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Multidisciplinary Learning Environments (MLE): Young Minds Science and Art Summer Camp Project

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Abstract

In this study, it was purposed to examine the effects of MLE on communication and social adaptation skills of secondary school students. In addition, examining the experiences of students throughout the process towards MLE was determined as another purpose. In this direction, a project named "Young Minds Science and Art Summer Camp" was developed based on the results of the studies in the literature on multidisciplinary learning. The study group of the research consists of 42 secondary school students. The embedded model (design), one of the mixed method research models in which qualitative and quantitative methods are used together, was applied in this research. In this context, the data collected by the quantitative research method before and after the practice process were supported by the qualitative data collected at the beginning, during, and at the end of the practice. In the quantitative dimension of the research, the single-group pre-test post-test experimental design was used, and the phenomenological design was conducted in the qualitative dimension. While the quantitative data of the research were analyzed with the help of a computer program, the qualitative data were analyzed through the content analysis method. As a result of the analysis, it was concluded that the learning model developed within the scope of the project did not make a significant difference in the communication and social adaptation skills of the students. Such factors as the insufficient engaged time, the difficulties experienced by the students when they encounter activities other than their usual activities, the low number of friends with whom they were acquainted before, and the fact that they had just emerged from the Covid-19 pandemic were noted among the reasons for this situation. Regarding the multidisciplinary learning process, it has been observed that students have different opinions on carrying out different activities and having knowledge and skills in different fields, different from school education. Based on these results, it has been recommended to keep engaged time wider and to consider student expectations and needs while developing MLE to improve the communication and social adaptation skills of students.

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Introduction

The dialogue between Panda Po and his father is remarkable in the movie "Kung Fu Panda 3", which can also be summarized as the story of Panda Po's transformation into Kung Fu Panda. What Po said against the sentence by Po's father that "We can learn kung fu, we can be like you!" also points out the way the teacher should follow in the learning process: "No, you cannot. And you don't have to be... I must transform you

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into yourself, not myself... Your real strength comes from making the best use of your unique abilities." After sharing these thoughts with his father, Po asks two important questions: "Who are you? What are you good at?". When the answers to these two questions are evaluated in the context of the students that today's teachers prepare for the future, according to Organization for Economic Co-operation and Development (OECD), it is also the beginning of the path to be followed in raising students who will be successful in 2030 and have the knowledge, skills, attitudes, and behaviors they need to shape the world (OECD, 2019). Ensuring that students acquire the subjects they need, thanks to their good sides, can be possible by creating environments where they can use and encounter different knowledge, skills, attitudes, and behaviors. In these studies, in which constructivist and socio-cultural theories form the infrastructure, the needs and interests of the student come to the fore in the focus of educational activities (Mård & Hilli, 2020). It is stated that multi-disciplinary studies conducted by connecting subjects and disciplines without integration anxiety (Jacobs, 1989) enable students to connect and contextualize information about the subject to develop meaningful learning (Liu & Wang, 2019; Mård, 2021). Connecting can be expressed as a parallel process with the functioning of the brain. Learning and teaching activities are also shaped with research on the brain and the way it works, and research in this field are used to raise the people required by the age. Santiago Ramon Cajal, who discovered that nerve cells form "networks" through synapses, won the Nobel Prize in 1906 for this research and paved the way for future research in this field. The Human Connectome Project, which was launched in the USA in 2009, aimed to "map these human networks", and the Human Brain Project was started in the European Union in 2013, focusing on neuroscience and information processing. Kılıç (2021), who interprets the reflection of this development process on human life as "connective unity", states that the definition of the brain as the organ that provides the physiological balance of the human body is left behind, and that the brain is now defined as a "mind-creating organ" with the data obtained from these projects. Upon the change in this definition, it was emphasized that the initial form of the question "What is the brain and how does it think?" started to transform into the question "How does the brain create a mind?". Therefore, it is clear that the mind-creating process of the brain is based on connectivity and that the data coming to the brain must be connected in order to become "information". Learning, which is defined as establishing new connections between neurons, is meaningful according to which disciplines and which fields a person connects with each other in this connectivity.

At present time, when innovative approaches are needed in learning and teaching, it is emphasized that students should take an active role in the center of the learning process and teachers should assume the role of consultants in the education paradigm of the new age (Aslan et al., 2016). As a matter of fact, in the real world, people evaluate the problems they encounter not through a single discipline, but by connecting events (Açıkgül-Fırat, 2020). This connection is also reflected in educational research, and because activities carried out with connections (GEMS, STEM, etc.) alone and in themselves are not sufficient especially in science education, art is added to these studies (STEAM, STEM+A, etc.), and studies that combine science and art studies have gained importance. Expressing the similarity between science and art as "imagining the unimaginability", Turkka et al. (2017, p. 1403) underlined the similarity of these two disciplines and emphasized that artistic processes should be included in science. As a matter of fact, in a study conducted through a multidisciplinary approach combining science and art by combining physics education with drama, it was stated that the studied subject was learned in a wider context and that learning was encouraged in many ways (Kallunki et al., 2017).

When the literature is examined, the concepts of interdisciplinary, transdisciplinary, cross-disciplinary and multidisciplinary are seen (Drake & Burns, 2004; Jacobs, 1989; Park & Mills, 2014). Among these, the multidisciplinary approach can both enrich the subjects with content from various disciplines and enable students to understand how to learn (Kgari-Masondo & Ngwenya, 2020). In a study conducted with secondary school students, it was stated that the presentation of multidisciplinary content provided students with the opportunity to explore interesting

problems, and teachers also assumed a greater supervisory role, making it easier for students to participate in self-directed group work (Braskén et al., 2020). In a study in which education programs are evaluated in terms of multidisciplinary understanding, it is recommended that multidisciplinary studies, in which both academic and industry related collaborative studies and projects are included, and elective courses vary, should be carried out instead of an inflexible system that is not fed from other fields in education (Özdamar & Özdamar, 2021). In another study, it is stated that multidisciplinary studies provide a general picture and avoid details and focus on the basis and basic premises of the subject (Davidovitch, 2013). In addition, a multidisciplinary understanding stands out in the 21st century skills that OECD foresees for people who will shape the future. 21st century skills consisting of knowledge construction, real-world problem solving, communication, collaboration, use of information and communication technology for learning and self-regulation (Stehle & Peters-Burton, 2019) are examined under four headings as Learning and Innovation Skills; Core Lessons and 21st Century Themes; Knowledge, Media, and Technology Skills; and Life and Career Skills (Cansoy, 2018). It can be stated that communication skills under Learning and Innovation Skills, entrepreneurship under Core Lessons and 21st Century Themes, and social adaptation skills under Life and Career Skills should be handled from a multidisciplinary perspective. For example, communication skills form the basis of human relations and learning is expressed as a product of good communication (Selanik-Ay, 2015). Social adaptation skill, on the other hand, refers to the individual's ability to establish and maintain a healthy and balanced relationship with herself/himself and her/his environment (Tanriverdi & Erarslan, 2015). Özdamar & Özdamar (2021, p. 254) explained the need for both skills to be addressed from a multidisciplinary perspective as follows:

"In today's world, where information and communication technologies are increasing and borders are being lifted in every field, multidisciplinary interaction areas are emerging and expanding. Such approaches reveal new markets, new needs, and new uses from the digital age. With the new needs, new markets opened, and approaches developed, the search for new information and therefore cooperation is increasing."

On the other hand, in a study examining the communication skills of secondary school students, it was determined that students with higher education levels in their families had higher communication skills, and that female students had a higher level of communication than male students (Armut & Türkyılmaz, 2019). In the same study, it was recommended to plan activities to increase the communication skills of male students, and it was emphasized that methods to improve communication skills should be researched and developed. In another study, it was determined that as the grade level of the students increased, their communication skills decreased, and it was suggested to examine the reasons for this (Köksal & Çöğmen, 2018). In another study, which deals with the social adaptation levels of secondary school students, the importance of children's social adaptation levels during the secondary school years, which coincides with adolescence, was emphasized and some recommendations were made to test the effects of programs aimed at improving social adaptation (Aydoğdu & Gürsoy, 2019).

In the light of the above reasons, it was purposed in this study to examine the effect of learning environments developed through a multidisciplinary perspective on the communication and social adaptation skills of secondary school students. In addition, in this research, examining the experiences of students throughout the process towards MLE was determined as another purpose. In this context, the research questions were formed as follows:

1. What is the effect of MLE on the communication skills of secondary school students?
2. What is the effect of MLE on social adaptation skills of secondary school students?
3. What are the opinions and recommendations of the students regarding the project process carried out in MLE?

Method

Research design

The embedded model (design), one of the mixed method research models in which qualitative

and quantitative methods are used together, was used in this research. In this model, there is a method that provides basic data about the research and a second method that supports these data (Creswell & Plano Clark, 2014). This design enables the same phenomenon to be examined with different methods and handled from different points (Mertkan, 2015). In this context, the data collected by the quantitative research method before and after the practice in the research were supported by the qualitative data collected at the beginning, during, and at the end of the practice. In the quantitative dimension of the research, the single-group pre-test post-test experimental design was used, and the phenomenological design was applied in the qualitative dimension. In the research, qualitative data were used to elaborate and strengthen the data obtained from the experimental process.

Study group

The study group of the research consists of 42 secondary school students selected from among the children of successful but low-income families determined through the District Governorships and National Education Directorates of 13 districts of Samsun (19 Mayıs, Alaçam, Asarcık, Ayvacık, Bafra, Çarşamba, Havza, Kavak, Ladik, Salpazarı, Terme, Vezirköprü, Yakakent) in the 2020-2021 academic year. The criterion sampling method was used as the basis for the determination of the study group. The criteria considered in the selection of students are as follows:

- Being a 7th or 8th grade student,
- Being academically successful (course grades were considered),
- Low-income level of the family (Socio-economic level determined according to the Turkish Statistical Institute 2020 data was used),
- Volunteering of students and families,
- Equal number of males and females among the determined students,
- Students from different districts.

Among the 42 students selected for the study in line with these criteria, students who wanted to leave the project for various reasons with the start of the project were excluded from the data collection process. However, since the data collection process was based on volunteerism, students who did not want to answer the scales were also excluded from the scope, and data were collected from 33 students. Whereas 13 of these students are males and 20 are females, 22 of them are 7th grade students and 11 of them are 8th grade students.

Multidisciplinary learning environment

Based on the results of the studies in the literature on multidisciplinary learning, a project named “Young Minds Science and Art Summer Camp” was developed. The project was implemented with the support of the Scientific and Technological Research Council, the highest institution supporting scientific and technological research in Türkiye. In the project, which lasted for seven days in total, the students were brought together in a hotel, and it was aimed that they could communicate outside the activities. Students were educated in a multidisciplinary education environment between 08:00 and 22:00 for seven days. This period also includes breakfast, lunch, dinner, and free time for students to spare for themselves and their friends. The project started with the introduction activities and pre-tests that were held on the first day and carried out with the creative drama method, and they carried out activities under the theme of “Fun Mathematical Modeling” on the same day. Under this theme, it is purposed to provide students with the ability to solve a problem that they may encounter in daily life through mathematical modeling. On the second day, studies in the field of astronomy were carried out within the framework of the theme of “The Gate Opening from the Planetarium to Space”. These studies include sky promotion, astronaut, unmanned aerial vehicle use, and sky observation in the planetarium environment. The third day is devoted to the theme of “Modelling”. Within the framework of this theme, the students were interested in the construction of a simple telescope, Hubble telescope model, and constellation model, and finally, they carried out a study of scaling the Solar System. Within the scope of STEM, the theme of the fourth day, activities such as nanotechnology, earthquake resistant bridge construction, simple machines, and digital game design were carried out. The remaining three days of the project are devoted to the theme of “Art”. Students who met fine arts on the fifth day received training on graffiti and relief

making. On the sixth day, the students who received training on music completed the day with content such as creating a playlist, body percussion, and rhythm games. At the beginning of the project, it was aimed to stage the play written by one of the project trainers on the last day of the project in front of parents and other audiences. Therefore, the students rehearsed the theater after each dinner (after 18:00). The theater play, whose preparations were made throughout the project, was staged with the audience on the last day (7th day) when the project was finalized.

Data collection instruments

Data indicating which data collection instruments were used to answer the research questions is presented in Table 1.

Table 1.
Research questions and data collection instruments

Research Questions	Data Collection Instruments
1. What is the effect of MLE on the communication skills of secondary school students?	– Communication Skills Assessment Scale (CSAS)
2. What is the effect of MLE on social adaptation skills of secondary school students?	– Social Adaptation Scale
3. What are the opinions and recommendations of the students regarding the project process carried out in a MLE?	– Semi-Structured Interview Questions – Reflective Diaries

Communication skills assessment scale (csas)

The Communication Skills Assessment Scale (CSAS), a five-point Likert-type scale developed by Korkut (1996a), consists of 25 items. The scale, which was scored as 0-4 in the first studies (Korkut 1996b), is scored from never (1) to always (5) in recent studies (Korkut, 1997). The high score obtained from the scale without reverse items means that individuals evaluate their communication skills positively. Analysis of variance results indicate that the scale is unidimensional. As a result of the reliability study performed with the test repetition method, the reliability coefficient of the scale was obtained as .76 ($p < .001$). Alpha value as internal consistency coefficient was found as .80 ($p < .001$) (Korkut, 1996a). The scale developed as a result of the study by Korkut (1996a) with high school students was used for secondary school students after being subjected to confirmatory factor analysis by Akçam (2019). Akçam (2019), in his study, revealed that the scale model is an acceptable model for secondary school students and calculated the Cronbach α reliability value as .89. This study indicates that the scale is current, reliable, and suitable for secondary school students.

Social adaptation scale

The scale developed by Aydoğdu and Gürsoy (2020) to determine the social adaptation levels of secondary school students was developed upon the analysis of the data collected from 668 secondary school students and consists of 55 items and a single factor. The lowest score that can be obtained from the five-point Likert type scale is 55, the highest score is 275, and the Cronbach α reliability value is .95.

Semi-structured interview questions

A semi-structured interview form was developed by the researchers to examine opinions of the students on the MLE, and thus, qualitative data supporting the quantitative data were obtained. During the development of the interview questions, the literature was reviewed, and the relevant titles and contents were determined. In this context, a question pool was created, and it was decided which questions to be included in the interview form after discussion among the researchers. The resulting draft form was finalized by taking expert opinions. To check the comprehensibility of the form, preliminary interviews were conducted with two secondary school students outside the study group. At the end of the interviews, necessary arrangements were made, and the form was finalized. Two semi-structured interview forms, which include

questions that will guide the interviews before and after the practice, were used as a qualitative data collection instrument in the research. Whereas there were five questions in the pre-interview form aiming to reveal the knowledge and expectations of the students about the MLE and what they will encounter in practice, seven questions trying to reveal their experiences, opinions, and thoughts in the MLE were included in the post-project interview form.

Reflective diaries

In the study, in addition to semi-structured interview forms, diary cards that include the theme of the activities of each day and aim to reveal the opinions of the students about the activities carried out that day were developed. The daily cards, which were developed specifically for seven different days and themes, consisted of a dual structure as morning and evening forms. While there are three questions in the morning form aiming to reveal the feelings, thoughts, and expectations of the participants regarding the theme and activities to be carried out during the day, the evening form consists of five questions that aim to reveal what they felt during the activities during the day, what they learned, their self-awareness after the process and their suggestions for the process.

Data collection process and analysis

In the research, quantitative data collection instruments were applied as a pre-test before the activities and as a post-test after the activities ended. Interviews were held with eight students determined among the participants before and after the activity. The maximum diversity sampling method (gender, grade level and parental education level) was taken as a basis while selecting these eight students from whom qualitative data were obtained. While three of these students are boys and five are girls, four seventh and four eighth grade students were included in the qualitative data collection. Considering that the educational status of the parents may affect the opinions and expressions of the students, the children of the parents who graduated from all education levels, from primary school graduates to graduate degrees, were included in the study. In addition to all these, all students were asked to fill in the morning form of the daily cards before the activities of each day began, and the evening form of the daily cards at the end of the day. In order to obtain clearer data from the students at the stage of filling out the daily cards, the participants were divided into groups, and a student advisor was assigned to each group. An information meeting was held with the student advisors, and the points to be considered while filling out the daily cards were explained. It is purposed to follow the students in the process with the data obtained from the daily cards, to evaluate the multidisciplinary learning process based on the theme, to receive their opinions on the basis of the theme, to support the qualitative data obtained from the interviews with the qualitative data obtained with these cards, and thus to provide data diversity. At the beginning of the project, the students were given the timetable of the practice (including the titles and durations of the activities), but no information was given about the contents of the activities.

The quantitative data obtained in the research were analyzed with the help of a computer program. The path to be followed in the analysis of the data was determined based on the distribution characteristics of the data. At the point of determining the distribution characteristics of the data, the skewness-kurtosis coefficients and normality tests were taken as basis. According to Tabachnick and Fidell (2013), the fact that the skewness and kurtosis coefficients are close to 0 within the limits of ±1 or the skewness and kurtosis indices calculated by dividing the skewness and kurtosis coefficients by their own standard errors are within the limits of ±2 indicates that the data show a normal distribution. However, it is recommended to consider the Shapiro-Wilks test, one of the normality tests, in studies with a sample size of up to 50 (Büyüköztürk, 2016). From this point of view, it was accepted that the data obtained in the study showed a normal distribution, with the skewness-kurtosis coefficient within the limits of ±1, the skewness and kurtosis indexes within the limits of ±2, close to 0 or the Shapiro-Wilks test higher than 0.05. Since it was determined that the quantitative data groups analyzed in the study showed normal distribution, dependent groups t-test was used in the analysis of the data.

The qualitative data obtained from the interviews with the participants were analyzed through the content analysis method. Content analysis refers to the data reduction and

interpretation effort to determine the basic coherences and meanings of a voluminous qualitative data (Patton, 2014). In this context, the data collected in the research were divided into codes and categories by the researchers and presented under certain headings, supported by direct quotations.

Reliability and consistency

Especially in research with a qualitative dimension, the competence of the researcher is important in terms of validity and reliability (Krefting, 1991). The researchers conducting this project consist of individuals who have qualitative and quantitative research experience, are experts in the field of education, and have a good command of the developmental characteristics of the working group. Therefore, it can be said based on previous studies and publications that researchers are competent in conducting and concluding the research. However, verifiability and generalizability of the collected data is another issue to be considered. In this context, the quantitative data collected in the research were analyzed by the researchers, and in addition, they were presented to the opinions of a researcher in the field of measurement and evaluation and another researcher who is an expert in the field of skills training. It was seen that both experts reached similar results, and the accuracy of the path followed in the analysis of the data was confirmed. The qualitative data obtained were transcribed in the first stage and analyzed by a researcher. In order not to be limited to the personal comments of the coding researcher, the codes and themes were discussed with other researchers, and the participant's views were looked at again and again. The results obtained from the qualitative data were confirmed by taking the opinion of another expert outside the research about the coding process and codes. In addition to these, the adopted method and the path followed in the project were described in detail in the text, and the transparency of the research was tried to be ensured.

Findings

Quantitative Findings

Under this title, findings regarding the effect of the MLE process on the communication skills and social adaptation of secondary school students are presented.

Communication skills

The distribution characteristics of the data obtained from the CSAS applied within the scope of the first research question of the study "What is the effect of MLE on the communication skills of secondary school students?" were examined in the first stage, and dependent groups t-test was applied because it was determined that the data showed normal distribution in both the pre-test (CT= -0.665; BK= -0.782) and the post-test (TC= -0.474; BK= -0.696). Dependent groups t-test results regarding the CSAS are presented in Table 2.

Table 2.

Dependent groups t-test findings regarding CSAS

Practice	X	Ss	sd	t	p
Pre-Test	108,82	13,49	7,73	-0,045	0,964
Post-Test	108,88	12,41			

When Table 2 was examined, it was concluded that there was no significant difference between the pre-test and post-test scores of students related to communication skills ($p>0.05$).

Social adaptation

It was observed that the skewness and kurtosis coefficients of the social adaptation scale pre-test and post-test scores applied within the scope of the second research question "What is the effect of MLE on the social adaptation skills of secondary school students?" were in the range of -1 to +1. Therefore, it was determined that the data showed a normal distribution. In order to compare the social adaptation scale pre-test and post-test scores of the students, the dependent groups t-test was applied, and the results are presented in Table 3.

Table 3.

Dependent groups t-test findings regarding social adaptation scale

Practice	X	Ss	sd	t	p
Pre-Test	247,45	22,39	13,34	0,796	0,432
Post-Test	245,61	23,77			

When Table 3 was examined, it was concluded that there was no significant difference between the social adaptation scale pre-test and post-test scores of the students (p>0.05).

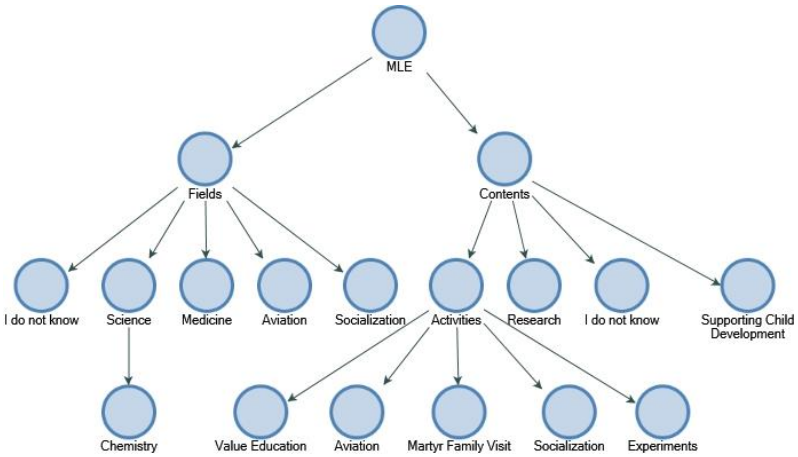
Qualitative Findings

Under this title, the findings obtained from the opinions of secondary school students on the multidisciplinary learning process are presented.

Preliminary opinions of secondary school students on the MLE

The findings obtained from the answers given by the secondary school students to the question asked to determine their preliminary opinions on the MLE are presented in Figure 1.

Figure 1.
Preliminary opinions on the MLE



In Figure 1, it is seen that preliminary opinions of the students on MLE are examined under two themes as “Fields” and “Contents”. Whereas “I don't know”, “Sciences”, and “Medicine” categories were included under the “Fields” theme, “Activities”, “Research”, and “I don't know” categories were located under the “Contents” theme. Some examples of student opinions are as follows:

> *Elvan: “I participate in STRCT (Scientific and Technological Research Council of Türkiye) projects. I know it as activities with students. You know, it could be research, different kinds of experiments are being done.”*
>
> *Contents-I do not know*

> *Merve: “To be honest, I don't know much. We looked at the paper you gave us. Well, we are going to do a telescope, and a lot of things can be done on science and music. It is being done, and I think it will be done this week. Well, importance is given to music, and it is beautiful.”*
>
> *Fields-Sciences/Contents-I do nott know*

The findings obtained from the answers of the secondary school students to the question asked so as to determine their preliminary opinions on associating the MLE with the lessons in their schools are presented in Figure 2.

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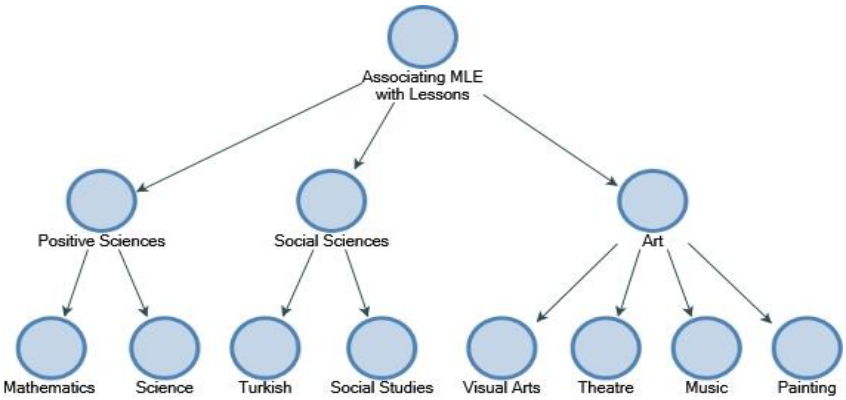
Figure 2.

Preliminary opinions on associating MLE with lessons

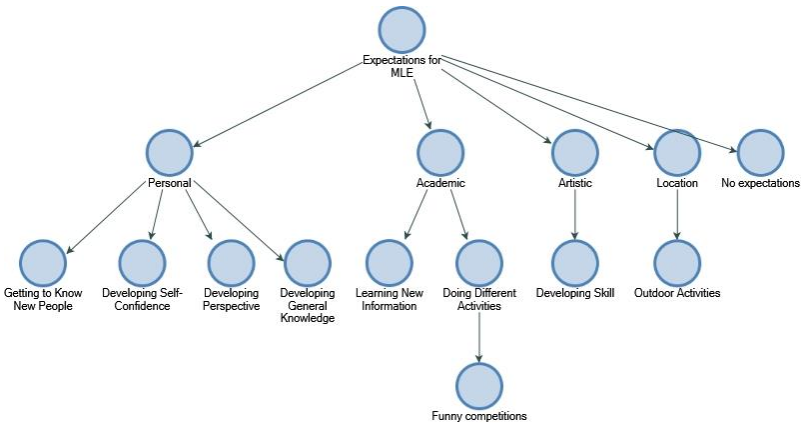


In Figure 2, it is seen that the opinions of students on associating MLE with lessons are gathered under the themes of "Positive Sciences", "Social Sciences", and "Art". Whereas "Mathematics" and "Science" categories were formed under the theme of Positive Sciences, "Turkish" and "Social Studies" categories were formed under the theme of Social Sciences. Under the Art theme, "Visual Arts", "Theatre", and "Music" categories were formed. Some examples of student opinions are as follows:

> *Emine: "It may be related to the lessons we have studied at the regular school and the subjects which we have seen. Mathematics, Turkish, Science. How can it be related to Turkish, more like this, for example, if someone does not like the Turkish lesson, I think the activities here and the way of expression here can make people like Turkish lesson. They can show more interest. There may be many activities related to mathematics, and there may be games within games. Lessons can be taught through the games, which would be nice. In fact, it could be any of the lessons."*
>
> *Positive Sciences, Social Sciences*
>
> *Ahmet: "Sir… Art and science or something. Something like science. Let's do something about science. Sir, that's it. So, there may be other art, theater, or something. The is nothing about that at school. Maybe it is music or painting or something."*
>
> *Art, Music-Painting-Theatre*

The findings obtained from the answers given to the question asked in order to determine the preliminary opinions of secondary school students on their expectations for the MLE are presented in Figure 3.

Figure 3.
Expectations for MLE



In Figure 3, expectations of students for the MLE are gathered under the themes of "Personal", "Academic", "Artistic", and "Location". Among these themes, while

"Getting to Know New People", "Developing Self-Confidence", "Developing General Knowledge" and "Developing Perspective" categories were formed under the "Personal" theme, "Learning New Information" and "Doing Different Activities" categories were formed under the "Academic" theme. Under the "Artistic" theme, the "Developing Skill" category took place. Some examples of student opinions are as follows:

Ali: "So, I came for education, for things that are aviation. I came for the relief arts such as relief and music, etc. In fact, I expect them to be explained well. I think it would be nice to have these. So, I can have a friend or two, or I can be informed or cultured. My general knowledge increases."

Personal-Developing General Knowledge

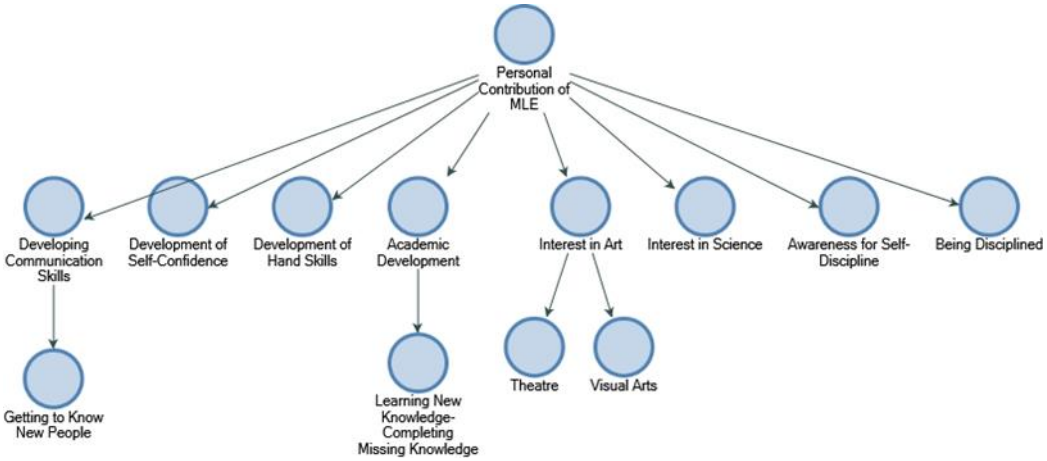
Merve: "When I walk out of this door from here, I want to say that a week later, I really know what I do not know. You know, I did not know that, and I did not know what it was, but when I went home, I want to say yes mom or dad, I knew or learned about it, or this is what happens or something like that can happen."

Academic-Learning New Information

Post opinions on MLE

The findings obtained from the answers given by the secondary school students to the question asked to determine their opinions on the personal contributions that the MLE provides to them are presented in Figure 4.

Figure 4.
Personal Contribution of MLE



In Figure 4, the opinion of the students on the personal contribution of the MLE after the activities were grouped under the themes of "Developing Communication Skills", "Academic Development", "Interest in Art", "Development of Hand Skills", "Development of Self-Confidence", "Interest in Science", "Awareness for Self-Discipline", and "Being Disciplined". While the "Getting to Know New People" code was formed under the "Developing Communication Skills" theme, the "Learning New Information/Completing Missing Information" code was formed under the "Academic Development" theme. Under the theme of "Interest in Art", "Theatre" and "Visual Arts" codes are available. Some examples of student opinions are as follows:

Ali: "It increased my self-confidence in painting. It increased my interest in astronomy. It increased my interest in theater. I met some new friends. It was pretty good."

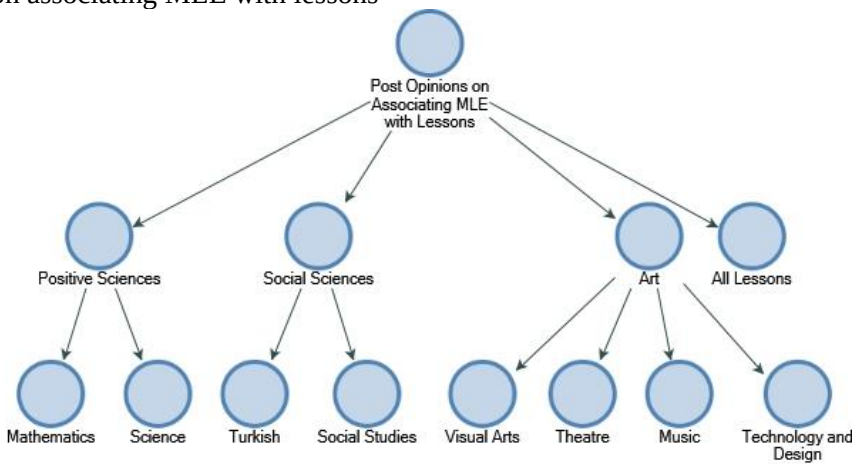
Interest in Art-Theatre, Visual Arts; Interest in Science, Developing Communication Skills

Semra: "I was normally a very shy person. When I came here, I felt like I coped with this shyness. I learned to speak and not be ashamed. I have improved in terms of communication."

Developing Self-Confidence, Developing Communication Skills

The findings obtained from the answers given by the secondary school students to the question asked to determine their post opinions on the status of associating the MLE with the lessons in their schools are presented in Figure 5.

Figure 5.
Post opinions on associating MLE with lessons

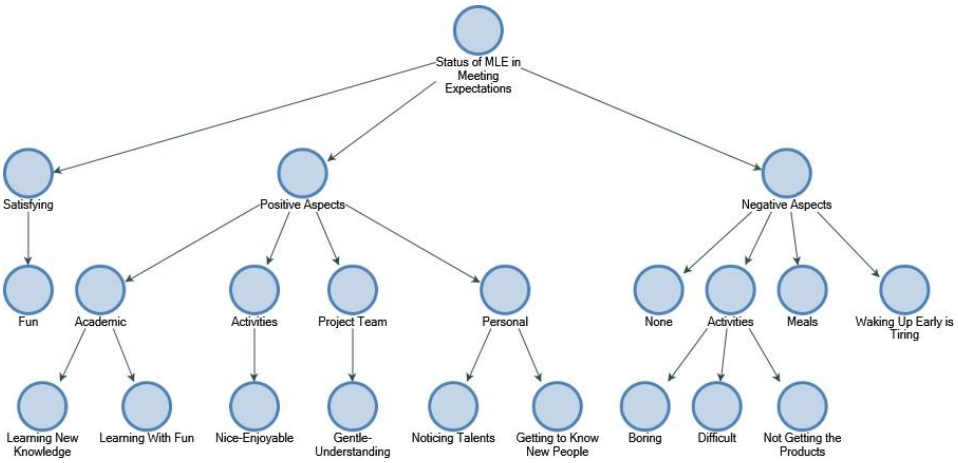


When Figure 5 is examined, it is seen that opinions of the students on associating MLE with lessons after the activities are gathered under the themes of "Positive Sciences", "Social Sciences", "Art", and "All Lessons". "Mathematics" and "Science" were obtained under the theme of "Positive Sciences", and "Turkish" and "Social Studies" were seen under the theme of "Social Sciences", and "Visual Arts", "Theatre", "Music", and "Technology and Design" codes were included under the "Art" theme. Some examples of student opinions are as follows:

> *Yusuf: "It was related to astronomy, science, mathematics, painting, Turkish, in general, every subject we can think of. Mathematics as we solve new generation problems; astronomy because we study space and make telescopes; Since we were playing word games, the activities were related to Turkish."*
>
> *All Lessons*
>
> *Semra: "First of all, Science. Visual Arts for handicraft. Math, Social Studies, and Music because we learned how to make rhythms."*
>
> *All Lessons*

The findings obtained from the answers given by the secondary school students to the question asked to determine their opinions on the fulfillment of their expectations from the MLE after the practices are presented in Figure 6.

Figure 6.
Status of MLE in meeting expectations



When Figure 6 is examined, it has been seen that the opinions on whether the MLE meet the expectations of the students after the activities are grouped under the themes of "Satisfying", "Positive Aspects", and "Negative Aspects". Whereas the "Fun" code was formed under the "Satisfying" theme, "Academic", "Activities", "Project Team", and "Personal" codes were placed under the "Positive Aspects" theme. Under the "Negative Aspects" theme, the codes such as "None", "Activities", "Meals", and "Waking Up Early is Tiring" were observed. Some examples of student opinions are as follows:

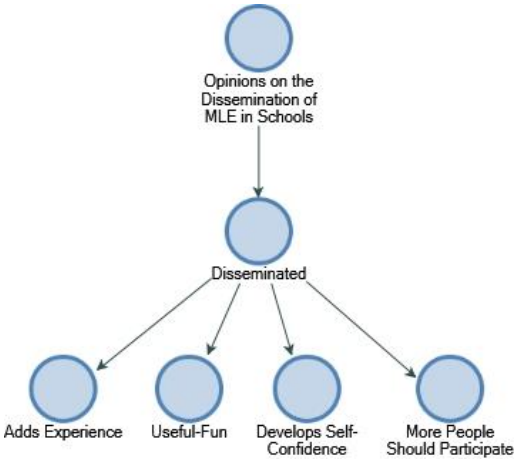
> *Ali: "The content was pretty good, and it was too much. The theater was pretty good. For example, relief work, planetarium, and cosmos activities were good. I used to not like theater very much, but now I am starting to like it. It is cool when you play it. I saw that I could succeed. The theater exceeded my expectations. The math activity was below my expectations because there was a delay. Other than that, it was fine."*
>
> *Positive Aspects, Activities-It was good/pleasant*
> *Negative Aspects, Activities-Difficult/Dexterous*

> *Merve: "I think it is a good project. I think, funny. I think it is good that it is a week before school starts. It is also entertaining. Both instructive. We did not want to do some activities, but we had fun despite it. I think we did good work. I think we all got along very well with each other. For example, at first, I thought that no one would agree with me. That was nice. This project is both educational, instructive, and inclusive. On a positive note, the brothers and sisters in charge were very good. They were very kind. Our teachers were very good. In fact, many of our teachers were all very good. They took care of us. I love all the teachers. The things I had called difficult before were also very easy."*
>
> *Positive Aspects, Academic-Learning New Information, Learning with Fun Project Team, Kind-Insightful*

The findings obtained from the answers given by secondary school students to the question about the dissemination of MLE in schools are presented in Figure 7.

Figure 7.

Opinions on the dissemination of MLE in schools

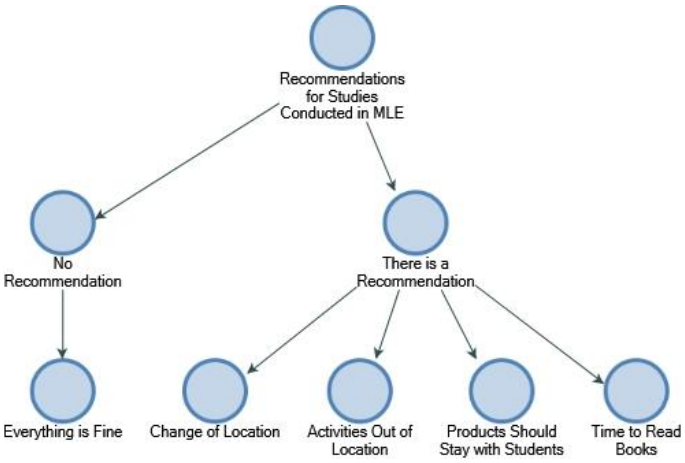


When Figure 7 is examined, it is seen that the opinions of students on the dissemination of MLE in schools after the activities consist of the codes "Adds Experience", "Useful-Fun", "Develops Self-Confidence", and "More People Should Participate" under the theme of "Disseminated". Some examples of student opinions are as follows:

> *Elif: "I think if they call our school again, of course, I would like to come again next year. In other words, there is nothing negative about the projects by STRCT. I would like to come, and I would like to be. For example, 40 people came to this project. If more people could come, my friend would also come, or a total of 10 people from our school came, or if it was more common, 20 people would come. 10 boys and 10 girls. More people would have come."*
> *Expanded, More People Should Participate*
> *Ali: "It could be nice. That is, it develops self-confidence. We can find new fields. There may be more cohesion. They can find new friends."*
> *Expanded, Develops Self-Confidence*

The findings obtained from the answers given by the secondary school students to the question asked to determine their recommendations regarding the studies carried out in MLE are presented in Figure 8.

Figure 8.
Recommendations for studies conducted in MLE



When Figure 8 is examined, it is seen that student recommendations regarding the studies carried out in MLE after the activities are grouped under the themes of "There is a Recommendation" and "No Recommendation". While the codes of "Change of Location", "Activities Out of Location", "Products Should Stay with Students", and "Time to Read Books" were formed under the theme of "There is a Recommendation", the code of "Everything is Fine" was included under the theme of "No Recommendation". Some examples of student opinions are as follows:

> *Elvan: "I do not have much of a recommendation. The events and activities were very nice, but we had a little trouble with the hotel. In this regard, I would only recommend being more careful in the selection of the hotel, namely, in the criteria of the hotel, and in future events."*
>
> *There is a Recommendation, Change of Location*
>
> *Yusuf: "If we had those telescopes, I would like to keep the galilescopes, the things we do. It would have been better if we had taken what we had made home."*
>
> *There is a Recommendation, Products Should Stay with Students*
>
> *Emine: "No recommendation because this place is too beautiful to think of."*
>
> *No Recommendation, Everything is Fine*

Discussion and Conclusion

In this study, which aims to determine the effect of the project, which was carried out in a multidisciplinary learning environment, on the communication and social adaptation skills of secondary school students, and to reveal student opinions and recommendations, secondary school students from different socio-economic levels were brought together. Before the practice, pre-interviews were held with the students and their thoughts on the content, which courses it could be related to, and their expectations from this project were asked. In the pre-interviews, it was seen that the students did not have knowledge about the content, but rather they had predictions about the content. These predictions were made based on the given practice chart. Students also thought that the activities they thought would be done in a MLE might be related to many different lessons they see in schools, but these thoughts were again based on predictions. Based on this, it was concluded that the secondary school students participating in the project did not have sufficient knowledge about the scope and content of the project. It has been taken into consideration at the point of evaluation of communication and social adaptation that students come to a different environment and will be confronted with relatively unknown content.

It has been examined that the expectations of the secondary school students from the project in terms of communication and social adaptation, which is the main research subject, while participating in the project, and how motivated the students are in terms of communication and social participation to the project. As a result of the preliminary interviews, it was determined that the participant group had some personal, academic, artistic, and spatial expectations from the project, and some participants did not have any expectations. Secondary school students believed that a MLE would improve them academically and artistically in terms of knowledge and skills, and they participated in education with this motivation. Students expressed their expectations of having a different education at these points. In addition, it was determined that the spatial expectations of the students were in the direction of doing an activity outside the usual school environment, and it was seen that they had expectations for outdoor activities. Therefore, it can be stated that the expectations of the students in the education carried out with a multidisciplinary learning approach are like the ongoing school education in terms of carrying out different activities and having knowledge and skills in different fields. However, the expectations of the participants from the training also showed their existence in a personal sense. Participants expect the MLE conducted with students from different locations to contribute to meeting new people personally, developing self-confidence in interpersonal communication, gaining different perspectives from communication with different individuals, and improving their general knowledge. These personal expectations can be evaluated within the scope of communication and social adaptation skills. Based on the preliminary interviews, it can be

stated that the students who make up the participant group have expectations in terms of communication and social adaptation, and therefore they participate in the learning environment in a motivated way towards these skills.

The model used in the research was developed as a result of a deep literature review. Based on experimental studies, Admiraal et al. (2019) listed the factors that should be in multidisciplinary learning environments as cooperation, communication, problem solving, critical thinking and creativity. Nigmatullin, Simonova, and Agathangelou (2016), on the other hand, stated that in order to develop social adaptation, activities should be based on learning environments and pedagogical support should be provided in the personal, social and cultural sense. In addition, Öztürk (2008) revealed that leisure activities, art activities, game activities, music activities, language activities, and science and nature activities can support social adaptation. In addition to these approaches, the methods that are stated to support communication and social adaptation were examined, and the methods and techniques to be used in the model were determined accordingly. In the literature, there are studies showing that cooperative learning (Alp, 2015; Rutherford et al., 1998), drama (Arslan et al., 2010; Aslan, 2018; Bayrak & Akkaynak, 2020; Dere, 2019; Görgülü, 2009; Kara & Çam, 2007; Ormancı & Şaşmaz Ören, 2010), educational games (Alp, 2015; Yıldız et al., 2017), problem solving (Sugito,et al., 2017), theater (Öztürk, 2006), and free time activities (Zerengök, Güzel, & Özbey, 2018) support social adaptation and communication skills. In addition, multidisciplinary learning environments have positive effects on cooperation and communication (Masters, O'Toole Baker & Jodon, (2013), teamwork and skills (Qattawi et al., 2021), and intercultural communication skills (Martinez-Mier et al. 2011). In some studies (Besnard & Letarte, 2017; Bohnert et al., 2007), it has been considered that well-organized learning environments are important in developing social adaptation and communication skills. Based on these results, when the quantitative data obtained on the effect of the multidisciplinary learning model on the communication and social adaptation skills of secondary school students were examined, it was concluded that the learning model developed within the scope of the project did not make a significant difference in the communication and social adaptation skills of the students. Before and after the education, communication and social adaptation skills tests were applied to the students, and the difference between the pre-test and post-test scores was analyzed statistically, and no significant difference was found. In the preliminary interviews, it was concluded that the students were motivated to the learning process, but on the other hand, their communication and social adaptation skills did not develop in a meaningful way. In order to explain this situation in the research, interviews were conducted with the students before and after the practice, and qualitative data were obtained in this context. In line with these data, some determinations were made that there was no significant difference in the tests measuring communication and social adaptation skills.

In this research, the practices lasted for one week, and the students received intensive trainings addressing different disciplines in multidisciplinary learning environments during this week. No studies have been found in the literature on the time required for the development of mental skills. It has been stated that current studies focus on motor skills, and the concept of time spent on the target in these studies plays an important role in students' acquiring these skills (Karweit 1989). McKenzie and Lounsbery (2013), on the other hand, stated that at least 5% to 12% of the duration of the lessons or learning environments aimed at skill development in secondary school students should include engaged time, and it has been proven in the literature that this duration can vary in different geographies. In the activities implemented in this project, this recommendation developed for motor skills was considered for mental skills, and at least 40% of the activity times were designed to include engaged time. Despite this, it was determined that the students' social adaptation and communication skills did not develop significantly. Therefore, it is thought that a week spent may be insufficient in developing these skills of students. While designing the MLE and activities to be used in the research, it was important to enable communication. It can be said that this approach affects secondary school students positively in terms of communication and social adaptation, but this

situation is not reflected in quantitative data. Therefore, it is recommended that the practice process be extended over a wider period in future studies that will deal with the MLE and communication and social adaptation skills, and that the students should be constantly active in terms of communication in the activities to be carried out.

Knowledge level of individuals about life and their expectations from other individuals may be the factors limiting their communication capacity (Manso, 2009). Individuals who try to meet the demands of the society by considering their own needs from birth are asked to change according to expectations (Çerkez et al., 2021). Therefore, the expectations of the individual from the environment and the expectations of other individuals in the environment may also affect the communication and social skills of the individuals. As a matter of fact, studies have shown that expectations of students can explain their adaptation to new learning environments and affect their social skills and personal development (Soares et al., 2021). In the preliminary interviews with the students in this study, it was determined that the students had some personal, academic, artistic, and spatial expectations from the multidisciplinary learning environment. This situation is expected to affect social adaptation and communication skills of the students. In the post interviews, the participants commented on the extent to which the project met the expectations of the students and stated that they benefited from the activities in academic and social terms at many points and that many of their expectations were met at this point. When the expressions of the students were examined, it was seen that what they expected from this learning environment socially was met and that there was an emphasis on communication in these expressions. The participants stated that thanks to this project, they came together and communicated with their peers from many different places and with teachers and academics studying in different fields, and this situation had a positive effect on them. In addition, the students who spend time with their friends stated that they can communicate during the activities and thus make new friendships.

In the preliminary interviews with the participant group, it was determined that the ideas of students about the learning environment they will enter and the activities to be done are limited. Therefore, students received education in a relatively different and new learning environment. This indicates the necessity of an adaptation process for students. The interviews made after the practice also support this opinion. Participants pointed out some difficulties during their education in a multidisciplinary learning environment. The students, who encountered a new environment and content outside the classroom and outside the usual education, had problems at some points while adapting to this education. The students, who encountered most of the things done in the activities for the first time, tried to overcome these difficulties. These difficulties experienced in this learning environment based on communication and social adaptation may have prevented students from developing their communication and social adaptation skills in a meaningful way. Students who prioritize overcoming these difficulties may have left communication and social harmony in the background. When the diagnoses of the concept of social adaptation are examined, such elements as reflecting the values and rules widely adopted in the society on behavior (Zhang et al., 2018), the ability of individual to change according to a new role and environment (Ruan, et al., 2019), or exhibiting behaviors in accordance with the norms and expectations of the society (Aydın & Sönmez, 2014) come to the fore. Therefore, the ability of children to meet the expectations of the new social environment and adapt to this new environment requires a certain level of readiness (Kaya & Akgün, 2016). This readiness is about understanding the norms and value judgments of the newly entered environment. The one-week practice period in the project may be an insufficient time for students to understand the norms and value judgments of the community formed by people from different socio-cultural environments and cultures. This is, of course, a factor that can be reflected in the communication skills of individuals. In addition, each environment creates its own culture. Therefore, this learning environment that students have not encountered before can create confusion at this point. At this point, the question arises whether the education carried out in a MLE with the activities that students are accustomed to will have a more positive effect on the communication and social

adaptation skills of the students. For this reason, it is recommended that researchers minimize the factors that will force students in such learning environments and shift the focus to communication.

Participants think that such projects should be expanded because they add different experiences, are fun, and develop the individual at many different points. Stating that such learning environments are beneficial for meeting and mingling with different people, the students developed some recommendations for the projects to be done. In the recommendations made, the students emphasized that the project should be done with more people and that they wanted more people from their friends to participate in such projects. Another starting point of this project, which brings together different disciplines, is to bring together students with different characteristics. However, this situation can also appear as one of the factors prolonging the process in the development of communication and social adaptation skills. Students who come together with different individuals may experience feelings of anxiety and worry at the point of social interaction. This opinion is also supported by the literature. According to Melikoğlu (2020), one of the most important pillars of social adaptation is friendship relations. Individuals who are included in a new environment may feel anxiety and worry in social interaction, and this may result in loneliness by causing separation from other people (Lau & Kong, 1999, as cited in Johnson et al., 2001). In addition, studies have shown that anxiety negatively affects social adaptation and thus communication (Erten, 2012; Öğüt, 2001; Peleg, 2012). This situation explains the preferences of the students who want their friends to be in the project in the recommendations. Since it is known that social adaptation is related to self-confidence and sense of achievement, Elias et al., (2010) stated that the comfort to be experienced at this point may allow students to develop their communication and social adaptation skills more. Therefore, in the studies to be conducted in this field, revealing how the communication and social adaptation skills of the students who are familiar with and are more comfortable together in the multidisciplinary education environment affect the results of this study at this point will carry forward the results of our study and contribute to the relevant literature.

Another result that can explain the fact that the MLE does not make a significant difference in the communication and social adaptation skills of secondary school students was obtained from the qualitative data collected after the practice. Some students from the participant group stated that they came together with their peers and teachers for the first time after the coronavirus pandemic. In Turkey, curfews and restrictions were implemented within the scope of combating the pandemic before the implementation period, and students, like everyone else, lived a long life in isolation. The Covid-19 pandemic has caused serious changes in the field of education, affecting 94% of the student population in more than 190 countries in the world (UNESCO, 2020). In this process, all academic activities started to be carried out remotely, and this approach was adopted by institutions that are not familiar with distance education (Sangster et al., 2020; Toquero, 2020). Kear (2010) revealed that students who encounter this learning method for the first-time face serious problems in distance education. The world was caught unprepared for distance education, which was passed due to the pandemic that caused a worldwide crisis, and it was seen that the experiences in this field were insufficient. However, the importance of prior experience in distance education, especially in the fields of communication and cooperation, has been emphasized by some researchers (Henderikx et al., 2017), and it has been stated that inexperience in this subject can create some negative consequences such as social isolation. As a result of social isolation, problems such as isolation from society and loneliness, as well as interpersonal skills, listening skills, attention skills and processes, and impaired functionality appear (Çelik, 2020). In addition, studies have reported that distance education is weak in terms of providing communication and cooperation (Jones & Chen, 2008), and students complain about the lack of communication in this process (Alawamleh et al., 2020; Boling et al. 2012; Vonderwell, 2003) and feel lonely (McConnell, 2006). It is thought that the psychological effects of the social isolation process, which was made compulsory during the pandemic process, especially on young individuals, affect many social skills. One of these effects is psychological resilience, which has a very important role in adapting to new

situations (Kurt, Sarıoğlu & Parlak, 2021). Psychological resilience consists of two important components: difficulties involving all kinds of negativity and stressful events, and behavioral and social skills that include adapting to them (Akın & Akın, 2015), and for this reason, it is considered important for the development of social adaptation and communication skills. Studies have also indicated that psychological resilience has a positive and significant effect on communication skills (Akduman et al., 2018). These findings support the results of this research. The psychological resilience of the adolescent individuals forming the study group during the pandemic process may have been affected, and thus their social adaptation and communication skills may have been negatively affected. A study conducted in a disadvantaged region in Turkey suggests that especially female students cannot adapt to this situation that has changed with distance education, that they do not adopt the behavioral patterns required by the pandemic process, especially that their social adaptation situation worsens (Kahraman & Havlioğlu, 2021). This is supported by the findings of our research on this point and the statements of the students. However, the limitation in socio-cultural activities experienced during the pandemic process has kept students away from such activities. However, as stated in the literature, socio-cultural and artistic activities have an important place in the development of social adaptation and communication skills (Karahan et al., 2005; Koca, 2010; Köksal, 2000). The reference to this situation by students indicates that the pandemic may negatively affect communication and social adaptation skills of students, or that students may find it harder to recover within the context of the same skills when they are freed from these difficult conditions.

Recommendations

In the research, the effect of MLE on the social adaptation and communication skills of secondary school students was revealed, and some results were obtained based on the qualitative data. Based on the above-mentioned results, in addition to the above recommendations, some other recommendations for the field have been developed. Initially, it was determined that there was no significant increase in the social adaptation and communication skills scores of the students, but the opinions of students on this type of learning environment were positive. The reason why the increase between the scores is not at a significant level has been discussed in the literature. Based on this, it is recommended that engaged time, which focuses on these skills in formal education or studies conducted with MLE, should be broader to improve the social adaptation and communication skills of students. It will be beneficial for the development of these skills if the students have more time to use their communication and social adaptation skills in such environments. Another recommendation is to consider student expectations and needs while developing MLE. However, in the studies to be carried out, the adaptation of the students to the new environment is another issue that needs to be emphasized. In the research, it was seen that the social isolation that occurred because of the pandemic process affected the development of these skills of the students. Therefore, it may be beneficial to focus on activities that will improve social adaptation and communication skills of individuals in a possible social isolation process. In addition, activities that focus directly on skill development rather than learning environment approach in the development of social adaptation and communication skills may be more effective in the development of these skills.

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Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of interest

None

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