

# Third grade elementary students' perception of science

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## **Abstract**

The current study investigated which dimensions of scientific process are capitalized on by elementary school third graders to explain the concept of science at conceptual level. The study was conducted by using "Basic Qualitative Research", one of the qualitative research approaches with the participation of 225 elementary school third graders. Totally 46 codes used by the students to explain the concept of science were formed and these codes were classified under seven themes. At the end of the study, it was concluded that the students mostly used the codes classified under the theme of scientific process to explain the concept of science. The findings of the study are believed to make some important contributions to the development of the teaching program of the Science Course to be given to elementary school third grade as of 2014-2015 school year and to the implementation of this program by eliciting the current state of students.

**Keywords:** Elementary school, Science education, Perception of science

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## **Introduction**

Science course has been taught starting from the third grade at the elementary school in Turkey, as of 2014-2015 school year. One of the objectives of the science course given at elementary level is to help students to understand how scientists construct information, the processes followed in the construction of this information and how it is used in new research attempts (MEB, 2013).

Contrary to what is told to us by discourse makers, the structure of our society has not been shaped by science, particularly by scientific thoughts and methods (Moles, 2012). This is because individuals do not capitalize on science and scientific research process as a source of information during solution generation process. This is directly associated with the education individuals are subject to about science and scientific process as of early years of childhood. In

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this connection, Özlem (2010) defined science as an activity resorted to find solutions to problems we face in our daily life. It is a desired situation for individuals to utilize science more than other sources of information in their daily lives. Therefore, great deal of research has been conducted to understand what students think about science, scientist and scientific process and how they can be educated better about these issues. It seems that the research to elicit perceptions/views/conceptions possessed in relation to science and scientist started in 1957 (Finson, 2002). Draw A-Scientist Test has been used by many researchers since it was developed by Chambers in 1983 (Losh et. al, 2008; Mason et. al, 1991; Moseley and Norris, 1999; Rubin et. al, 2003). In this research, students' perception of science were attempted to be investigated based on their drawings. The findings about children's perceptions of scientist were investigated in terms of some variables such as gender, image and stereotype. Steinke et. al, (2007) stated that there is some research showing that many social and cultural variables affect students' perceptions of scientist.

The research focusing on perceptions/views/conceptions possessed children at different age-groups in relation to science and scientist started to be conducted in Turkey in 2000 (Baldu, 2006; Güler & Akman, 2006; Kaya et. al, 2008; Kormaz & Kavak, 2010; Leblebicioğlu et. al, 2011; Nuhoğlu & Afacan, 2011; Ozgelen, 2012; Toğrol, 2000; Türkmen, 2008) As one of the sub-dimensions of the study conducted by Ozgelen (2012) is the main goal of the current study, the current study investigated the students' responses to the question "What is science?" in more detail. The findings of these two studies are compared in the discussion section of the study.

Different findings have been reported by the research focusing on the development of children's perception of science. For instance, Schibeci and Sorenson (1983) and Chambers (1983) determined that development of children's perception of science continues up to fifth grade of elementary education. On the other hand, Lee (2010) conducted a study on first and second grade students at elementary education and maintained that the development of students' perception of science continues until second grade. Students' schemes of science formed at early childhood as a result of various experiences are affected by the education they take in their pre-school and elementary school years. Altun & Demirtaş (2013) found that "Science and Scientist" teaching program administered to 6 years old children led to improvement and change in the children's perceptions of science and scientist.

In this regard, determining what third grade students understand from the concept of science and which dimensions of scientific process they draw on to explain the concept of science essential because the findings of such an attempt are believed to contribute to the development of science education given to elementary school students.

## **Method**

Research model, participants, data collection process and data analysis are discussed in this part.

### *Research Model*

The study was conducted by using "Basic Qualitative Research", one of the qualitative research approaches. Much of the research in the field of education does not focus on a specific culture or aim to construct a theory. Moreover, qualitative research in the field of education does not need to be in the form of a case study aiming to investigate a specific unit or restricted case. Researchers using qualitative research approach in the field of education are in the quest of understanding and discovering a phenomenon, process and viewpoint at the basic level (Merriam, 1998). As the purpose of the current study is to explore and

comprehend how elementary school third graders explain the concept of science at conceptual level, basic qualitative research design was employed.

#### *Participants*

In a qualitative study, participants are selected through conscious and purposeful sampling strategies known as purposeful sampling method (Yin, 2011). The purposeful sampling method is grounded on the assumption that the researcher needs to work with sampling groups from which he/she can obtain rich data in line with the purpose of discovery, understanding and gaining some intuitions. In the purposeful sampling method, first the criteria to be used in the selection of the states to be investigated or participants of the study should be determined (Merriam, 1998). The basic criterion set in the current study is that the participants should be elementary school students because elementary school students' opinions about and perceptions of the concept of science and scientific process skills are shaped by Life Science course for the first time within the context of formal and compulsory education. In this regard, it was believed that working with elementary school third graders would yield rich data about the issue on the basis of what they had learned in Life Science course.

It is known that in literature, different researchers mentioned different purposeful sampling strategies. The present study preferred typical case sampling (Yıldırım & Şimşek, 2006; Patton, 2001). Typical case sampling requires working with people, states and examples that can reflect the average state of the phenomenon under investigation (Patton, 2001). In this respect, state schools with medium socio-economic level in the city of Kütahya were considered to be the typical case and from these schools, those whose directors and classroom teachers were willing to participate were selected. The study was conducted with the participation of 225 third graders from 9 different elementary schools. Of the participants, 115 are girls and 110 are boys. The participants' academic achievements in Life Science course were also obtained; yet, as no significant difference was observed in their academic achievements, this was not used as a variable.

#### *Data Collection and Analysis*

The data of the present study were collected in the spring term of 2013-2014 academic year. For this purpose, the students were asked "What do you think what science is?" and they were requested to give their responses in written form. No limit was set for the students' responses on the paper so that they could feel more relaxed and express their opinions freely. Moreover, for the students to express their opinions without feeling the anxiety of being a participant of a study, it was thought that conducting the study in an environment which they were already accustomed to would be suitable and thus, the data were collected within the course of Life Sciences.

In the analysis of the participants' responses, content analysis was employed. Content analysis method involves the collection of similar data under certain concepts and themes and arrangement and interpretation of them in such a way as to be understood by the reader (Yıldırım & Şimşek, 2006). Cohen, Manion and Morrison (2007) define content analysis as the summarization and explanation of the messages included within the collected data. Content analysis is suitable strategy for the analysis of the verbal data collected through face-to-face interviews or wide-scale visual data collected from web sites, newspapers, journals and blogs (Schreier, 2013). As the data of the current study were collected from 225 participants, content analysis was thought to be the best means of analysis of these data due to its principle characteristics.

The stages followed in the analysis of the collected data are as follows: (1) reading the students' responses and taking notes, (2) creation of the codes based on the data and labeling of the texts, (3) conducting confirmatory activities for inter-rater agreement (4) generation of the themes on the basis of the agreed codes, (5) presentation and interpretation of the findings. Within the context of the mentioned stages of content analysis, the participants' responses were coded by the researcher; an academican specialized in the field and a classroom teacher independently from each other. Through crosswise comparisons, common codes were determined and discussions were conducted on the dissimilar codes to reach an agreement. Thus, agreement was reached on 46 codes. The codes were reclassified by the researcher under 6 themes and the relationship between the themes was modeled. At the end of the data analysis process, with the assistance of another researcher specialized on research methods, research procedure and codes were revised. As a result of this revision, total number of the themes was determined to be 7. These themes are Cognitive Dimension, Affective Dimension, Characteristic Dimension, Human Dimension, Process Dimension, Product Dimension and Scientific Fields Dimension.

### Findings

In this section, firstly general findings of the study are discussed. Then the 7 themes are explained.

The analysis of the data revealed 46 codes delineating the concept of science. These codes were classified under 7 themes by the researcher. The themes and relational illustration of these themes are as follows:

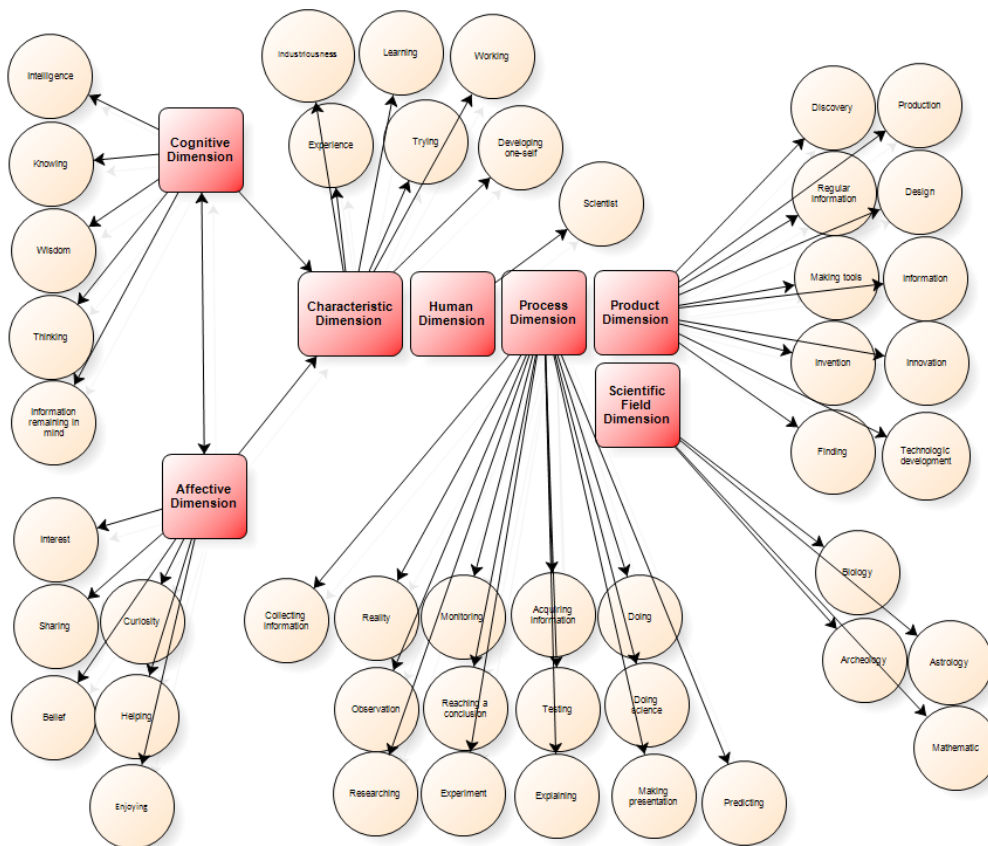


Figure 1. The Map of Themes and Codes

As can be seen in Figure 1, there are no relationships among the themes of human, process, product and scientific disciplines. On the other hand, the themes of cognitive and affective dimensions are associated with each other and effect the theme of characteristics.

*Finding 1. Cognitive Dimension*

The concepts used by the students trying to explain the concept of science over the characteristics to be possessed by a scientist were subsumed under the theme of cognitive dimensions. There are totally five codes under the theme of cognitive dimension that are wisdom, knowing, thinking, intelligence and information remaining in mind. The frequencies and percentages of these codes are presented in Table 1.

**Table 1.** *Frequencies of the codes collected under the theme of cognitive dimension*

	<b>Codes</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
<b>Cognitive dimension</b>	Wisdom	2	6.66
	Knowing	20	66.66
	Thinking	1	3.33
	Intelligence	6	20
	Information remaining in mind	1	3.33
	Total	30	100

When Table 1 is examined, it is seen that the most frequently recurring code in the theme of cognitive dimension is "knowing" ( $n=20$ , 66%) and the least frequently recurring code is "thinking" ( $n=1$ , 3%).

While some of the students defining the concept of science under the theme of cognitive dimension emphasized only cognitive dimension, some others mentioned other codes classified under the remaining six themes shown in Figure 1 in addition to those collected under the theme of cognitive dimension. For instance, some of the students emphasizing only the cognitive dimension explained the concept of science as follows;

**S36** *Science: "is learning and knowing."*

**S217** *Science: "means intelligence, wisdom."*

On the other hand, the students emphasizing the other dimensions besides the cognitive dimension defined the concept of science as follows;

**S5** *"Science means intelligence, research, experience and developing oneself."*

**S182** *"Science is the information remaining in mind, conducting experiments and making presentations."*

As can be seen above, some students adopt a uni-dimensional approach to the definition of the concept of science; some others have multi-dimensional conception of the concept.

*Finding 2. Affective Dimension*

The affective dimension includes six codes that are interest, belief, curiosity, sharing, helping and enjoying. The frequencies and percentages of these codes are presented in Table 2.

**Table 2.** Frequencies of the codes classified under the theme of affective dimension

	<b>Codes</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
<b>Affective dimension</b>	Interest	1	8.33
	Belief	2	16.66
	Curiosity	3	25
	Sharing	2	16.66
	Helping	3	25
	Enjoying	1	8.33
	<b>Total</b>	<b>12</b>	<b>100</b>

When Table 2 is examined, it is seen that the most frequently recurring code in the theme of affective dimension is "helping" ( $n=3$ , 25%) and the least frequently recurring code is "enjoying" ( $n=1$ , 8%).

All of the students defining the concept of science primarily through the codes classified under the theme of affective dimension also mentioned the codes collected under the other themes in their definitions. Some definitions provided by the students emphasizing the other dimensions besides the affective dimension are as follows.

**S56** "Science means collecting information and sharing it with other people or inventing something. For instance, Graham Bell invented the telephone."

**S24** "Science means conducting an experiment about an issue. It means feeling curious about something and then conducting research on it."

As can be seen above, the students adopting an affective approach to the definition of the concept of science seem to have multi-dimensional perception of the concept.

*Finding 3. Characteristics Dimension*

There are 6 codes involved in the characteristics dimension that are industriousness, working, trying, experience, developing one-self and learning. Frequencies and percentages of these codes are presented in Table 3.

**Table 3.** Frequencies of the codes classified under the theme of characteristics

	<b>Codes</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
<b>Characteristics dimension</b>	Industriousness	1	2.77
	Working	2	5.55
	Trying	7	19.44
	Experience	2	5.55
	Developing one-self	1	2.77
	Learning	23	63.88
	<b>Total</b>	<b>36</b>	<b>100</b>

When Table 3 is examined, it is seen that the most frequently recurring code in the theme of characteristics dimension is "learning" ( $n=23$ , 64%) and the least frequently recurring codes are "industriousness" ( $n=1$ , 3%) and "developing one-self" ( $n=1$ , 3%).

While some of the students defining the concept of science under the theme of characteristics dimension emphasized only characteristics dimension, some others also mentioned other codes classified under the remaining six themes. Some of the students focusing only on the characteristics dimension explained the concept of science as follows;

**S12** "Science means trying something."

**S83** "Science means learning something."

On the other hand, the students emphasizing the other dimensions besides the characteristics dimension defined the concept of science as follows;

**S4** "Science means trying and researching something. Science means experience to me."

**S13** "Science means collecting information about something and working on it and thus finding a solution."

As can be seen above, while some students adopt uni-dimensional approach to the conception of the concept of science, some others adopt multi-dimensional approach to it. The codes classified under the themes of cognitive dimension and affective dimension are mostly related to the cognitive and affective qualifications to be possessed by a person to do science. These two themes can be classified under the theme of characteristics or as in the current study, can be presented under a relational scheme.

*Finding 4. Human Dimension*

The concepts used by the students trying to explain the concept of science over the human dimension are classified under this theme. Under this theme, there is only one code that is "scientist"(n=15). As in the other dimensions, here, while some of the students emphasized only human dimension, some others also mentioned other codes classified under the remaining six themes. Some of the definitions proposed by the students only emphasizing the human dimension are as follows;

**S96** "Science means being a scientist."

**S99** "Science means being a professor etc."

Those putting emphasis more than one dimension;

**S183** "I think science means scientists' conducting research."

**S219** "Science is an invention or a scientist."

*Finding 5. Process Dimension*

The process dimension includes totally 14 codes that are explaining, researching, acquiring information, collecting information, doing science, monitoring, experiment, reality, observation, reaching conclusion, making presentation, predicting, testing and doing. Frequencies and percentages of these codes are presented in Table 4.

**Table 4.** Frequencies of the codes classified under the theme of process dimension

	Codes	Frequency (f)	Percentage (%)
<b>Process Dimension</b>	Explaining	1	0.94
	Researching	62	58.49
	Acquiring information	3	2.83
	Collecting information	3	2.83
	Doing science	3	2.83
	Monitoring	1	0.94
	Experiment	20	18.86
	Reality	1	0.94
	Observation	2	1.88
	Reaching a conclusion	1	0.94
	Making presentation	1	0.94
	Predicting	2	1.88
	Testing	1	0.94
	Doing	5	4.71
<b>TOTAL</b>	<b>106</b>	<b>100</b>	

When Table 4 is examined, it is seen that the most frequently recurring codes in the theme of process dimension is "researching" ( $n=62, 58\%$ ) and "experiment" ( $n=20, 19\%$ ) and the least frequently recurring codes are "explaining" ( $n=1, 0.94\%$ ), "monitoring" ( $n=1, 0.94\%$ ), "reality" ( $n=1, 0.94\%$ ), "reaching a conclusion" ( $n=1, 0.94\%$ ), "making presentation" ( $n=1, 0.94\%$ ) and "testing" ( $n=1, 0.94\%$ ).

The fifth finding is different from the other findings in terms of two aspects. First, it is seen that there are more codes derived from the analysis of the statements of the students defining the concept of science under the process dimension. The second, the terms used by the students in explaining the concept of science is the indicators of some of the scientific process skills to be acquired by these students (making observation, making prediction, classifying and measuring) during their elementary education.

For instance;

**S32** "Science means knowing what will happen today or tomorrow."

**S120** "Science means making observations."

The students making references to the codes classified under the other themes besides the theme of process dimension defined the concept of science as follows;

**S31** "Science means wondering about something and then researching and discovering it. It means finding and inventing something."

**S182** "Science is the information remaining in mind and conducting experiment and making presentation."

#### Finding 6. Product Dimension

The statements of students including the codes such as discovery, invention, information and production in the explanation of the concept of science are collected under the theme of "product". There are totally 10 codes under this theme that are making tools, information, finding, regular information, invention, discovery, design, technologic development, production and innovation. Frequencies and percentages of these codes are presented in Table 5.

**Table 5.** Frequencies of the codes classified under the theme of product dimension

	<b>Codes</b>	<b>Frequency (f)</b>	<b>Coverage (%)</b>
	Making tools	2	1.86
	Information	14	13.08
	Finding	37	34.57
	Regular information	3	2.80
	Invention	32	29.90
<b>Product Dimension</b>	Discovery	6	5.60
	Design	2	1.86
	Technologic development	2	1.86
	Production	7	6.54
	Innovation	2	1.86
	<b>TOTAL</b>	<b>107</b>	<b>100</b>

When Table 5 is examined, it is seen that the most frequently recurring codes in the theme of product dimension is "finding" ( $n=37, 35\%$ ) and "invention" ( $n=32, 30\%$ ) and the least frequently recurring codes are "making tools" ( $n=2, 2\%$ ), "design" ( $n=2, 2\%$ ), "technologic



development" ( $n=2$ , 2%) and "innovation" ( $n=2$ , 2%). Here, it is seen that the students try to explain the concept of science on the basis of the products to be created by science. The distribution of the codes gathered under the theme of product is given in Table 5. As can be seen in the table above, given the cognitive development level of the students, it is a remarkable finding that the students try to explain the concept of science by using the codes such as technology and design as well as the codes such as discovery, invention and finding that can be used interchangeably. The codes collected under this theme are used individually and/or together with the codes from other themes to explain the concept of science.

Some definitions based on the single theme are as follows;

**S133** "Science means making tools."

**S18** "Science means designing something."

Some definitions made through references to more than one theme are as follows;

**S3** "Science means discovering and presenting this discovery to others."

**S169** "Science is information, learning, researching and working."

#### *Finding 7. Scientific Field Dimension*

Finally, the disciplines capitalized on by the students to explain the concept of science such as biology, astronomy and mathematics are collected under the theme of scientific field dimension. The codes collected under this theme were stated by two students. Thus, frequencies and percentages of the codes collected under the theme of scientific field dimension are not presented. These two students defined the science as follows;

**S53** "Science includes disciplines such as astrology, archeology and biology."

**S55** "Science is done through mathematical inventions."

When the definition of S53 is considered, it is seen that the student defines astrology as a science. This shows that the student has a conceptual fallacy about the concept of science. Though this is a conceptual fallacy, given the age group of the students, it is still important for them to try to define the concept of science on the basis of disciplines.

#### **Discussion**

In light of the data of the current study, the codes driven from the statements used by the students to explain the concept of science were subsumed under 7 themes. This is believed to result from the students' attempts to explain the concept of science from different viewpoints. Türkmen (2007), Chambers (1983), Barman (1999), Finson (2002), Solomon, Scott and Duveen (1996), Newton and Newton (1992) conducted studies on children from different age groups focusing on their perceptions of scientist. They tried to analyze the students' perception of scientist based on their drawings and statements. In these studies, the children's perceptions of scientist were classified according to ethnic origin, race, gender and clothing. In the current study; on the other hand, it is seen that the students trying to explain the concept of science on the basis of the scientist both used the term "science man" and "science human". However, as the main focus of the current study is to determine the students' perceptions of and opinions about the concept of science, the statements used to define the scientist were not examined in terms of gender and other variables.

Güler and Akman (2006) maintained that the basic factor leading children aged 6 to the discovery of the concept of science is curiosity and effort to understand their environment. In the same study, the children tried to define science through the codes of researching and investigating and this concurs with the findings of the current study. Thus, it can be argued

that both pre-school children and elementary school students mostly try to explain the concept of science on the basis of the process dimension of science. This shows that the third grade elementary school students' perception of science starts to shape during pre-school years.

The current study demonstrates some similarities to the study by Ozgelen (2012) in terms of the study group and the question asked "What is science?" In both of the studies, the students' responses to the question "What is science?" include similar codes. Yet, Ozgelen collected the codes related to each other under the heading of KIDS. The other codes are similar to the codes of discovery, finding, information, technology and curiosity gathered under the themes of "product" and "affective" dimensions of the current study. Due to the nature of qualitative research, the codes were classified under different themes in these two studies.

The codes used by the sixth, seventh and eighth graders students to define "scientist" in the study by Kaya et al. (2013) overlap with the statements of the students explaining the concept of science through the codes classified under the theme of "characteristics" and its related themes of "cognitive and affective dimensions" in the present study. Given that the study group of the current research consists of third grade students, it is notable that their statements are similar to those of sixth, seventh and eighth graders. The reason for this similarity seems to support the study conducted by Lee (2010) because as mentioned above, Lee (2010) reported that the development of children's perception of science continues up to the second grade at elementary education. This also reveals that factors such as pre-school education, media and family are influential on the formation of children's perception of science.

## **Results**

Classification of the codes used by the students to define the concept of science under 7 different themes is of great importance given the cognitive development of the children. Though the frequencies of some codes are notably higher than those of others, wide variety of the codes used in the current study to explain the concept of science is quite promising. Since 2014-2015 school-year, science course has been taught as of elementary school third grade. In this connection, an important finding of the current study is that the students try to explain the concept of science over scientific process skills and the codes subsumed under the theme of scientific process considering that one of the objectives of science teaching is to impart inquiry skills to students.

## **Implication**

Future research to deal with children's perceptions/views/conceptions of science may focus on variables such as the socio-economic and socio-cultural backgrounds of students, education level of their parents, media and pre-school education. Moreover, integration of pre-school education program with elementary school program can make great contributions to the understanding of the concept of science by children.



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