

*Full Length Research Paper*

## A research on high school students' concepts of "erosion" by using phenomenographic analysis

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The purpose of this research is to define and explain how high school students in Turkey perceive the concept of "erosion" by using phenomenographic research methods. The research group of the study is comprised of 450 high school students studying in 9<sup>th</sup> to 12<sup>th</sup> grades. In this research, there are some expressions gathered from students, such as "According to me, erosion means..." and "I think erosion means..." statements. After phenomenographic analysis, six different earthquake definition categories were determined. 14.2% of the high school students who contributed to the research defined erosion as a "natural disaster", 26% defined it as "erosion is loss of soil by external forces", 50.6% defined it as "erosion is landslide of soil", 4.7% defined it as "erosion is damage of soil", 2.6% defined it as "erosion is damage of nature by humans", and 1.9% said "I do not know what erosion is".

**Key words:** Erosion, high schools, geography education, phenomenography.

### INTRODUCTION

Erosion is loss of soil vegetation due to the effect of rivers, glaciers and wind (Doğanay and Sever 2011). According to Çepel (2006), erosion is "relocating of soil material with wind and water". Thomas and Goudie (2000) defined erosion as "the group of processes whereby debris or rock material is loosened or dissolved and removed from any part of the earth's surface. Also, it includes weathering, solution, corrosion and transportation. Miller (1985) stated that "erosion is the process of picking up and transporting weathered material". These weathered materials may be picked up and deposited by water, ice or wind many times in a single day, or they may lie in the same place for thousands of years before they are again moved. According to Bozkurt and Akin (2004), "If erosion occurs in the normal process of nature, it is called 'normal erosion'; but when erosion occurs as a result of disrupting the balance of nature due to human population, then it is called 'accelerated erosion'. Normal erosion is usually seen in places in which human intervention is absent and it develops very

slowly. Due to excessive grazing of pasture, soils that are less protected by the destruction of forest can easily be transported by water and erosion is accelerated. Six main processes have eroding effects, which are gravity, wind, rain, rivers, oceans and glaciers.

Erosion is the most important ecological problem in many countries. Gobin et al. (2003) noted that in Europe, about 114 million ha, or more than 17% of the total land area are affected by soil erosion, of which more than 24 million ha or approximately 4% show high or extreme degradation and nearly 70 million ha or 11% are affected by moderate degradation. Also, cultivated areas, which were once forested, are contributing to 12 million tons of sediment per year to the Tana River in central Kenya. Doğan (2011) confirmed that approximately 743 million tons of fertile land and 9 million tons of plant nutrients are lost each year from erosion around the world. As a result of misuse of land, 26% of the world's land (1,230 billion ha) is being damaged; additionally, 34.5% overgrazing, deforestation, improper agricultural activities and wrong

land use is causing the emergence of this problem. Moreover, improper agricultural techniques, as well as incorrect position process of urban, industrial and transportation investments have increased the rate of erosion. According to Montgomery (2007), soil erosion is a major environmental threat to the sustainability and productive capacity of agriculture. During the last 40 years, nearly one-third of the world's arable land has been lost by erosion and it continues to be lost at a rate of more than 10 million hectares per year. With the addition of a quarter of a million people each day, the world population's food demand is increasing at a time when per capita food productivity is beginning to decline.

As in many countries, Turkey is also affected by erosion. Ünal (2011) observed that in Turkey, erosion covers 87% of land surface; 59% of this erosion is very intense, 20% is moderately intense and 7% is slightly intense. According to expert studies, approximately 24 billion tons of soil is lost every year from agricultural areas due to erosion. So, 60 million hectares of agricultural land is lost annually. This loss places Turkey at the top of the list among many countries: annual soil loss occurring on a kilometer square area is 84 tons in Europe, 273 tons in Australia, 491 tons in America, 610 tons in Asia, 715 tons in Africa and 715.8 tons in Turkey. One of the most important effects of erosion occurs on the rivers and at dams. For example, the Fırat River has transported 73 million tons of soil, the Kızılırmak River has transported 929 tons of soil, and the Yeşilirmak River has transported 1521 tons of soil. Also, the Seyhan River has transported 563 tons of soil, the Gediz River has transported 582 tons of soil, the Menderes River has transported 519 tons of soil and the Göksu River has transported 331 tons of soil (Ceritli, 1997). As a result of the effects of erosion, yield value of the land declines, the natural balance deteriorates, and dams are filling to excess, all of which causes a reduction of the biological wealth of our country (Atalay, 1992).

Meydan et al. (2009) suggested that to prevent erosion, forestation and planting activities must be given great importance and soil must be used on a regular basis. In order to keep it from eroding, the soil should be terraced and set. Conscious agriculture, agricultural areas and forest areas must be clearly identified and must be subject to alternate grazing.

For the effective implementation of the proposed solutions to erosion, people should be informed. For this, we must first put special emphasis into education. Especially, importance should be given to education concerning erosion and students must be conscious about this subject. Even though the erosion issue is taught in secondary education programs in Turkey, students do not learn this issue sufficiently. For example, in Turkey, the Secondary Education Program mentions the concept of erosion in 10<sup>th</sup> grade classes, describing the effects of erosion in Turkey (MEB, 2010) (Table 1).

However, the program has not given adequate

importance to the erosion concept; in fact, the word 'erosion' is mentioned just once. In such, students have not learned the concept of erosion sufficiently.

## METHODOLOGY

The purpose of this research is to analyze the perceptions of students about erosion by using the phenomenographic research method. The phenomenographic method is a qualitative research method defined as "a research method for mapping the qualitatively different ways in which people experience, conceptualize, perceive and understand various aspects of, and phenomena in, the world around them." Beliefs, values, morals, culture and time determine the number, nature and boundaries of each category of description (Demirkaya, 2008). Since there is no similar study in Turkey about erosion, this study is of special importance.

In this research, the phenomenographic method was used among the qualitative research methods and includes open-ended questions. Phenomenography is one of the most effective methods used in the last thirty years in research on learning and teaching in higher education. The most preferred method of data collection for phenomenographic research is conducting face-to-face individual interviews (Demirkaya and Tomal, 2008). Aydin and Coşkun (2010) conclude that "phenomenography is a qualitative research approach that investigates qualitatively different ways in which people experience something or think about it. Phenomenographic research with face-to-face interviews, group interviews, surveys and written responses are used amidst the subjects".

This study was applied to high school students in Istanbul's city center between the 2011 and 2012 academic years. In order to reach 450 students, the survey was conducted in 10 classes. Three of these classes are 9<sup>th</sup> and 11<sup>th</sup> grade classes; four of these classes are 10<sup>th</sup> grade classes. As seen in Table 2, from 450 students, 243 students are female and 207 students are male. Percentages of girls are 54%; percentages of males are 46%.

In order to explain how high school students perceive the erosion concept, a form with open-ended questions was given to them. On this form, there are expressions like: "According to me, erosion means..." and "I think, erosion means.....". 20 min were given to answer the questions. Descriptions are expressed by students' own handwriting.

In our study, we looked for answers to these questions:

- 1) What are secondary school students' perceptions about the concept of erosion?
- 2) What is the misconception of students about erosion?

## FINDINGS AND INTERPRETATION

The data of this study was used in accordance with the phenomenographic method. Firstly, the answers were categorized according to those having the same basic meanings. As a result, the survey consists of 6 identification categories about the erosion concept. In the following, "categories of description", "student expressions", frequencies and percentages of male and female students in these categories are provided.

### Concept 1: Erosion is a natural disaster

In concept one, students defined erosion as a natural

**Table 1.** Geography education program, 10<sup>th</sup> grade.

| Attainments   | Activity examples   | Explanations   |
|---|---|--|
| C.10.6. The soil types and the factors affecting the distribution of soil in Turkey | How do we benefit from the soil? Examination of the soil examples in the class. Conducting a project regarding the use of soil. | The opinions of Atatürk regarding the importance of soil.  |
| C.10.7. The assessment of soil use in Turkey in terms of productivity               | “The voice of soil?” Short serials about soil use patterns and soil productivity in Turkey can be watched in class.             | The effect of soil erosion in Turkey should be underlined. |

**Table 2.** Gender of respondents.

| Gender | Frequency | Percentage |
|--------|-----------|------------|
| Female | 243       | 54         |
| Male   | 207       | 46         |
| Total  | 450       | 100        |

**Table 3.** The expression of the respondents about the definition, category 1.

| Definition, category 1        | Expression                    | Number of student |      |       |            |
|-------------------------------|-------------------------------|-------------------|------|-------|------------|
|                               |                               | Female            | Male | Total | Percentage |
| Erosion is a natural disaster | Erosion is a natural disaster | 25                | 27   | 52    | 11.6       |
|                               | Erosion is a natural event    | 7                 | 5    | 12    | 2.6        |
|                               | Total                         | 32                | 32   | 64    | 14.2       |

**Table 4.** The expression of the respondents about the definition, category 2.

| Definition, category 2                     | Expression   | Number of student |      |       |            |
|--|--|-------------------|------|-------|------------|
|  |  | Female            | Male | Total | Percentage |
| Erosion is loss of soil by external forces | Erosion is loss of soil                                | 22                | 11   | 33    | 7.3        |
|  | Erosion is loss of soil due to external forces         | 19                | 17   | 36    | 8.1        |
|  | It is loss of soil due to floods, rivers and rain      | 4                 | 3    | 7     | 1.6        |
|  | Erosion is loss of soil due to wind and rivers         | 6                 | 15   | 21    | 4.4        |
|  | It is loss of soil due to glaciers, water and air      | 10                | 7    | 19    | 4.2        |
|  | Erosion is loss of soil in places experiencing drought | 1                 | 1    | 2     | 0.4        |
|  | Total  | 62                | 54   | 116   | 26         |

disaster. This definition category was created by students' similar expressions (Table 3). From 450 students, 64 of them say that erosion has occurred in a natural way; half of the respondents are female.

#### Concept 2: Erosion is loss of soil by external forces

In concept two, students defined erosion as a loss of soil by external forces. From 450 students, 116 students say that erosion has occurred by external forces; 62 of them are female and 54 of them are male (Table 4).

#### Concept 3: Erosion is a landslide of soil

In concept three, students defined erosion as a landslide of soil. From 450 students, 228 students say that erosion is landslide of soil; 127 of them are female and 101 of them are male (Table 5).

#### Concept 4: Erosion is damage of soil

In concept four, students defined erosion as damage of soil. From 450 students, 21 students say that erosion is

**Table 5.** The expression of the respondents about the definition, category 3.

| Definition, category 3         | Expression  | Number of student |      |       |            |
|--------------------------------|---|-------------------|------|-------|------------|
|                                |   | Female            | Male | Total | Percentage |
| Erosion is a landslide of soil | Erosion is a landslide  | 120               | 92   | 212   | 47.1       |
|                                | Erosion is a landslide due to excessive rain                        | 5                 | 4    | 9     | 2.1        |
|                                | Erosion is a downward landslide of soil                             | 1                 | 2    | 3     | 0.6        |
|                                | Erosion is a landslide of soil due to rare vegetation in the region | 1                 | 3    | 4     | 0.8        |
|                                | Total   | 127               | 101  | 228   | 50.6       |

**Table 6.** The expression of the respondents about the definition, category 4.

| Definition category 4     | Expression   | Number of student |      |       |            |
|---------------------------|--|-------------------|------|-------|------------|
|                           |  | Female            | Male | Total | Percentage |
| Erosion is damage of soil | Erosion is cracking of soil                            | 3                 | 1    | 4     | 1.0        |
|                           | Erosion is damage and break- away of soil              | 4                 | 2    | 6     | 1.3        |
|                           | Erosion is damage of soil by rock particles            | 1                 | 1    | 2     | 0.4        |
|                           | Erosion is disappearance of soil.                      | 0                 | 1    | 1     | 0.2        |
|                           | Erosion is poverty of soil.                            | 4                 | 3    | 7     | 1.6        |
|                           | Erosion is poverty of soil due to much more irrigation | 1                 | 0    | 1     | 0.2        |
|                           | Total  | 13                | 8    | 21    | 4.7        |

damage of soil; 13 of them are female, 8 of them are male (Table 6).

### Concept 5: Erosion is damage of nature by humans

In concept five, students defined erosion as damage of nature by humans (Table 7). From 450 students, 12 students say that erosion is damage of nature by humans; 4 of them are female and 8 of them are male.

## DISCUSSION AND CONCLUSION

The results of the research show that most of the students do not know the concept of erosion sufficiently and most of them confuse the erosion concept with landslide. One of the important problems related to erosion education occurs due to students' incorrect and incomplete understanding of the erosion concept. 14.2% of the high school students who contributed the research defined erosion as a "natural disaster", 26% of them mentioned that erosion is loss of soil by external forces, 50.6% of them thought that erosion is landslide of soil, 2.6% of them said that erosion is damage of nature by humans, 4.7% of them thought that erosion is damage of soil and 1.9% of students said that they do not know what erosion is (Table 8).

According to the findings of the research, descriptions

of erosion by the high school students who participated in the survey were analyzed as 6 different qualitative descriptions of erosion. The number of students who express them is as follows:

- 1) Erosion is a natural disaster (Total=64).
- 2) Erosion loss of soil by external forces (Total=116).
- 3) Erosion is landslide of soil (Total=228).
- 4) Erosion is damage of nature by humans (Total=12).
- 5) Erosion is damage of soil (Total=21).
- 6) I don't know what erosion is (Total=9).

50.6% of the students thought that erosion is a landslide. The findings show that high school students have not mastered a complete definition of erosion. The most significant reason for this situation is that the issue of erosion is not described thoroughly in the schools. Therefore, this research is important because there is no study using the phenomenographic method about erosion in the literature. This study shows that high school students are not conscious enough about the erosion concept and in such, they have a variety of mis-conceptions.

Results of the research can be summarized, as follows:

- 1) Students have an insufficient and incorrect definition of the erosion concept.
- 2) The students confuse the concept of erosion with landslide and earthquake concepts.

**Table 7.** The expression of the respondents about the definition, category 5.

| Definition, category 5                | Expression  | Number of student |      |       |            |
|---------------------------------------|---|-------------------|------|-------|------------|
|                                       |   | Female            | Male | Total | Percentage |
| Erosion is damage of nature by humans | Erosion is damage of nature due to the cutting of trees | 2                 | 2    | 4     | 0.8        |
|                                       | Erosion is damage of nature by humans                   | 1                 | 5    | 6     | 1.3        |
|                                       | Erosion is destruction of nature by human population    | 1                 | 1    | 2     | 0.4        |
|                                       | Total   | 4                 | 8    | 12    | 2.6        |

**Table 8.** The general expressions of the students.

| Expression                                 | Number of student |      |       |            |
|--|-------------------|------|-------|------------|
|  | Female            | Male | Total | Percentage |
| Erosion is natural disaster                | 32                | 32   | 64    | 14.2       |
| Erosion is loss of soil by external forces | 62                | 54   | 116   | 26         |
| Erosion is a landslide of soil             | 127               | 101  | 228   | 50.6       |
| Erosion is damage of nature by humans      | 4                 | 8    | 12    | 2.6        |
| Erosion is damage of soil                  | 13                | 8    | 21    | 4.7        |
| I do not know what erosion is              | 5                 | 4    | 9     | 1.9        |
| Total                                      | 243               | 207  | 450   | 100        |

The following recommendations are made based on the findings of the research:

- 1) The high school students' perceptions about erosion were investigated with the phenomenographic research method.
- 2) The results from this research are comparable with other studies.
- 3) The issue of erosion, which has immense importance in the curriculum, should be more comprehensive.

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