ISSN: 0976-3104
SPECIAL ISSUE: Current Trends in Social Sciences

ARTICLE

# EXAMINATION OF THE LEARNING STRATEGIES USED BY SECONDARY SCHOOL STUDENTS TOWARDS A MATHEMATICS COURSE IN TERMS OF CERTAIN VARIABLES

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## ABSTRACT

*The aim of this study is to determine whether the strategies of secondary school students towards mathematics are different according to gender and class level variables. The participants of the study are 166 students studying in the 6th, 7th and 8th grades of a college affiliated to the Ministry of National Education in Northern Cyprus. In this study, the survey method, which is one of the quantitative research methods, was used. Also, the four-dimensional mathematics learning strategies scale was used as a data collection tool. The research findings revealed that the most widely used learning strategy by students is 'time and study environment', and the least used strategy is 'effort regulation'. The results of the research show that secondary school students' learning strategies for math classes differ according to gender and class level variables. The results of the research were discussed within the context of the findings in the literature and suggestions were made for practical application*

**KEY WORDS**
*Learning Strategies, Mathematics, Gender, Class Level*

Received: 5 June 2018
Accepted: 17 Aug 2018
Published: 10 Sept 2018

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## INTRODUCTION

In accordance with the rapidly changing scientific and technologic improvements, accessing new information and adapting to current developments has become a necessity. At the present time, as student based learning-teaching increases in popularity, the aim is for individuals to access correct information, to analyse, to comment, to use the information and to discover new knowledge based on this information. This can be possible by learning to learn, which means acquiring new learning strategies. It can be therefore stated that learning strategies can improve learning productivity and augment persistency, while enabling students to learn easier and more effectively; it can be said that this consequently improves learning performance [1].

Kafadar [2] identified learning strategies as the process of the learner interpreting information during their cognitive and affective procedures in order to acquire new information. According to Weinstein [3], learning strategies are behaviours expected to affect a person's process of coding information and that it should be at the centre of learning activities. Based on these definitions, any learning strategies' purpose is to have an effect on learners' selection, obtainment, regulation and compilation of new information.

Additionally, learning strategies provide easy and lasting learning, while also increasing the efficiency of learning and giving the learner the ability to learn independently.

Today, we focus more on learning than teaching. In order for the learning action to be concluded as intended, the most appropriate strategies should be used [4]. Analysing the literature on learning strategies, it can be seen that various classifications have been made on this subject. Although it is possible to encounter different classifications in this field, this paper will focus on the classification of learning strategies conducted by Pintrich and his colleagues [5], [6]. Accordingly, learning strategies are discussed below in three main categories: Cognitive strategies, meta-cognitive strategies and resource management strategies.

Cognitive strategies are addressed under four main headings. These are the strategies of rehearsal, elaboration, organization and critical thinking. Rehearsal strategies are the strategies that occur with mental rehearsal activity, which enable learners to select and acquire the information they will obtain. Elaboration strategies help to create meaningful codes in long-term memory by integrating existing information with new information intended to be learned in long-term memory. Organization strategies enable learners to selectively obtain information that is appropriate for them and to connect with the information they have learned. Finally, critical thinking strategies refer to the purpose of problem solving, which learners apply to previously learned information in emerging situations, to make judgments, to make decisions and to approach new information critically [5].

Metacognitive self-regulation strategies are aimed at ensuring that students make the necessary adjustments by controlling themselves during the learning process. These strategies include three activities: planning, organizing and monitoring. Planning activities consist of goal setting and analysis of the tasks to be performed. Monitoring activities include self-control during reading, collecting attention and asking questions. Monitoring activities involve the actions of testing and performing the necessary adjustments to improve performance. The time and study environment as resources management strategy is one of the main requirements of planned and scheduled study time management. Determining realistic goals and making a program time periods (daily, weekly, monthly) in accordance with these objectives ensures effective use of the study time. Additionally, it is important that the studying environment is



Guest Editor: Prof. Dr. Huseyin Uzunboylu

IIOAB JOURNAL
ISSN: 0976-3104

conducive to the studying behaviour of the learner. In order to achieve this, the studying environment must be free from noise, clutter and distractions. Resource management strategy is the ability to control the study and attention of the learner on a non-engaging and distracting task. Peer collaboration management refers to with the facilitation of learning with peers in order to take advantage of the benefits of group work [5], [7], [8].

The strategy of asking for help in resource management refers to the behaviour of asking teachers or peers if the learner needs help in the learning process on his or her own. The important factor in this context is that that learners are aware when they need help and determine the appropriate person from whom help can be obtained.

At all levels of education, students' educational needs for learning strategies can be met naturally within the educational programs of schools. In primary and secondary education levels in Turkey and in Northern Cyprus, learning strategies are not sufficiently involved in education programs and are irregular. In the literature on this subject, research and satisfactory information have not been found. It is necessary to understand the degree of involvement of learning strategies in school curricula in order to develop students' behaviour in the use of learning strategies. Additionally, there is a need for information on how learning strategies are transferred to students, teachers' competences in this field, and the learning strategies used by students. The present study will therefore fill this gap in the literature.

The main purpose of this research is to determine the learning strategies used by students studying in secondary schools' in 6th, 7th and 8th grade mathematics classes and to determine whether these strategies differ according to gender and class level variables. Based on this basic objective, answers to the following research questions have been sought:

1) What learning strategies do 6th, 7th and 8th grade secondary school students use in mathematics?
2) Do the learning strategies used by those students in mathematics classes differ according to the gender of the students?
3) Do the learning strategies used by those students in mathematics classes differ according to the level of the students?

## MATERIALS AND METHODS

In this study, the survey method, which is one of the quantitative research methods, was used to investigate the gender and age variables of the learning strategies used by 6th, 7th and 8th grade secondary school students in mathematics. The survey method examines a particular case that is related to the subject matter. Handling the researched case together with its connections helps to understand it in greater detail [9]. In this study, students ' learning strategies and the situation of these strategies in terms of gender and age variables were determined.

### Participants

The participants of the study were students studying in the sixth, seventh and eighth grades of colleges affiliated to the Ministry of National Education of Northern Cyprus in the 2017-2018 academic year. At the end of work, 166 students were identified as participants of the study.

### Data collection tool

In order to determine learning strategies, a 68-item "Mathematics Learning Strategies Scale" scale developed by Liu and Lin [10] was used in this study. The Cronbach's alpha coefficient of the scale used in the study was 0.921 [10]. The scale is based on 4 dimensions. The first dimension is cognitive strategies, which includes 3 sub-dimensions: Rehearsal, Elaboration and Organization. The second dimension is meta-cognition strategies. In this dimension, there are two sub-dimensions: Critical thinking and Self-regulation. The third dimension is Non-informational resources management. This dimension includes 4 sub-dimensions: Effort regulation, Time and study environment, Peer-learning and Help-seeking. The last dimension is Informational resources management. This dimension includes two sub-dimensions: Exploratory behavior on the Internet and Communication behavior on the Internet. The sub-dimensions of these dimensions and the items they contain are displayed in [Table 1] below.

The learning strategies scale for the mathematics course is a 5-point Likert type scale, which is based on the following points to determine the level of realization of the relevant materials on the scale [10]: Disagree Completely = 1, Disagree = 2, Indecisive = 3, Agree = 4, Agree Completely = 5.

### Analysis of the data

Statistical analysis of data was conducted using the SPSS 23 (Statistical Package for Social Sciences) package program. In order to answer the research question, frequency (f), percent (%), arithmetic mean (X) and standard deviation (Sd) were calculated and the independent samples t-test and one-way analysis of

IIOAB JOURNAL
ISSN: 0976-3104

variance (ANOVA) tests were applied to compare two and more than two sub groups respectively in the analysis of the data.

**Table 1:** Mathematics learning strategies scale

| Sub-Scale | Factor | Items |
|---|---|---|
| Cognitive strategies | Rehearsal<br>Elaboration<br>Organization | 3, 11, 22, 33, 44, 55<br>4, 12, 23, 34, 45, 56<br>5, 13, 24, 35, 46, 57 |
| Meta-cognitive strategies | Critical thinking<br>Self-regulation | 6, 14, 25, 36, 47, 58<br>15, 26, 37, 48, 59, 65 |
| Non-informational resources management | Effort regulation<br>Time and study environment<br>Peer-learning<br>Help-seeking | 17, 28, 39, 50, 61<br>16, 27, 38, 49, 60, 66, 67, 68<br>7, 18, 29, 40, 51, 62<br>8, 19, 30, 41, 52, 63 |
| Informational resources management | Exploratory behavior on internet<br>Communication behavior on internet | 1, 9, 20, 31, 42, 53<br>2, 10, 21, 32, 43, 54, 64 |

## RESULTS

In this section, the findings on the gender and class level variables obtained as a result of the research and the findings on the learning strategies used by the students who participated in the research are reported. Additionally, the findings regarding whether the level of learning strategy differs according to gender and class level variables are given.

**The findings and interpretations of the personal information of the sixth, seventh and eighth grade mathematic students in secondary school**

In total, 40.4% (n= 67) of the participants were girls and 59.6% (n=99) of the students were boys. Additionally, 24.1% (n=40) of the students were in the sixth grade, 38.6% (N=64) in the seventh grade and 37.3% (n=62) were eighth grade students. According to these data, the majority of the students participating in the survey were seventh grade students.

**The findings and interpretations of the learning strategies used by the students in the sixth, seventh and eighth grade Mathematics courses in secondary schools**

The results of the students' learning strategies are given in [Table 2]. In this study, it was determined that the students who participated in the study were frequently using the organization strategy with an average of 28.49 (from cognitive strategies), the self-regulation strategy with an average of 28.69 (from meta-cognitive strategies), the time and study environment with an average of 31.40 (from non-information resource management strategies), exploratory behavior on internet with an average of 23.93 (from information resources management). Furthermore, it was identified that the students who participated in the study were using elaboration less frequently, with an average of 23.83 (from the cognitive strategies), critical thinking strategy with an average of 23.54 (from the meta-cognitive strategies), Effort regulation strategy (from the non-information resource management strategies) with an average of 20.42 and communication behaviour on the internet (from the information resource management strategies) with an average of 21.97. With an overview shown in [Table 2], it can be seen that the most used strategy by the students is the Time and study environment and the least used us the Effort regulation strategy.

**Table 2:** Levels of using learning strategies of students

| Dimensions | Sub-Dimensions | $\bar{X}$ | *Sd* |
|---|---|---|---|
| Cognitive Strategies | Rehearsal | 23.87 | 3.97 |
| | Elaboration | 23.83 | 3.96 |
| | Organization | 28.49 | 4.21 |
| Meta-Cognitive Strategies | Critical Thinking | 23.54 | 3.99 |
| | Self-regulation | 28.69 | 4.66 |
| Non-Information Resource Management | Effort regulation | 20.42 | 3.29 |
| | Time and study environment | 31.40 | 5.89 |
| | Peer-learning | 26.46 | 5.89 |
| | Help-seeking | 24.30 | 4.60 |
| Information Resources Management | Exploratory behavior on internet Communication behavior on internet | 23.93 | 8.40 |
| | Exploratory behavior on internet Communication behavior on internet | 21.97 | 6.77 |



THE IIOAB JOURNAL

Guest Editor: Prof. Dr. Huseyin Uzunboylu

IIOAB JOURNAL
ISSN: 0976-3104

**Findings and Interpretations of the Learning Strategies Used by the Students in the Sixth, Seventh and Eighth Grade Mathematics Course in terms of Gender Variables**

According to the independent samples t-test. there was only a significant difference in the "research behavior on the internet" strategy according to the to the distribution of the students' learning levels in terms of gender. It was found that there was a statistically significant difference in the average scores for the use of learning strategies by male and female students in this dimension (p<.05). In [Table 3], a significant difference in the sub-dimension of "Internet research behavior" was found according to gender. [Table 3] shows that the average for the female students in this dimension is 25.88 and the average for male students is 22.62. This suggests that the dimension of research behavior on the internet is in favor of females.

**Table 3:** Independent samples t-test results according to gender variables of students' levels of using learning strategies

| Strategies | Gender | *F* | | *Sd* | t | P |
|---|---|---|---|---|---|---|
| Rehearsal | Female | 67 | 24.39 | 3.58 | 1.40 | 0.17 |
| | Male | 99 | 23.52 | 4.20 | | |
| Elaboration | Female | 67 | 24.03 | 4.25 | 0.55 | 0.59 |
| | Male | 99 | 23.69 | 3.77 | | |
| Organization | Female | 67 | 28.82 | 3.86 | 0.84 | 0.40 |
| | Male | 99 | 28.26 | 4.43 | | |
| Critical Thinking | Female | 67 | 23.48 | 3.41 | -0.16 | 0.88 |
| | Male | 99 | 23.58 | 4.35 | | |
| Self-regulation | Female | 67 | 29.10 | 4.17 | 0.95 | 0.34 |
| | Male | 99 | 28.40 | 4.97 | | |
| Effort regulation | Female | 67 | 20.55 | 3.31 | 0.42 | 0.68 |
| | Male | 99 | 20.33 | 3.29 | | |
| Time and study environment | Female | 67 | 32.13 | 5.62 | 1.32 | 0.19 |
| | Male | 99 | 30.91 | 6.04 | | |
| Peer-learning | Female | 67 | 27.09 | 4.92 | 1.13 | 0.26 |
| | Male | 99 | 26.04 | 6.46 | | |
| Help-seeking | Female | 67 | 24.25 | 4.45 | -0.11 | 0.91 |
| | Male | 99 | 24.33 | 4.72 | | |
| Exploratory behaviour on internet | Female | 67 | 25.88 | 10.53 | 2.50 | 0.01 |
| | Male | 99 | 22.62 | 6.30 | | |
| Communication behaviour on internet | Female | 67 | 22.96 | 6.35 | 1.55 | 0.12 |
| | Male | 99 | 21.30 | 6.99 | | |

**The findings and interpretations of the learning strategies used by the students in the sixth, seventh and eighth grade Mathematics lesson regarding the class level variable**

One-way analysis of variance (ANOVA) test was performed in order to determine whether the learning strategies used by the sixth, seventh and eighth grade students in the mathematics class differed according to the class level variable. The results of the ANOVA test are reported in [Table 4]. Analysis results show that the students involved in the study have a significant difference in cognitive strategies, meta-cognitive strategies, non-information resource management and learning strategy levels in the information resources management sub-dimensions. In other words, the strategies used by the students vary depending on the class level.

**Table 4:** Findings on the class level variable of the learning strategies used by the students in the sixth. seventh and eighth grade Mathematics lesson in secondary school

| | Source Of Variance | Sum Of Squares | df | Mean Squares | F | p |
|---|---|---|---|---|---|---|
| Cognitive Strategies | Between Groups | 1843.870 | 2 | 921.935 | 12.150 | .000 |
| | Within group | 12368.708 | 163 | 75.882 | | |
| | Total | 14212.578 | 165 | | | |
| Meta-Cognitive Strategies | Between Groups | 792.266 | 2 | 396.133 | 7.959 | .001 |
| | Within group | 8112.487 | 163 | 49.770 | | |
| | Total | 8904.753 | 165 | | | |
| Non-Information Resource Management | Between Groups | 4521.901 | 2 | 2260.951 | 10.303 | .000 |
| | Within group | 35768.243 | 163 | 219.437 | | |
| | Total | 40290.145 | 165 | | | |
| Information Resources Management | Between Groups | 2742.094 | 2 | 1371.047 | 8.445 | .000 |
| | Within group | 26464.364 | 163 | 162.358 | | |
| | Total | 29206.458 | 165 | | | |

p<0.05

IIOAB JOURNAL
ISSN: 0976-3104

In order to determine which class groups differ from the class levels that emerged as a result of the ANOVA test, an ad hoc test was required. The results of the Scheffe test are given in [Table 5].

In terms of cognitive strategies, there was a statistically significant difference between the 6th and 7th as well as the 6th and 8th classes. It is observed that there is no significant difference between the 7th and 8th classes in terms of cognitive strategies. The result showed that there was difference in the dimension of meta-cognitive strategies between the 6th and 8th classes, whereas there was no significant difference between the other groups. It was found that there was a significant difference in learning strategies among the classes 6th, 8th and 7th, 8th in the dimension of non-information resource management. In the information resources management dimension, it was found that there was a significant difference between the 6th and 7th, as well as the 6th and 8th classes. It was found that there was no significant difference between the 7th and 8th classes.

**Table 5:** Scheffe test multiple comparison findings of the learning strategies used by the sixth. seventh and eighth class students' mathematics lesson in the secondary school

| | (I) Class Level | (J) Class Level | Mean Difference (I-J) | Standard Error | P |
|---|---|---|---|---|---|
| Cognitive Strategies | 6th Grade | 7th Grade | 5.23125* | 1.75576 | .013 |
| | 6th Grade | 8th Grade | 8.70806* | 1.76662 | .000 |
| | 7th Grade | 8th Grade | 3.47681 | 1.55227 | .085 |
| Meta-Cognitive Strategies | 6th Grade | 7th Grade | 2.60625 | 1.42194 | .190 |
| | 6th Grade | 8th Grade | 5.61532* | 1.43073 | .001 |
| | 7th Grade | 8th Grade | 3.00907 | 1.25714 | .060 |
| Non-Information Resource Management | 6th Grade | 7th Grade | 3.15313 | 2.98574 | .574 |
| | 6th Grade | 8th Grade | 12.43387* | 3.00420 | .000 |
| | 7th Grade | 8th Grade | 9.28075* | 2.63970 | .003 |
| Information Resources Management | 6th Grade | 7th Grade | 6.97188* | 2.56823 | .027 |
| | 6th Grade | 8th Grade | 10.59839* | 2.58411 | .000 |
| | 7th Grade | 8th Grade | 3.62651 | 2.27058 | .282 |

*p<0.05

In order to determine if there are differences in the sub-dimensions of the learning strategies in terms of the class level, the ANOVA method was used to analyze the sub-dimensions after the analysis of the main dimensions of the learning strategies. With this analysis, the answers to the question of whether there is a significant difference in class levels in terms of rehearsal, elaboration, organization, critical thinking, self-regulation, effort regulation, time and study environment, peer-learning, help-seeking, exploratory behavior on the Internet and communication behavior on internet are sought. Analysis findings revealed that there was a significant difference between class levels in all sub-dimensions except for communication behavior on the Internet. The results of the Scheffe test to determine which groups have differences are given in [Table 6].

**Table 6:** Findings on the class level variable in the lower dimensions of the learning strategies used by the students in the 6th, 7th and 8th class Mathematics lesson

| | Source Of Variance | Sum Of Squares | df | Mean Squares | F | p |
|---|---|---|---|---|---|---|
| Rehearsal | Between Groups | 136.641 | 2 | 68.321 | 4.511 | .012 |
| | Within group | 2468.443 | 163 | 15.144 | | |
| | Total | 2605.084 | 165 | | | |
| Elaboration | Between Groups | 268.699 | 2 | 134.350 | 9.459 | .000 |
| | Within group | 2315.235 | 163 | 14.204 | | |
| | Total | 2583.934 | 165 | | | |
| Organization | Between Groups | 229.523 | 2 | 114.761 | 6.944 | .001 |
| | Within group | 2693.953 | 163 | 16.527 | | |
| | Total | 2923.476 | 165 | | | |
| Critical Thinking | Between Groups | 162.340 | 2 | 81.170 | 5.376 | .005 |
| | Within group | 2460.943 | 163 | 15.098 | | |
| | Total | 2623.283 | 165 | | | |
| Self-Regulation | Between Groups | 247.949 | 2 | 123.975 | 6.051 | .003 |
| | Within group | 3339.762 | 163 | 20.489 | | |
| | Total | 3587.711 | 165 | | | |
| Effort regulation | Between Groups | 691.809 | 2 | 345.905 | 11.204 | .000 |
| | Within group | 5032.148 | 163 | 30.872 | | |
| | Total | 5723.958 | 165 | | | |
| Time and study environment | Between Groups | 454.637 | 2 | 227.318 | 7.019 | .001 |
| | Within group | 5278.646 | 163 | 32.384 | | |
| | Total | 5733.283 | 165 | | | |
| Peer-learning | Between Groups | 189.306 | 2 | 94.653 | 4.679 | .011 |
| | Within group | 3297.634 | 163 | 20.231 | | |

IIOAB JOURNAL
ISSN: 0976-3104

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|---|---|---|---|---|---|---|
| | Total | 3486.940 | 165 | | | |
| Help-seeking | Between Groups | 823.875 | 2 | 411.937 | 6.210 | .003 |
| | Within group | 10812.396 | 163 | 66.334 | | |
| | Total | 11636.271 | 165 | | | |
| Exploratory behaviour on internet | Between Groups | 600.705 | 2 | 300.352 | 7.038 | .001 |
| | Within group | 6956.145 | 163 | 42.676 | | |
| | Total | 7556.849 | 165 | | | |
| Communication behaviour on internet | Between Groups | 61.329 | 2 | 30.665 | 2.894 | .058 |
| | Within group | 1727.153 | 163 | 10.596 | | |
| | Total | 1788.482 | 165 | | | |

**Table 7:** Scheffe test multiple comparison findings of the learning strategies used by the students in the 6th, 7th and 8th class mathematics lesson in secondary school

| | | (J) Class Level | Significance Difference (I-J) | Standard Error | p |
|---|---|---|---|---|---|
| Rehearsal | 6th Grade | 7th Grade | 1.55313 | .78436 | .144 |
| | 6th Grade | 8th Grade | 2.36613* | .78921 | .013 |
| | 7th Grade | 8th Grade | .81300 | .69345 | .504 |
| Elaboration | 6th Grade | 7th Grade | 2.23750* | .75963 | .015 |
| | 6th Grade | 8th Grade | 3.31210* | .76432 | .000 |
| | 7th Grade | 8th Grade | 1.07460 | .67159 | .281 |
| Organization | 6th Grade | 7th Grade | 1.44063 | .81940 | .216 |
| | 6th Grade | 8th Grade | 3.02984* | .82447 | .002 |
| | 7th Grade | 8th Grade | 1.58921 | .72444 | .093 |
| Critical Thinking | 6th Grade | 7th Grade | 1.55313 | .78317 | .143 |
| | 6th Grade | 8th Grade | 2.58387* | .78801 | .005 |
| | 7th Grade | 8th Grade | 1.03075 | .69240 | .333 |
| Self-Regulation | 6th Grade | 7th Grade | 1.05313 | .91235 | .515 |
| | 6th Grade | 8th Grade | 3.03145* | .91799 | .005 |
| | 7th Grade | 8th Grade | 1.97833 | .80661 | .052 |
| Effort regulation | 6th Grade | 7th Grade | 1.15000 | 1.11990 | .591 |
| | 6th Grade | 8th Grade | 4.82742* | 1.12683 | .000 |
| | 7th Grade | 8th Grade | 3.67742* | .99011 | .001 |
| Time and study environment | 6th Grade | 7th Grade | .55938 | 1.14700 | .888 |
| | 6th Grade | 8th Grade | 3.73629* | 1.15410 | .006 |
| | 7th Grade | 8th Grade | 3.17692* | 1.01407 | .009 |
| Peer-learning | 6th Grade | 7th Grade | 1.70313 | .90658 | .175 |
| | 6th Grade | 8th Grade | 2.79032* | .91218 | .011 |
| | 7th Grade | 8th Grade | 1.08720 | .80151 | .401 |
| Help-seeking | 6th Grade | 7th Grade | 3.05625 | 1.64159 | .180 |
| | 6th Grade | 8th Grade | 5.79113* | 1.65174 | .003 |
| | 7th Grade | 8th Grade | 2.73488 | 1.45133 | .173 |
| Exploratory behaviour on internet | 6th Grade | 7th Grade | 3.91563* | 1.31670 | .013 |
| | 6th Grade | 8th Grade | 4.80726* | 1.32484 | .002 |
| | 7th Grade | 8th Grade | .89163 | 1.16410 | .746 |
| Communication behaviour on internet | 6th Grade | 8th Grade | 1.07984 | .66015 | .265 |
| | 7th Grade | 6th Grade | .25938 | .65610 | .925 |
| | 7th Grade | 8th Grade | 1.33921 | .58006 | .073 |

*p<0.05

The test results show that there was a significant difference in the Rehearsal dimension between the 6th and 8th grades, in the Elaboration dimension between the 6th - 7th grades and 6th - 8th grades, in the Organization dimension between the 6th and 8th grades, in the critical thinking dimension between the 6th and 8th grades, in the self-regulation dimension between the 6th and 8th grades, in the effort regulation between the 6th and 8th as well as the 7th and 8th grades, in the time and study environment between the 6th and 8th grades, in the peer learning dimension between the 6th and 8th grades. in help-seeking between the 6th and 8th grades and in searching on the exploratory behaviour on the internet dimension between the 6th and 7th as well as the 6th and 8th grades.

## DISCUSSION

Secondary school 6th, 7th and 8th grade students use different levels of learning strategies in different categories of mathematics courses. This result is consistent with research in the literature [8], [11], [12], [13]. According to the results of this study, the use of learning strategies in 6th, 7th and 8th grade secondary school students differs according to gender. The use of learning strategies in 6th, 7th and 8th grade secondary school students differs only in the sub-dimension of the "non-information resource management" sub-dimension of the "research behaviour on the internet" category. This difference is in favour of the female students. Studies in the literature support this result [8], [14], [15], [16]. Karalar's

IIOAB JOURNAL
ISSN: 0976-3104

[17] concluded that the learning strategies used by secondary school students varied according to their gender.

In his study, Şahin [1] found that his students used time and study environment strategies, which is one of the non-informational resource management strategies and effort regulation strategies, which is one of the least used resource management strategies. In their study, Ilgaz and Gül [18] found that, contrary to the results found in this research, the students used time management strategies the least.

The study shows that learning strategies differ according to class level. Similarly, the study of Karalar [17] found that the learning strategies used by secondary school students in science courses have changed according to the level of the class in which they are studying. Research conducted by Kafadar [2] and Stoffa, Kush and Heo [19] concluded that students used rehearsal strategies. Additionally. in the study of Ilgaz and Gül [18], it was determined that there was a significant difference in the use of self-regulation strategies as the class level increased.

## CONCLUSION

In this study, the learning strategies used by the students in the 6th, 7th and 8th grades of secondary school in mathematics were investigated, including whether these strategies differ according to gender and class level variables.

According to the results of this study, the use of learning strategies in the mathematics lesson of the 6th, 7th and 8th grade secondary school students differs according to the level of the class. In this study, the differentiation of learning strategies based on the students' class level is discussed at two levels. It has been determined that there are significant differences in all dimensions of the learning strategies in the classroom level. Similarly, the results of the sub-dimensions also show that all sub-dimensions of learning strategies are different, except for communication behaviour on the Internet.

In this study, it was concluded that the students who participated in the study used the time and study environment strategy and the minimum effort regulation strategy. This result shows that students use a combination of different learning strategies.

### Recommendations

Based on the results above, the following recommendations can made to teachers, students, researchers and parents:

- Research results show that students use different strategies. In this context, a teaching strategy should be adopted in accordance with the differences of students' learning strategies.
- The reasons for the differentiation of the use of learning strategies by gender and class level should be investigated and measures taking into account the differences should be reflected in the classroom environment.
- Experimental studies should be conducted to increase the level of the students' use of strategy and they should be reflected in the classroom environment.
- At the beginning of the academic year, students should be informed about the use of strategies and the attitudes towards mathematics lessons; activities should be implemented to increase the use of strategies and to create a positive attitude towards the course.
- Students, teachers and parents should understand the positive impact of the use of learning strategies on success.
- Teacher training and in-service training programs should include the topics of learning strategies.
- Teachers should be a model for learning strategies in the lessons and should be involved in teaching learning strategies in the curriculum.
- Studies that are more comprehensive should be conducted on the relationship between attitudes towards the course and the strategies used, as well as the reasons for applying specific strategies.

## CONFLICT OF INTEREST
There is no conflict of interest.

## ACKNOWLEDGEMENTS
None

## FINANCIAL DISCLOSURE
None

## REFERENCES

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Guest Editor: Prof. Dr. Huseyin Uzunboylu