes towards the course in terms of leaving the responsibility to the student, providing effective learning, being attractive, and being organized. However, it was also determined that the students had negative attitudes, especially when duties and responsibilities were complicated and intense and when tasks were not precise.

Some direct quotes from students' opinions under these categories are given below:

S24: "It was nice that he directed us to research instead of giving ready-made information."

S43: "What I liked during the course was that I had the opportunity to evaluate my friends."

S81: "It was nice to watch the other groups' work and presentations openly and compare with my homework accordingly."

S93: "At first, I thought that it would be complicated, as I was used to the fact that teachers conveyed information to us in a ready-made manner until now, but later I realized that it was very beneficial for us to obtain the necessary information as a result of our research."

S51: "It was very intense. It was very tiring. The course content was very intense. There could be less content. At the same time, it was tough to find resources for the course."

S63: "It was tiring to have a presentation every week."

S72: "It was a problem not understanding exactly what we needed to do at some steps. Could have been more descriptive."

Attitudes Towards Cooperative Learning

According to the analysis of the data collected via the opinion form, the students' attitudes towards cooperative learning are presented in Table 7.

Table 6: Students' Attitudes Towards the Course

Categories	Positive Attitude	Negative Attitude
Responsibility/ Guidance	Took responsibility for his own learning Learned by researching/experiencing himself Actively took part in the course Dominated every week of the course The teachers guided	The topic was not taught
Effectiveness	Was not in the form of rote learning Directed to research Provided permanent learning Producing products was efficient Individual studies contributed to learning Gained self-confidence with presentations Got used to teaching with presentations Reporting was effective End-of-course assessments were effective Learned from presentations of other groups Compared his own presentation with other presentations Evaluating other groups was effective Self-assessment of the group was effective Peer reviews provided thinking Received recompense for his work	Peer review was unnecessary Feedbacks was not group specific/efficient
Attractiveness	It was an interesting style he had not experienced before Individual studies were fun and good The presentations were fun and good Writing the reports were fun and good Getting feedback every week was exciting Sharing their products was fun Was nice to get points from reports every week Getting high scores was nice	Having it every week was boring
Intensity/ Difficulty		It was very intense/time consuming It was very challenging/tiring He couldn't find time for other classes Homework times were short Visa and final weeks were busy It was hard to find time every week There was a fear of making a mistake Finding information/resources was difficult It was difficult to choose the right information in the resources It was difficult to organize homework Quests were not up to their levels Peer reviews were tiring
Intelligibility/ Regularity	Teaching the course according to a plan was helpful The teachers gave clear answers to the questions	What they were going to do was not clearly explained Example format was not shown The instructions were non-explanatory/was vague No clear answers were given to the questions

Table 7: Students' Attitudes Towards Cooperative Learning

Categories	Positive Attitude	Negative Attitude
Activity	Contributed to learning/understanding A product was launched/successful	
Attractiveness	It was fun and beautiful	
Democracy	Everyone contributed equally to the process The chairperson changed every week The presenter changed every week They chose the groups themselves	
Responsibility	It was nice to take responsibility Everyone had a sense of responsibility	Some did not fulfill their responsibilities
Socializing/ Belonging	They made friends There was an interaction between students The friendship between them was increased	It was difficult to join a group in the first weeks There was no close friendship
Exchange of Ideas	Information was discussed/shared/concluded Different ideas arose It was nice to taken care of their opinions	There were differences of opinion
Communication/Work sharing	The division of work was effective They were easily organized Problems were solved together	There was no effective division of work They did not act together It was difficult to meet/get together from a distance

When Table 7 is examined, it is seen that students' attitudes towards cooperative learning fall under seven categories: *effectiveness, attractiveness, democracy, responsibility, socialization/ belonging, exchange of ideas* and *communication/ work division*. It is seen that students have positive attitudes that cooperative learning is compelling, engaging, and democratic, brings responsibility, and provides opportunities for socialization, exchange of ideas, and division of labor. On the other hand, it is also determined that students have negative attitudes about fulfilling responsibilities, socialization/belonging, exchanging ideas, and division of labor.

Some direct quotations from students' opinions under these categories are given below:

S4: "The practical teaching of the course was excellent in terms of learning. It helped us a lot in working as a group."

S70: "I enjoyed working as a team regularly."

S99: "I couldn't always get the support I wanted in group works."

The pre-test post-test results based on the analysis of the data, collected via the Attitudes Towards Cooperative Learning Scale, with the Wilcoxon Signed Ranks test are given in Table 8.

Table 8: Wilcoxon Signed Rank Test Pre-Test Post-Test Results

Factor		n	Rank Avg.	Rank Sum	z	p
Total Score	Negative Rank	47	55.28	2598.00	-1.058	.290
	Positive Rank	61	53.90	3288.00		
	Equal	8				
	Total	116				

When Table 8 is examined, it is seen that there is an increase in the students' Attitude Towards Cooperative Learning Scale post-test scores, but there is no significant difference (z=-3,650, p=0.000) between the pre-test and post-test scores.

Attitudes Towards Scientific Research

After the analysis of the data collected with the opinion form, it is seen that the students had attitudes such as *Understanding that scientific research is significant* and *Understanding that scientific*

research requires effort at the end of the course.

RESULTS AND DISCUSSIONS

At the end of the course, it is concluded that the students gained social skills, such as *speaking/expressing oneself*, *discussion, listening, cooperative work, and personal skills such as self-knowledge, self-confidence, regular/disciplined work, self-control*, and *use of time effectively.* At the end of the course, it was determined that students gained some thinking skills, such as *critical thinking, problem-solving, questioning, developing a different perspective*, and *multi-dimensional thinking.* At the end of the course, it was concluded that there was a significant positive difference in the students' critical thinking skills.

Improving students' critical thinking skills is considered a crucial indicator of the model's effectiveness. Since inquiry-based learning is an approach that forces students to understand and solve challenging real-life problems collaboratively, this approach is expected to support students' critical thinking (Ghaemi & Mirsaeed, 2017). Because providing students with research-examination opportunities and providing interaction environments where they can compare various views and perspectives will encourage them to think critically (Simó et al., 2016). Particularly, interactions in group work will enable students to become active learners who are open to diversity and critical thinking (Nagda et al.,, 2003). It is thought that all these elements that encourage critical thinking are provided with this model.

At the end of the course, it was concluded that the students gained the necessary skills about the scientific research process and generally considered themselves sufficient in terms of scientific research processes to varying degrees.

In support of the results of this research, the results in the literature show that students improved their research skills after inquiry-based learning (Altunsoy, 2008; Bozkurt, 2012; Cuevas et al., 2005; **Çelik** & **Çavaş**, 2012; Lin et al., 2009; Paris, 2009; Tatar, 2006; Wu & Hsieh, 2006).

At the end of the course, it was determined that the students gained various values such *as love/friendship, unity/togetherness, being without prejudice, empathy, tolerance, sacrifice, helping/sharing, responsibility, diligence/perseverance,* and *justice*. It was concluded that the students generally have positive attitudes towards the course regarding leaving responsible to the students, providing effective learning, being interesting, and being organized at the end of the course. However, it was also concluded that they have negative attitudes about the difficult and intense duties and responsibilities and the incomprehensibility of the tasks.

In the literature, it was reported that an inquiry-based learning approach increases students' interest in the course (Bilir, 2015), provides effective learning (Alouf & Bentley, 2003; Bozkurt, 2012; Bozkurt et al., 2013, Cuevas et al., 2005; Çelik & Deaktor, 2005, Çavaş, 2012; Wu & Hsieh, 2006) and increases students' participation in the course (Bilir, 2015; Coşkun, 2018; Lin et al., 2009). It has also been determined that the Layered Inquiry-Based Learning Model provides order in the learning process to be developed differently from the other studies.

It is thought that the tasks and responsibilities are intense and challenging for the students because they are not used to student-centered models that require them to take responsibility for their learning. In student-centered environments, some students may not be willing to put in the effort and involvement necessary to manage their learning. Students may need help to gain this understanding and the necessary skills (Carpenter & Pease, 2013). As it is in our country of Turkey, it is expected that this situation will be even more difficult for students accustomed to receiving education according to a teacher-centered approach, as in our country. In support of this situation, **Üstünoğlu** (2009) concluded in his study with 960 university students in Turkey that students are reluctant to take responsibility for their learning and see the teacher as a decision-maker.

At the end of the course, it was concluded that there was an increase, although not a significant increase, in the students' attitudes towards cooperative learning. It was determined that the students have positive attitudes that cooperative learning is compelling, engaging, and democratic and that cooperative learning brings responsibility and provides opportunities for socialization, exchange of ideas, and division of labor. On the other hand, it was also determined that they have difficulties fulfilling responsibilities, socializing, exchanging

ideas, and dividing their labor.

In the literature, there are studies stating that cooperative learning increases students' success (Akbuğa, 2009; Aktaş, 2013; Astra et al., 2015; Carpenter & Pease, 2013; Meral & **Şimşek**, 2014; Nam & Zellner, 2011; **Ökmen**, 2020; Shy-Jong, 2007), attitudes towards learning (Akbuğa, 2009; Gelici & Bilgin, 2011; **Özdoğan**, 2008), and motivations (Arısoy, 2011; **Ökmen**, 2020). It also improves social skills, group awareness, self-esteem, self-confidence, and self-discipline (Bashir et al., 2020; Carpenter & Pease, 2013; Cecchini, et al., 2020; Harianto et al., 2020; Redes, 2016; Sawyer & Obeid, 2007). In addition, in groups with high team harmony, high levels of problem-based coping, emotion-based coping, and team goal achievement (Hartman et al., 2013), were seen. Moreover, it was also stated that group work provides an interactive classroom environment and produces positive results in terms of providing peer interaction, exchanging ideas, and producing common and successful products (**Şahin** et al., 2020).

However, Gül and Konu (2008) state that some students have negative opinions about group work. This situation can be considered as a situation related to whether the students have gained the ability to work collaboratively. Carpenter and Pease (2013) also state that cooperation is not easy, and students cannot always be expected to be ready for it. Therefore, educators must design experiences that support the development of this skill.

At the end of the course, it was observed that students have positive attitudes towards scientific research. In studies conducted with undergraduate students, İlhan et al. (2016) and Biçer,et al. (2013) found that students' attitudes towards research were at a low level, while Polat (2014) found that it was at a moderate level. Considering that undergraduate students generally have negative attitudes towards scientific research processes, it can be said that the model is also successful in this context.

In line with all the results, it can be said that the effectiveness of the model, even in distance education conditions, is supported by this study. Based on the research results, the following recommendations have been formulated:

1. It is recommended to use and disseminate the Layered Research-Based Learning Model in different branches. Teachers should be encouraged to use Layered Inquiry-Based Learning Model.
2. Similar studies can be performed in different educational institutions and in different subject areas, and the results can be compared.

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