British Journal of Education, Society & Behavioural Science
17(4): 1-9, 2016, Article no.BJESBS.27017
ISSN: 2278-0998

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Analysis of the Perceptions of Gifted Students on Scientist Concept through Metaphors

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJESBS/2016/27017
Editor(s):
(1) Vlasta Hus, Department of Elementary Teacher Education, University of Maribor, Slovenia.
Reviewers:
(1) S. Deniz korkmaz, Eskişehir Osmangazi University, Turkey.
(2) Elif Esra Arikan, Sabahattin Zaim University,Turkey.
(3) Bobby Jeanpierre, University of Central Florida, USA.
Complete Peer review History: http://www.sciencedomain.org/review-history/15935

Original Research Article

Received 16th May 2016
Accepted 11th August 2016
Published 26th August 2016

ABSTRACT

The purpose of this study is to determine the gifted students' perceptions about "scientist" analysis through metaphors. The sample of the study was composed of 56 gifted students that were registered to Erzurum Remzi Sakaoğlu Science and art center. The data were collected by means of the students' completion of the statement "Science man is like/resembles ……. because ……". In this research phenomenological research design was used and the data were analyzed by means of content analysis. According to results, the students mentioned 41 metaphors. Developed metaphors were reviewed under 6 different categories which were: "with respect to their necessity", "with respect to their hardworking", "with respect to their usefulness", "with respect to producer", "in respect to source of variety" and "in respect to intelligence individual". According to survey results: in general it can be said that; gifted students have positive perspectives about science man and have generated the most metaphor about in respect to intelligence individual categorie.

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Keywords: Science education; gifted students; scientist; metaphors; gifted students' perceptions.

1. INTRODUCTION

Gifted individuals are the people that have a wide area of interest, and can produce original and creative ideas with a different viewpoint on the problems given to them [1]. Training and educating these individuals in accordance with their talents means raising the individuals who will ensure that the country progresses both in art and in science fields in the future [2], and who will ensure that the problems of modern societies are solved [3].

Traditional science curriculum has little effect on the skills of students thinking like a scientist and problem solving skills [4]. According to the new science curriculum that is revised, students' feeling like a scientist and following their footsteps are the most important elements in providing an efficient science education. The viewpoints of gifted students, whom we are trying to guide and want to specialize, and their interest in the scientists and their way of dealing with science are influential in their choosing careers in the future [5], and in being role models for the successive gifted students that will follow [6]. Therefore, it is extremely important to determine the perceptions and perceptional properties of gifted students on scientists. For this reason, in order to reveal these perceptions of gifted students, making use of metaphors is considered as a functional approach.

Metaphor means using a word instead of another one by isolating it from its original meaning (basic or second meanings) [7]. Metaphors are associated with different terms in different sources and in different sciences. Generally, metaphor has a wide usage in social sciences; and used to mean analogy in Sociology and Philosophy; figure of speech, simile, and borrowing, figure in Literature and Linguistics; and simulation in Educational Sciences. However, none of these can explain metaphoric thinking exactly [8]. Because, for example, according to [9], figure of speech or figure miss the meaning of metaphor. "Figure of speech", figuring means taking something temporarily and eliminates the real meaning of the word and gives another meaning which is similar, "Figuring" means loan or borrowing [9]. Metaphor, on the other hand, does not mean borrowing for a temporary time period, just the opposite, it stays permanently and shows continuity [10]. For this reason, it is observed that the term "metaphor", which comes form the Greek word "*metaphereinor metaphor*" [11], is preferably used to mean metaphor, i.e. figure of speech, directly [8].

Metaphor was developed for the first time in 1980 in the work of Lakoff and Johnson "Metaphors We Live By" [12]. According to [13], metaphor means understanding and experiencing something according to something other. In addition, metaphor is a trick of poetical imagination and rhetoric show for many people, and not a problem of usual/daily language but a problem of extraordinary language. By discovering that metaphor is not only common in language but also in thoughts and actions in daily lives, it is possible to claim that a great deal of daily concept system is metaphorical on a basis of linguistics [13]. Metaphors are not only a verbal art that is intended to ornament the everyday language of ours [14], but it must also be assessed as a powerful mental model that enables individuals to ground their worlds [15].

Metaphors are used in explaining the situations, concepts and terminology that are not well-known or are less-known. They are especially beneficial in understanding and expressing a new phenomenon [16]. In this way, metaphors may be used as an attempt to express something that has a complex structure by simulating it to a well-known object or concept [17]. Altun (2003), emphasizes that there must be three properties in a metaphor:

- The word must be used in a meaning that is out of the real meaning of it
- The aim must be simulating
- There must be a situation hindering the use of the real meaning of the word (narrated by [18]).

There is a close relation between human beings and science, which dates as back as the human history [19]. Scientists are defined as the people who produce regular information by using scientific methods, and this concept does not date back very much. The scientist who fist used this concept was William Whewell who was the physicist of 2830s. This famous physicist thought that if people who dealt with art were called as 'artists', those who dealt with science should be called as 'scientists', and proposed this at a meeting (Snow, 2001; narrat. by [20]).The concept of scientists is based on science. The

scientist concept has been translated into English language as 'science-dealer'. Raising individuals who can establish connections between daily life and science subjects, and who can use scientific methods in solving problems encountered in every field of life, and who can view the world with the viewpoint of a scientists are the major aims of modern science education [21].

In recent years, metaphors have been used in many studies to understand the viewpoints of teachers and students on various subjects [22-23-24-16-25-26]. It has been observed in the literature that metaphoric studies have been conducted on gifted students in the literature; however, the perceptions of gifted students on scientists have not been examined [27-28]. The purpose of this study is seeking answers for the following study statements.

1. What are the metaphors on 'scientists' produced by gifted students?
2. Under which conceptual categories can the metaphors that are produced by gifted students on 'scientists' be collected?

2. METHODOLOGY

2.1 Method of the Study

The study was designed with phenomenology, which is one of the qualitative research approaches. Phenomenology studies, generally define the mutual meaning of the individual experiences of people on a phenomenon or a concept [29].The perceptions of gifted students about scientists based on their individual experiences, and interpretations have been made.

2.2 The Study Group

The Study Group consisted of 56 students who were studying at Erzurum RemziSakaoglu Science and Art Center. The students were selected with Convenient Sampling Method. Convenient Sampling is the method in which the author of the study reaches the easiest elements to form the sampling from the target universe [30]. In order to keep the identities of the students at the study group, the metaphors produced by the students were listed in alphabetical order, and the students were given codes like S1, S2, S3, S4 …… S55, S56. The gender and grade distribution of the students are given in Table 1.

Table 1. Information of the participants' grade and gender

Grade level	Boy	Girl
5. Grade	17	11
6. Grade	8	2
7. Grade	6	1
8. Grade	8	3
Total	**39**	**17**

2.3 Data Collection Tool

The data of the study were collected via forms that were prepared for the students. The forms were applied in classes by the teachers. In the first part of these forms, the parts where the students would write their genders, school types, and grades were given. At the beginning of the second part, there was an explanation on metaphor (liken a scientist to an object, emotion, concept, animal, plant, person, profession, phrase, reduplication, i.e. to an original or ordinary thing, and explain the reason). In the following part, the students were asked to complete the statement "A scientist is/is like … because …" in order to reveal the perceptions of the students on scientist.

2.4 The Analysis of the Data

The process that has to be followed in phenomenological studies is as follows (Downing, 2007; Narrat. by [31]):

2.4.1 Definition

In phenomenological studies, the first thing to do in the analysis process of the data is defining the phenomena. We can obtain these definitions via interview with the participants of via written forms.

2.4.2 Determination

After the definitions are made, this stage is the one where categories are determined according to their importance levels. Special attention must be paid that the coverage of the category must be different.

2.4.3 Definition of the noeticandnoematic relations

This stage is the one where the relation between the Noematic, which is an objective expression, and the Noetic, which is subjective, is revealed. The assessment of the relation between these

plays an important role in expressing the experience.

2.4.4 Hypothesizing the bases (Cores)

The basis or the core is defined as the thing that makes experience what it is. The stage of hypothesizing of the bases is the universalization of the noetic and noematic relations. The aim in this stage is not homogenizing the results, but presenting different experiences about meaning (source).

The Content Analysis Technique was made use of to analyze the data collected in this study. First of all, the metaphors about scientists were listed temporarily in alphabetical order according to the first letter of the metaphor. The forms that did not produce valid metaphors or the ones that had empty explanation parts were eliminated. Then, the valid metaphors were re-examined, and were listed in alphabetical order according to the frequency values in the tables starting from the highest declining to the lowest level. The metaphors that were developed by the students were grouped according to the similarities by considering the explanations. Noetic and noematic relations were determined, and the categories were reviewed. The metaphors about scientists were collected under 6 categories. The reason of each category was explained separately while the categories were analyzed.

2.5 Validity and Reliability

Validity on phenomenological studies may be defined as the justifications being accurate and creditable [32], the method and the results of the study being clear and full; and the reliability of a phenomenological study may be defined as the same data being assessed by different authors and then comparison of the result [33]. In phenomenological studies the following precautions may be taken in order to increase the validity and the reliability in the results (Ashworth, 1996; Hycner, 1985; Knaack, 1984; Priest, 2002; Narrat. by [30].):

- **Epoche:** The meaning of the word is 'blocking' or 'suspending'. It requires that the author leaves all experiences, perceptions, emotions and thoughts about the phenomenon aside and then perform the study.
- **Spending too much time on the data collected:** The data must be read again and again and one step must be taken forward and one step must be taken backwards. By doing so, the reliability of the study will also increase.
- **Receiving feedback from the participants:** When necessary, the parts that are unclear or ambiguous may be shown to the participant and asked whether they are understood clearly or not, and the parts that s/he wants to add or omit may be defined.
- **Receiving information from another author:** Another author may be asked to review the data and form categories. His/her findings and the themes that are found by the author of the current study may be compared.
- **Using the expressions of the participants as they are word-to-word:** Using the statements of the participants as they are will increase the reliability when they are used side by side with the comments of the author.
- **Checking the notes and voice recordings:** The notes taken and the voice recordings being accurate is extremely important.
- **The studies being auditable:** The study must be auditable by third parties.

In order to ensure the validity and reliability of this study, the abovementioned items were applied, and the data collection and analysis processes were explained in detail, the metaphors were listed, and the explanations of the students on metaphor were quoted directly to ensure validity. In order to receive information from another author to ensure reliability, a specialist was consulted to determine whether the metaphors listed in categories or in the themes were in accordance with the categories or not. The specialist was asked to place the metaphors to categories, and then the matching were compared by two authors and one specialist. The reliability of the study was measured by using the Reliability=Consensus/(Consensus+Divergence) Formula of [34]. 92% consensus was ensured in the study. The consensus in qualitative studies being 70% is considered as being adequate in terms of ensuring the reliability of the study.

3. RESULTS AND DISCUSSION

It was observed that 56 gifted students who participated in the study produced 41 metaphors

on scientists. The metaphors were collected under 6 different categories as follows; "The scientist as the source of needs", "The scientist as the industrious one", "The scientist as the provider of benefits", "The scientist as the manufacturer", "The scientist as the source of variety", and "The scientist as the intelligent entity".

The metaphors and their frequencies that were categorized under the "The scientist as the source of needs", by the gifted students are given in Table 2:

Table 2. The scientist as the source of needs' category

Metaphors	F	%
Tree	2	3,57
Sun	2	3,57
Water	2	3,57
Soil	1	1,78
Total	**7**	**12,5**

It is observed in Table 2 that 12,5% of the gifted students used the metaphors that emphasized a scientists with metaphors like "*need, necessity*". About the tree metaphor, S2 said "*A scientist is like a tree, because s/he starts to grow with a small seed and develops by watering. And produces oxygen, just like science. Without oxygen, humans cannot live.*"S49 said about the *water* metaphor "*A scientist is like water, because s/he is transparent and cleans everywhere it passes. Humans cannot live without water. Everybody (mainly me) need it. Without scientists, life stops.*" S27 used the Sun metaphor and said "*A scientist is like the Sun; because it is not possible to live in the world without the Sun. similarly, it is not possible to live in the world without the discoveries of the scientists. Even the writing and fire were found by then-present scientists.*" The perceptions of 7 of the students are based on necessity. For this reason, it is considered that expressing scientist as the necessity source.

The metaphors and their frequencies that were categorized under the ""The scientist as the industrious one", by the gifted students are given in Table 3.

It is observed in Table 3 that about 20% of the gifted students used the metaphor "*industrious*" about scientists. In other words, 20% of the gifted students have a perception like being '*industrious'* about scientists.

Table 3. The scientist as the industrious one's category

Metaphors	F	%
Perseverance	1	1,78
Baby	1	1,78
I/Me	3	5,35
Brain	3	5,35
Ant	1	1,78
Marie Curie	1	1,78
Robot	1	1,78
Total	**11**	**19,64**

The most prominent metaphor here is the "*me*". As an example to this, the statement of S12 may be given: "*Scientist is like me, because I am determined, patient and industrious. I always study.*" S7 said "*A scientist is like determination, because all scientists did their inventions by working hard, without giving up and by working with determination. When someone says 'scientist', I say 'determination'. They became scientists by working, determination, using their minds. They exist with these feelings.* "Here, it was considered that the '*determination'* metaphor was associated with the quality of being industrious of a scientist. Three students stated that the brain worked constantly and associated scientists with "*brain*" metaphor.

The metaphors and their frequencies that were categorized under the "The scientist as the provider of benefits", by the gifted students are given in Table 4.

Table 4. The scientist as the provider of benefits' category

Metaphors	F	%
Bee	1	1,78
Invention	1	1,78
Plane	1	1,78
North Star	1	1,78
Matter	1	1,78
Candle	2	3,57
Yandex	2	3,57
Total	**9**	**16,07**

It is observed in Table 4 that about 16% of the gifted students used the metaphor "*provider of benefits*" about scientists. The students have the idea that scientists are beneficial. S35 used the "*The North Star*" about scientists, and said "*A scientist is like the North Star, because it guides humans, and just like this, scientists also guide humans.*" One of the students likened scientists to *Yandex*, and said

that "*Yandex*" did great things; however, were not well-known at an adequate level, and likewise, scientists also did many great things; but were not well-known. As it is observed, it is understood from these statements that students have a strong perception about scientists being '*useful*'.

The metaphors and their frequencies that were categorized under the "The scientist as the manufacturer", by the gifted students are given in Table 5.

Table 5. The scientist as the manufacturer's category

Metaphors	F	%
Astronaut	2	3,57
Indefiniteness	1	1,78
Factory	1	1,78
Dough	1	1,78
Chemical Bond	1	1,78
Machine	1	1,78
Total	**7**	**12,5**

It is observed in Table 5 that about 12,5% of the gifted students used the metaphor "*manufacturer*" about scientists. The students who produced these metaphors perceived scientists as productive and innovative. Some of the metaphors in this category and the reasons are expressed as follows by the students: S5 said "*A scientist is like an astronaut, because a scientist always discovers new things in an infinity universe like science.*" S34 said "*A scientist is like a chemical bond, because s/he can consider the substances with a different viewpoint in every different situation. They can connect to different substances like chemical bonds and produce new things.*" S10 said "*A scientist is like indefiniteness, because scientists are people who always produce new unknown things.*"

The metaphors and their frequencies that were categorized under the "The scientist as the source of variety", by the gifted students are given in Table 6.

It is observed in Table 6 that about 12,5% of the gifted students used the metaphor "*variety*" about scientists. Two of the students likened scientists to a piano. S46, who used the piano metaphor said "*A scientist is like a piano, because s/he gives a different tone in each strike. A scientist has always a way of thinking.*" S43 used the ocean metaphor and explained this by saying "*They are open to any kind of ideas.*" S44 used the "*window*" metaphor and said "*A scientist is like a window, because the sun's rays can enter inside as long as there are no obstacles. A scientist will also collect information as much as s/he is hungry. If you do not draw the curtains to the sun's rays, you will have all kinds of light inside.*" As it is observed, the students have perceptions like a scientist is open to any kind of viewpoints and is open-minded.

Table 6. The scientist as the source of variety's category

Metaphors	F	%
Memory Cube	1	1,78
Violin	1	1,78
Ocean	1	1,78
Window	1	1,78
Piano	2	3,57
Hyaena	1	1,78
Total	**7**	**12,5**

The metaphors and their frequencies that were categorized under the "The scientist as the intelligent entity", by the gifted students are given in Table 7.

Table 7. The scientist as the ıntelligent entity's category

Metaphors	F	%
Owl	1	1,78
Computer	2	3,57
Genius	1	1,78
Thinker	1	1,78
Einstein	2	3,57
Human	2	3,57
Ski	1	1,78
Monkey	1	1,78
Mozart	1	1,78
Brainbox	2	3,57
Intelligent	1	1,78
Total	**15**	**26,7**

It is observed in Table 7 that about 27% of the gifted students used the metaphor "*intelligence*" about scientists. It is observed here that the students associated scientists with intelligence mostly. S8, who is one of the gifted students, said "*Scientists are like owls, because they are very intelligent. It is the owl that is the most intelligent animal in tales.*" S54 used the metaphor "*Brainbox*", and said "*Scientists have made so many discoveries, theories etc. that their minds are always full of theories and discoveries*" to justify his/her metaphor.

4. CONCLUSION

Important findings were obtained in this study which aimed to determine the perceptions of the gifted students on scientists. When the findings were examined in general terms, it is possible to claim that the gifted students generally have positive perceptions about scientists. The most interesting finding of the study is that the gifted students perceive scientists as human beings with the highest intelligence levels, and perceived them as the source of needs and producers at the least level. Among the metaphors, the one "A scientist is like me" is extremely important in that it shows that the gifted students consider them as scientists in the future. On the other hand, the gifted students considering scientists as the humans with the highest intelligence levels shows that they consider themselves as scientists. Because gifted students are also referred to as 'the students with high intelligence level' in the literature.

One of the most frequently used metaphors by the gifted students is the simulation of scientists to "*humans*". When metaphoric explanations on this are examined it is understood that they are referring to "*humans*" as the "*people whose humanity has developed*". Because in the relevant metaphor, the students describe the humans as provider of benefits. They stated that scientists justified being scientists by performing beneficial deeds for humanity. Another frequently-used metaphor is the *piano*. In this metaphor, it was stated that scientists had different ideas and were open for new ideas just like a piano having many different sounds.

The gifted students producing different metaphors about scientists is the indicator of their thinking differently according to their peers [35-36]. For example, their using different metaphors like Mozart, Yandex and North Star about their metaphors for scientists is the indicator of their high metacognitive level.

This study may be made use of by authors or teachers who want to reveal what the participants think on a specific phenomenon. It also provides benefit for those who want to learn and collect information on what students think by using metaphors especially in Science and Art Centers and in other private sector institutions. Results may be written on the fields, subjects and people from the analyses. In addition, it will also be beneficial to write some recommendations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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The peer review history for this paper can be accessed here:
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