An Analysis of the Factors Affecting Student Achievement in Chemistry Lessons

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Abstract: In this study, certain factors affecting student achievement in chemistry and the degree of their respective effects on achievement were examined. The end-of-year grades in the report cards were emphasized so as not to comprise the average of written and oral exams only. In the assessment of achievement in chemistry classes, the necessity of some factors to be considered was expressed as a numeric formula at the end of the statistical calculations. Additionally, socio-economical criteria were calculated with four operations together with the coefficients determined through regression analysis. The finding was that student achievement should not be assessed and evaluated with the average of written and oral exam grades throughout the year only, but that socio-economical factors, which are thought to have significant effects, should also be considered. This finding is also supported in the interviews with chemistry teachers.

Key words: Achievement in chemistry • attitude scales • socio-economical factors • interviews in education

INTRODUCTION

Explaining the factors affecting student achievement in various lessons has become a subject that interests a great number of researchers. Studies of this kind are carried out intensively in the field of science. The reason for this is that studies have established that student achievement in the field of science is low [1]. Recently, a great number of studies have been carried out to investigate the possible effects of low achievement and to increase students’ learning of the subject. Many variables considered to contribute to low achievement have been discussed. The variables under discussion are variables of both cognitive and sensory quality. There are many studies available that have been conducted on the effects of these cognitive and sensory variables on achievement in chemistry lessons [2]. The aim of chemistry education is not just to load the students with knowledge, but to contribute to their mental development. Therefore the content and methodology of chemistry teaching should be organized in such a way as to lead to this kind of change in students. For this reason, establishing the conditions which affect student achievement, and organizing these conditions in such a way as to contribute first of all to the students’ mental development, and then to their learning of chemistry, is of great importance. As is the case with the teaching of all other subjects, when determining the syllabus content of chemistry lessons, one should bear in mind the cultivation of students in accordance with current conditions, as well as measuring and evaluating student achievement. Furthermore, extracurricular environments and the abilities of the students should be considered when forming syllabus programs.

Existing studies reveal that after a few years of teaching experience, teachers begin to realize that students are able to learn only a very small portion of what they teach. It transpires that the reason for this is that teachers usually teach in accordance with their own learning techniques [3, 4]. Because of this, it is incorrect for teachers of chemistry lessons to assume that their students are capable of learning using their own learning methods. Chemistry teachers should first be aware of their own teaching approaches, and then pay attention to the learning approaches of their students. Heimlich and Norland [5] state that students learn according to different techniques, and because of this, when teachers apply their teaching approaches in class, they must take into account their students’ approaches. It has been established that using a single teaching approach in class is ineffective; furthermore, it has been established that however much teachers favor one particular method, they must be capable of implementing other approaches depending on the situation [6]. In his book, Grasha [7] identifies the grouping of teaching approaches, the relationship between these approaches and learning

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approaches, and the requirements of the technique necessary for the effective teaching of each group (this discovery should be taken into consideration in the case of chemistry lesson subject matter, as well). When determining the conditions which affect the achievement of chemistry lesson students, teachers should consider their teaching approaches, the learning conditions of the students, and their own style of conveying the lesson. In this study, the aim of identifying the factors which affect student achievement in chemistry is primarily to enable the mental development of students in the teaching of chemistry subjects, and secondly to provide learning environments which contribute to the students' learning of chemistry. In chemistry lessons, teachers should strive to ensure that students are cultivated with an investigative mentality; attention should be paid to ensure that students adopt the principle of solving problems with scientific methods, become aware that knowledge is not static and evolves parallel to technological developments; they should be given an idea of how important living and non-living entities are for human life and that these should be protected, they should be encouraged to love nature, and it should be ensured that students learn the fundamentals of chemistry, and the ways to attain new information based on this knowledge. The science lessons to be delivered to students should be designed with these four basics taken into consideration:

- Science as an infrastructure of knowledge,
- Science as a research instinct,
- Science as a method of thought,
- Science with regard to its role in the universe of technology and society.

Furthermore, the subject matter of physics, biology and chemistry lessons which come under the umbrella of science lessons should be identified and presented within the following four frameworks:

- Logicality
- Intelligibility
- Usefulness

The desire to learn new information caused by the feeling that current information is inadequate.

Nowadays certain problems are encountered in chemistry education with respect to both the content of subjects and the style of delivery of the lessons. Most concepts at the high school level include abstract features. Therefore, the comprehension logic of those abstract concepts in education programs, and the use of this abstraction in other subjects, can lead to problems. Particularly in the case of chemistry, the mental development process of the students is commonly overlooked in the delivery of the subject content; moreover, as achievement is only evaluated through given conceptual contents, the objective evaluation of students is out of the question. It is generally accepted that chemistry comprises three types of elements, namely macro, sub-micro, and representative elements. The elements at the macro level are tangible, visible, and usable elements. The elements at the sub micro level comprise subjects such as molecules, atom and sub-atomic structures, and connections etc. The elements at representative level are symbols, equations, and chemical calculations. What is important is to ensure that students learn how to establish connections between the subjects of the elements at these three levels [8]. For all this, certain factors and activities apart from chemistry subjects should be taken into consideration in the measurement of student achievement. In one study, university lecturers state that the main factors influencing achievement in courses are attitude and motivation [9, 10]. One focus of this study is an examination of attitudes towards chemistry and chemistry homework, out of the factors affecting student achievement in chemistry. In one of his studies, Cukrowska [11] has discovered that students’ attitudes toward science affect their achievements in chemistry lessons more than their abilities. Considering the fact that several factors affect the attitudes, this study suggests that, along with other factors, attitudes towards the chemistry lesson and homework may affect achievement in the chemistry lesson.

If a chemistry teacher, while teaching the subjects within the framework outlined above, knows students' attitudes towards the chemistry that comprise these subjects, as well as their attitudes towards the assigned homework just for the sake of better understanding of the chemistry subjects, and the time allotted by the students to homework, only then can the teacher reach any generalization about student achievement in the chemistry lesson. Furthermore, certain independent variables such as the gender of the student and the number of the student's siblings, as well as the examination of their effect on achievement in chemistry class, are considered important. The reason for this is that social process makes individuals become addicted to science and technology. Raising successful individuals
in the field of science and technology should at the same
time be of equal importance as educating individuals
whose teacher is well acquainted with their inner
environmental conditions. This means that in order to
formulate an explanation of the students’ achievements
in one lesson, demographic variables and affective factors
are of great importance. As a matter of fact, there are
various studies that examine the effect of the attitudes
toward lessons and the students’ socioeconomic
(background) features on achievement. Schibeci and Riley
[12] and Schibeci [13], have examined the effect of
students’ background features and their perceptions of
the attitudes toward science on achievement. These
studies reveal the home environment has that a
considerable effect when explaining science achievement.
Among the variables under consideration, the effect of
students’ attitudes on science and mathematics
achievements is particularly emphasized [14-16]. In
general, these studies maintain that attitude change is
related to achievement. Many studies have proved that
the gender of the student significantly affects scientific
achievement and attitudes [17-20]. Several studies have
also proven that many socio-economic (background)
factors constituting the physical environment have an
effect on scientific achievement [1, 2, 21-25]. In addition to
examining the effects of the positive or negative attitudes
of students on achievement, this study suggests that
attitudes toward chemistry homework may contribute to
achievement in the chemistry lesson. When one considers
the fact that homework comprises mental and physical
studies that students are obliged to do in relation with
certain topics or issues, it will be obvious that they have
a particular significance in understanding the topics of
the chemistry lesson. In addition, when considered as an
extension of teaching that reaches beyond the classroom
setting, homework is an important monitoring tool that
reveals students’ knowledge and maturity level in relation
to the learning of chemistry subjects. Apart from this,
homework has the additional function of encouraging
better adoption of the acquired knowledge and abilities by
having them applied to new problems. In this sense,
homework assignments in chemistry lessons resemble
a tool that complements the “learning” and “teaching”
functions. However, as this hypothesis is an assumption
only and lacks measurement-based rationales, there is a
requirement for an attitude identification tool that
reveals the behaviors of doing or not doing the homework
assigned in chemistry lesson, taking into consideration
the factors that affect chemistry achievement, measuring
the current attitude and revealing its effects on
achievement. To this end, the researcher has used a scale
that identifies “the attitudes of the students at the
secondary education level toward homework given in
chemistry lesson’s”, developed by the researcher [26].
The main view of this study is as follows: The
achievement of the student in high school chemistry
lessons should not be identified based solely on their
average written and oral grades. When identifying
student achievement in chemistry, the student’s attitude
toward chemistry and to homework assigned for chemistry
lessons, the time devoted to homework, and the number
of siblings (which is related to the quality of the study
environment and the effect on the student’s qualities),
and also the determination of the significance of the
gender factor should be taken into consideration.

METHODS

Scope and Sampling: The sample of the study comprised
530 high school students within the 16-18 age group. All
these students attend chemistry lessons and they have
volunteered to participate in this study.

Data Collection Tools: In this study, the following data
collection tools were used to determine the factors
affecting student achievement in chemistry:

The first data collection tool was “The Attitude
Towards Homework Scale” developed by Yücel [26].
This valid and reliable Likert-type scale contains 17 items
and its Cronbach alpha reliability coefficient is 0.9104
(Appendix 1).

The second data collection tool was the “The
Attitude towards Chemistry Scale” developed by
Berberoglu [27]. This scale consists of 16 items, its
Cronbach alpha reliability coefficient is 0.9200 and it is a
Likert-type measurement tool (Appendix 2).

Furthermore, certain socioeconomic factors which
affect the achievement of students in chemistry are
analyzed, such as gender influence, the time devoted to
homework, and the number of siblings. The “chemistry
achievement grade”, which is affected by all these criteria,
is the grade needed to pass the class, and it is determined
by asking the chemistry teacher’s opinions and approval,
as well as the overall average of the grades awarded for
the written and oral examinations and homework that are
carried out throughout the semester.

In addition, interviews are carried out with these
students’ chemistry teachers; these interview questions
and what transpires in the interviews are explained in
detail below.
Appendix 1

Attitude-Scale toward Homework

- I have a lot of fun while I’m doing my chemistry homework.
- I really enjoy doing my homework given in chemistry lessons.
- I get really bored while I’m doing my chemistry homework.
- When I sit to complete my homework, I feel sleepy.
- I think the homework given plays an important role in my comprehension of chemistry subjects.
- In my opinion, the dialogue between teacher and student would improve with the checking of the assigned chemistry homework.
- I believe that the homework given in chemistry lessons will be useful if the taught subjects are presented appropriately.
- I strive to be very careful and meticulous when I am doing the homework assigned in chemistry lessons.
- When the subjects that appeal to me within the scope of chemistry are assigned as homework, I lose my interest in that subject.
- I feel very unhappy while doing the homework assigned in the chemistry lesson.
- I feel very unhappy while doing the homework assigned in the chemistry lesson.
- I think doing research-based homework for the chemistry lesson is a waste of time.
- No matter what it is about, homework has always been a chore for me.
- In my opinion, preparing homework assigned in the chemistry lesson using non-textbook resources would be more instructive with regard to the subjects.
- Preparatory homework assigned about a subject in chemistry makes me more enthusiastic to learn that subject.
- The homework given as a practice exercise when chemistry topics are covered makes me understand and comprehend better.
- Research-based homework assigned in the chemistry lesson to check whether we have comprehended a topic is a good benchmark for me to assess the extent that I have understood that particular topic.

Appendix 2

Attitude-Scale toward Chemistry

- Chemistry is a field that I like a lot.
- I like reading books on chemistry topics.
- Chemistry lessons are generally very boring.
- I want to learn more about chemistry.
- If I were to study a field on science, I wouldn’t prefer chemistry.
- I attend the chemistry courses enthusiastically.
- Out of all the branches of science teaching, I would most like to be a chemistry teacher.
- Chemistry is an enjoyable branch to study.
- Participating in a debate on chemistry topics does not appeal to me.
- I would want to take the chemistry course even if it were not a compulsory course.
- I don’t feel the happiness I feel in chemistry lessons in any other lesson.
- The word “chemistry” irritates me.
- I do not like the chemistry lesson at all.
- I never regret the time I spend on chemistry subjects.
- Struggling with a chemistry-related problem gives me pleasure.
- Participating in a debate on chemistry topics does not appeal to me.

In the study, while the effects of criteria thought to influence student achievement in chemistry lesson were investigated, such as attitude toward homework, attitude toward chemistry, gender, number of siblings, time spared to homework, the relationship between these criteria were also examined. The pass grade in the chemistry lesson for the term when the research was conducted was taken into consideration when measuring student achievement. While the attitude toward homework assigned in chemistry lesson is evaluated using a 17-item scale developed by Yücel [26], attitude toward chemistry was evaluated using a 16-item scale developed by Berberoglu [27]. The evaluation of the scales was done as follows:

The grading in the 17-sentence “Attitude towards homework assigned in chemistry lessons scale” was devised considering those who mark all sentences with “Don’t Agree At All: 1” constituting the lowest score of 17, and those who mark all sentences with “Definitely Agree: 5” constituting the highest score of 85. Therefore, in this scale, the scores which correspond to the statements in the papers in the range of 85 to 17
(including 85 and 17) were summarized to calculate the scale scores of the subjects. Likewise, in the 16-question “Attitude towards Chemistry Scale,” in which the lowest score was 16 and highest score was 80, these scores and the scores corresponding to the statements of the students were calculated. In both scales, the distribution of scores according to the choices is as follows:

- Don’t Agree At All: 1
- Don’t Agree: 2
- Undecided: 3
- Agree: 4
- Definitely Agree: 5

The following criteria were scored with the numbers after them: In the evaluation of gender, Female: 1, Male: 2 points.

In the evaluation of the number of siblings:

- No sibling: 1
- One Sibling: 2
- Two Siblings: 3
- Three Siblings: 4
- More than three Siblings: 5 points,

In the evaluation of time devoted to homework:

- 15 to 30 minutes: 1
- 31 to 60 minutes: 2
- 61 to 90 minutes: 3
- 91 to 120 minutes: 4,

and the “grade of chemistry achievement” affected by all these criteria was evaluated based on the class pass grade which identifies the general average of student’s evaluation scores in oral and written examinations as well as chemistry homework grades, and also asking the opinions and approval of chemistry teachers.

Table 1 shows the descriptive statistics related to the grade of chemistry achievement according to gender.

Table 2 portrays the results of descriptive statistics related to the grade of chemistry achievement according to the number of siblings.

Table 3 shows the results of descriptive statistics related to the grade of chemistry achievement according to the time devoted to homework.

Finding the Effect Amounts of the Factors that Affect the Achievement Grade and Their Comparing:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of Achievement</td>
<td>1</td>
<td>271</td>
<td>68.679</td>
<td>6.122</td>
<td>36.000</td>
<td>95.000</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>259</td>
<td>56.950</td>
<td>18.180</td>
<td>15.000</td>
<td>95.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Siblings</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of Achievement</td>
<td>1</td>
<td>59</td>
<td>76.410</td>
<td>8.610</td>
<td>60.000</td>
<td>90.000</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>219</td>
<td>72.380</td>
<td>12.460</td>
<td>45.000</td>
<td>95.000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>132</td>
<td>60.830</td>
<td>11.540</td>
<td>35.000</td>
<td>90.000</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>50</td>
<td>46.500</td>
<td>17.090</td>
<td>20.000</td>
<td>70.000</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>70</td>
<td>37.790</td>
<td>14.760</td>
<td>15.000</td>
<td>60.000</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Time Devoted to Homework</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of Achievement</td>
<td>1</td>
<td>153</td>
<td>43.59</td>
<td>14.75</td>
<td>15.00</td>
<td>75.00</td>
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<tr>
<td></td>
<td>2</td>
<td>153</td>
<td>62.28</td>
<td>11.37</td>
<td>30.00</td>
<td>85.00</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>150</td>
<td>74.85</td>
<td>9.99</td>
<td>60.00</td>
<td>95.00</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>74</td>
<td>80.20</td>
<td>8.58</td>
<td>60.00</td>
<td>95.00</td>
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<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SSe</th>
<th>AdjSS</th>
<th>AdjMS</th>
<th>F</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Attitude toward homework</td>
<td>1</td>
<td>1280.57</td>
<td>5272</td>
<td>5272</td>
<td>134.87</td>
<td>0.000</td>
</tr>
<tr>
<td>Attitude toward chemistry</td>
<td>1</td>
<td>23235</td>
<td>14412</td>
<td>14412</td>
<td>368.73</td>
<td>0.000</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>697</td>
<td>115</td>
<td>115</td>
<td>2.95</td>
<td>0.086</td>
</tr>
<tr>
<td>Number of Siblings</td>
<td>4</td>
<td>1036</td>
<td>326</td>
<td>326</td>
<td>5.99</td>
<td>0.000</td>
</tr>
<tr>
<td>Time devoted to homework</td>
<td>3</td>
<td>326</td>
<td>109</td>
<td>109</td>
<td>2.78</td>
<td>0.041</td>
</tr>
<tr>
<td>Error</td>
<td>519</td>
<td>20286</td>
<td>20286</td>
<td>20286</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>529</td>
<td>173657</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Table 5: The regression results demonstrating the effect of attitudes on the Achievement Grade.

<table>
<thead>
<tr>
<th>Term</th>
<th>Coef</th>
<th>SECoef</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward homework</td>
<td>0.34937</td>
<td>0.03008</td>
<td>11.61</td>
<td>0.000</td>
</tr>
<tr>
<td>Attitude toward chemistry</td>
<td>0.53304</td>
<td>0.02776</td>
<td>19.20</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 6: The statistical calculation results demonstrating the effect of the number of siblings on the Achievement Grade.

<table>
<thead>
<tr>
<th>Number of Siblings</th>
<th>Coef</th>
<th>SECoef</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (no sibling)</td>
<td>0.8832</td>
<td>0.8447</td>
<td>1.05</td>
<td>0.296</td>
</tr>
<tr>
<td>2 (1 sibling)</td>
<td>2.5623</td>
<td>0.5442</td>
<td>4.71</td>
<td>0.000</td>
</tr>
<tr>
<td>3 (2 sibling)</td>
<td>0.6254</td>
<td>0.5759</td>
<td>1.09</td>
<td>0.278</td>
</tr>
<tr>
<td>4 (3 sibling)</td>
<td>-2.1780</td>
<td>0.8280</td>
<td>-2.63</td>
<td>0.009</td>
</tr>
<tr>
<td>5 (more than 3)</td>
<td>-1.8929</td>
<td>0.8280</td>
<td>-2.63</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Table 7: The statistical calculation results demonstrating the effect of the time devoted to homework on the Achievement Grade.

<table>
<thead>
<tr>
<th>Time devoted to homework</th>
<th>Coef</th>
<th>SECoef</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(15-30 min.)</td>
<td>-1.8163</td>
<td>0.8802</td>
<td>-2.06</td>
<td>0.040</td>
</tr>
<tr>
<td>2(31-60 min)</td>
<td>-1.0681</td>
<td>0.5045</td>
<td>-2.12</td>
<td>0.035</td>
</tr>
<tr>
<td>3(61-90 min)</td>
<td>0.7887</td>
<td>0.5946</td>
<td>1.33</td>
<td>0.185</td>
</tr>
<tr>
<td>4(91-120 min)</td>
<td>2.0957</td>
<td>0.5946</td>
<td>-2.12</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Table 4 shows how the effect amounts of the factors that affect the achievement grade are found and provides a comparison of them.

In this calculation, due to the ongoing nature of the attitude toward homework and the attitude toward chemistry, they have been added to the model of variant analysis gender as covariant, the number of siblings and the time devoted to homework have been added as factors to the model of variant analysis (data is inadequate to do variant analysis on factorial arrangement).

According to the results of this Variant Analysis, the gender difference is insignificant with regard to the average Achievement Grade statistics, because the value in column “P”, located at the end of the table, is 0.086 and therefore greater than 0.05. All the other effects of factors are found to be statistically significant (P<0.05). As the variables of the attitude toward Homework and the attitude toward Chemistry are continuous, their effect on the Achievement Grade has been calculated as the Exponents of Partial Regression. The results of this calculation are presented in Table 5.

The meaning of these effect figures is that as the attitude toward Homework increases by 1 point, the Achievement Grade increases by 0.34937 of a point, and as the attitude toward Chemistry increases by 1 point, the Achievement Grade increases by 0.53304 of a point, and that this increase is not a coincidence. There is no gender difference in the effect figures (although the effect figure for females is 0.6589 and the male gender's is -0.6589, there is no difference between these effect figures).

Table 6 shows the statistical calculation results demonstrating the effect of the number of siblings on the Achievement Grade.

When the number of siblings is 1, the effect on Achievement Grades is 0.8832 of a point, and this effect is statistically insignificant (the value in column P is 0.296, greater than 0.05)

When the number of siblings is 2, the effect on Achievement Grades becomes 2.5623 points, and this effect is statistically significant. The value in column P is 0.000 and is smaller than 0.05. That is to say, those whose number of siblings is 2 have on average Achievement Grades higher by 2.5623 points.

When the number of siblings is 3, the effect on Achievement Grades is 0.6254 of a point and this effect is statistically insignificant (the value in column P is 0.278, greater than 0.05)

When the number of siblings is 4, the effect on Achievement Grades is -2.1780 points and this effect is statistically significant. The value in column P is 0.009 and is smaller than 0.05. That is, those whose number of siblings is 4 have on average Achievement Grades lower by 2.1780 points.

When the number of siblings is 5, the effect on Achievement Grades is -1.8929 points and this effect is statistically significant. The value in column P is 0.009 and is smaller than 0.05. That is to say, those whose number of siblings is 5 have on average Achievement Grades lower by 1.8929 points.

Table 7 shows the statistical calculation results demonstrating the effect of the time devoted to homework on the Achievement Grade.

When the time devoted to homework is 1, the effect on Achievement Grades is -1.8163 point, and this effect is statistically significant. The value in column P is 0.040 and is smaller than 0.05. That is, those whose time
devoted to homework is 1 have on average Achievement Grades lower by 1. 8163 points.

When the time devoted to homework is 2, the effect on Achievement Grades is -1. 0681 point, and this effect is statistically significant. The value in column P is 0.035 and is smaller than 0.05. That is, those whose time devoted to homework is 1 have on average Achievement Grades lower by 1.0681 points.

When the time devoted to homework is 3, the effect on Achievement Grades becomes 0.7887 of a point, and this effect is statistically insignificant (the value in column P is 0.185, greater than 0.05).

When the time devoted to homework is 4, the effect on Achievement Grades becomes 2.0957 points, and this effect is statistically significant. The value in column P is 0.035 and is smaller than 0.05. That is, those whose time devoted to homework is 4 have on average Achievement Grades higher by 2.0957 points.

**TYPE OF INTERVIEW**

Interviews were carried out to learn the views of chemistry teachers in connection with the establishment of the factors affecting student achievement in chemistry lessons. All the interviews were carried out after the application of measurement tools, and the application work carried out after asking the students questions intended to determine the socio-economic factors mentioned in this study. Furthermore, the teachers being interviewed were informed of the scale applied and questions asked to the students. The teachers being interviewed comprised 6 chemistry teachers, with a minimum of 8 years and a maximum of 19 years of experience. Out of the six teachers, four of them are female and the other two are male, and they are the teachers who teach those students in the sampling group which is the subject of the study. The criteria in the content of the study, believed to have an effect on chemistry achievement, will objectively evaluate the performance of the students, and the aim was that the students be discussed from the point of view of their teachers. The teachers being interviewed were unaware of the measurement results related to the students' attitudes, socio-economic factors and achievement. The interviews consisted of four main questions:

- What do you think about the study's criteria, believed to affect student achievement?
- Do you know whether or not your students have problems or different interests?
- Which teaching approaches do you prefer to apply in class?
- What do you think about the homework you assign?

During the interview, the teachers were free to select other points they wanted to talk about. Without doubt, attempts were made to discover the teaching approaches and methods applied in class by the teachers being interviewed, and to make connections with the results obtained from the students. Furthermore, the intention here was to discover personally the extent of the teacher's role in the factors affecting the students' chemistry achievement. For instance, if the teacher said "The main factor affecting the students' chemistry achievement is the students' interest in the lesson", then the following question would be asked: "In your opinion, what's the reason for this interest?", and finally the question "Are there any problems caused by you?" would be asked. The interviews carried out with each of the teachers lasted approximately 1-2 hours, and during the interviews brief notes were taken.

At the end of the interviews with the chemistry teachers, it was evident that:

- Course Teachers agree that the students whose attitude toward chemistry is high, the lesson achievement is high too.
- They can't always check whether or not the homework they give in lessons is completed.
- Yet they say that the questions they ask in exams are related to this assigned homework.
- Chemistry teachers state that they don't know the students' family structure, or whether or not they have special interests, and they can't store their names in their memory, but they can recognize their students when they see them.
- Teachers state that their female students show more interest in chemistry lessons than their male students.
- Teachers claim that the factors affecting achievement in chemistry lessons can be further diversified, and they express a desire for a study in which students are grouped according to their intelligence qualities, identified by applying the theory of multiple intelligence.
- They state that usually a teacher-centered learning approach is applied in class, and sometimes they make use of student-centered learning approaches.
- Regarding the achievements of the students, each teacher shares the following idea: "If the student
likes the teacher, s/he is more inquiring about the lesson and more successful in class”.

- When the six chemistry teachers criticize themselves in connection with student achievement in the lesson, they sincerely state that they suffer from the problem of not paying lesser attention to the students, they have a desire to knowing their details, but as the classes are so crowded (45-50 students) and due to the curriculum they can’t spare the time for this.

- Finally, they agree that they have a definitive role in determining the grades of achievement in chemistry lesson (The note books were prepared in such a way that the students’ pictures were included along with their names and grades). With regards to the grade that they determine as an achievement grade, they state that as well as the arithmetical average of the grades taken from mid-term examinations and term homework they add a performance grade that consists of criteria such as their situation in class, their class attendance, and their activeness during the lesson, and that performance grade and passing grades are manifest in the students’ reports as one grade higher or lower.

RESULTS AND DISCUSSION

As a result of the statistical evaluations, the difference between averages of student achievements with respect to gender was found statistically insignificant. Therefore it was concluded that the gender factor does not have an effect on achievement in chemistry lessons. A significant connection between the student’s achievement and the student’s attitudes toward chemistry homework and chemistry itself was established. If the word “homework” is defined as “the part of education which extends outside the classroom”, it is clearly observed in the study that the homework given in chemistry lessons has an important effect on the enhancement of achievement in chemistry. Along with the reinforcing quality of homework on education, its reminding effect which makes the students remember previous learning activities and its consolidating effect which merges these activities with new ones shows how indispensable homework is in the process of chemistry education. However, determining the “content of homework”, which aims at reinforcing new subjects and which must relate to previous subjects, is another issue that requires meticulous attention. It is vital for chemistry achievement that the homework given by teachers in chemistry lessons is in no way casually prepared, but prepared taking certain criteria into consideration in order to give the students positive assignments. The positive attitude of students toward chemistry affects chemistry achievement to a significant extent. In studies examining the relationship between attitudes towards chemistry and achievement in chemistry [28], it was observed that the achievement rates of students with a positive attitude toward chemistry tend to increase in proportion to their positive attitude toward chemistry. For this reason, attitude-measuring scales should be used for other lessons as well as chemistry. The reasons for the negative attitudes, if any, should be observed, the necessary steps should be taken to transform the negative attitudes into positive ones. When analyzing whether a relationship existed between chemistry achievement and the number of siblings, no significant relationship was observed between the chemistry achievements of students with no siblings and those with two siblings. However, there is a difference in the case of students with one sibling, and this difference is positive. In this case, chemistry achievements of students with one sibling increase in positively.

The sibling factor is very important in the development of children. The sibling presents itself as an important factor in the socializing of individuals and in gaining their confidence [29]. The individual with a sibling will participate harmoniously in group activities in the classroom. The individual will study harder in order to earn praise and appreciation from parents at home as well as from the teacher and their desire for success will increase [31-33]. In fact, the moderate competition between the individual and the sibling resembles that occurring in the external environment, which will lead to ultimate success [34, 35]. However, the increase in the number of siblings will cause many problems. The positive and achievement-enhancing effect of competition will be eliminated. The inappropriate study environment will affect their social life as well, and the result will be failure. In this study, no meaningful relationship was established between being the only child and achievement.

As for students with three or more siblings, a difference in their chemistry achievements was also identified. However, this difference defines negative effect. In other words, as the number of sibling increases, the rate of chemistry success decreases. In all likelihood, achievement in other lessons could be related to the number of siblings; one could conclude that similar results are valid for this kind of researches. Because the
increasing number of siblings puts a lot of responsibilities on the student’s shoulders along with creating troubles within the family order, it will redirect success towards failure [36].

When one looks to see if a meaningful difference exists between average chemistry achievements in connection with the time devoted to homework, a positive effect is observed between chemistry achievements of students who devote half an hour, an hour or two hours to their homework. When the time devoted to homework is little, there is a negative effect on achievement. It could be asserted that chemistry achievement increases positively with an increase in the time devoted to homework. This could be accepted as evidence that homework increases achievement, when prepared in certain periods and is appropriate for its purpose.

Furthermore, this study has stressed that the end-of-year grades should not consist of the average of written and oral examination grades alone. The necessity of taking into consideration certain other factors when evaluating achievement was also stated as a numerical formula established as a result of statistical calculations. After the regression analysis is conducted, the student’s achievement grade in chemistry can be determined with a 87.9% degree of accuracy even without the exam grades, when it is calculated according to 10.7 + 0.364 attitude toward homework + 0.511 attitude toward chemistry − 1.28 number of siblings + 1.66 the length of time devoted to homework.

Moreover, when the examined socio-economic criteria are processed with the coefficients acquired from the regression analysis using four operations as required by the formula above, the following result emerges: student achievement in chemistry should not be assessed and evaluated referring to the average of written and oral examination grades throughout the term or the year alone, but socio-economical factors, which are thought to have significant effects, should also be taken into consideration. A student’s attitude toward homework and chemistry should be significant criteria in the performance grade the teacher is supposed to give. As well as this, when the criteria of “number of siblings” and “the time devoted to homework” examined in the study are included in the scope of analysis, a result that can be stated in real values was produced within the framework of all the factors under discussion. In accordance with this, it is argued that the performance grade has to be considered from a broader perspective when it is considered together with the in-class observations of teachers, and that student achievement can be calculated using not only exam grades but also taking these factors into consideration. What is suggested to teachers here is to create this kind of table with the help of certain independent variables. It is believed that the result would be the serious estimation of achievement, working on these tables at certain times throughout the academic year or term. In all likelihood, the evaluations made by calculating the arithmetical average of the numeric result found here and the arithmetic average of the numeric results which are the average of oral-written examination grades are likely to be more objective and correct.

In addition, interviews with the teachers were conducted as they are a way of obtaining detailed and rich information [37-39]. Because it has been possible to grasp the nuances and highlights presented by teachers in the interviews, as well as an evaluation of factors affecting success in chemistry from the students’ point of view, the point of view from the teachers’ perspective was also obtained fairly satisfactorily. When the results of the interviews are considered, the teachers state that the students become more successful when they like the course; the teachers appreciate that they have certain shortcomings in this matter. They acknowledge that they mainly carry out teacher-centered activities in the lessons, are unable to check the homework they assign regularly, and ask homework-related questions in the examinations. In addition, they sincerely admit that they fail to show their students the requisite amount of interest and they are not adequately informed about their students individually. When certain factors affecting student success in chemistry lessons were explored, it was known that the teacher is one person with direct responsibility for student success. Teachers may reflect their positive and negative characteristics on students even though they may be unaware of this. Therefore, positively shaping teacher behaviors that are considered to affect success in lessons in line with teaching settings should be made a vital requirement. Based on the interviews, the researcher maintains that teachers should be made competent in certain methods. There is a need to enhance the communication between class teachers and parents through in-service training and activities to be arranged by schools in order to create a platform on which it would be possible to get to know the students with their all individual characteristics and to identify their abilities. This should be made the responsibility of not only teachers, but also school administration. The researcher also defends the view that the increase in success not only in chemistry but also in all other branches and the orientation of students towards
awareness will be possible only when teachers behave with an awareness that could be illustrated by the following sentence: I should not only deal with my students in connection with the teaching of my own branch but also attempt to get to know them closer and explore their abilities.

In conjunction with this, based on this study, the measurement of success in all lessons using appropriate scales and measurement methods will be more objective when these activities are supported with efficient interviews.

REFERENCES


