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Metaphors of 4th Grade Students about Organs

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Abstract

The aim of this research is to determine metaphors of 4th grade students about some of the organs which they come across in science courses. The research's sample consisted of a total of 215 students (108 girls and 107 boys) whom are 4th grade student and studies at Afyonkarahisar city center. In order to determine students' ideas about organs in circulatory and respiratory systems, according to expert opinions a data collection tool which had 7 questions has been developed and has been used. The data collection tool contains concepts which have been taught in science courses. Concepts have been chosen by considering Ministry of Education's primary school Science courses' units and limitations. Tool has been used after a pre study which has carried out with a group of 30 students. In order to define students' ideas about organs, it is asked to all of the students to complete sentences like "Hearth looks like, because", "Blood looks like, because" . The students were asked to write their thoughts by concentrating on the organs which were on the questionnaire page. Students' answers were the main source of this research. As a result of this research, it can be observed that students use a lot of metaphors about organs. Students formed metaphors about organs' shapes, dimensions and actions. Also metaphors about organs functions and colors were also determined. The developed metaphors were generally concrete and positive.

Keywords: organs, metaphor, student, science course

INTRODUCTION

The goal of basic education science courses is to improve students' skills to make sense of themselves and of their immediate environment and to account for them. The content of the course covers such topics as living world, the natural environment and the interaction between human and environment (Meriç & Ersoy, 2007). It is stated that one of the major goals of science course is to improve learners' skills to observe the natural environment. Another major goal is to produce individuals who can keep up with the changing science age and to employ technological inventions in all domains and to teach them the necessity of science in all inventions and discoveries (Hançer et al., 2003). The common topic searched for in the studies on science education has been how students learn science and which supports they employ in learning environment in this process. It is frequently stated that new understanding is needed in science education in terms of learning, teaching, learning

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environment and teaching strategies (Board of Education, 2004). It is commonly argued that teaching strategies and learning experience of students should be based on constructivist approach in order to make students to gain desired behaviours. One of such teaching strategies is the use of metaphors, which can be employed to relate prior knowledge of students with newly learned topics (Kesercioğlu et al., 2004). It is argued that analogies, metaphors and physical models are useful and effective tools in producing information as meaningful wholes in student mind (Asoko & deBoo, 2001). Metaphors are one of the cognitive mechanisms which individuals use to make inferences and to learn new concepts. Metaphors play a significant role in learning and improving the cognitive concepts. In addition, metaphors are very strong learning and teaching tools (Küçükturan, 2003).

Purpose of the Study

This study aims at identifying the metaphors developed the fourth grade students about organs that are covered in the science course. Based on the findings it can be understood how these students perceive organs and the potential problems about the concept teaching can be uncovered. In concept teaching proper teaching materials should be used and necessary analogies should be employed.

METHOD

The participants of the study designed as a scanning research were 215 fourth grade students attending a public basic education school in downtown Afyonkarahisar. Of the participants 108 were girls and 107 boys. The data of the study were collected through the use of a survey questionnaire, which included statements about seven different concepts. The statements were designed to reveal the metaphors about respiratory and circulatory system. The statements were organized as follows: “Heart is like, because.....”, “Lung is like, because.....”.

The data analysis was carried out at four steps. During the data analysis the first step was to list the metaphors produced by the participants. Those metaphors, which were not related to respiratory and circulatory system, were excluded. The second step was elimination and revision. At this step the metaphors produced by the students were revised and each metaphor was analysed in terms of the topic of the metaphor, the source of the metaphor and the relationship between the topic of the metaphor and the source of the metaphor. Then the similar metaphors were grouped.

The third step was the development of categories. At this step the metaphors identified were categorized in terms of the relationship between the topic of the metaphor and the source of the metaphor. Each category covered those metaphors with similar characteristics and explanations.

The last category of the data analysis was the establishment of reliability and validity. For this step the collection and analysis of data were given in detail. The direct quotations were also used in the discussion of findings.

The data were analysed used the descriptive statistics and content analysis. First the metaphors were coded and than listed. The findings are given tables.



RESULTS

Table 1: Metaphors related to heart concept developed by the students

Heart			
<i>Categories</i>	<i>Metaphors</i>	<i>Frequencies of Metaphors</i>	<i>Number of Metaphors</i>
<i>1) Analogies Regarding the Shape</i>	Balloon (13), apples (11), punch (8), ball (6), strawberry (4), grenades (3), pears (2), toy world (2), apartments (2), pomegranate (2) eggs (1), hands to heart (1) bags (1), walnuts (1), shotten ball (1), leaf (1), tucked into a round ball and pipe (1), basketball (1), figure (1), tomato (1), round the clock (1), schools lamp (1), a triangle (1) head (1), heart (1)	68	25
<i>2) Analogies Regarding the Color</i>	Red (4), flags (1)	5	2
<i>3) Analogies Regarding the Shape-Color</i>	Red quilt (1), red balloons (1)	2	2
<i>4) Analogies Regarding the Functionality</i>	Pump (66), clock (24), engine (2), bees (2), machinery (2), blood pumping (2), the communication pipe (1), hard-working students (1), the computer charge (1), cycling pump (1), dam (1), blood pressure meter (1), drums (1), water pump (1), firmly sonorous toys (1), vibration (1) hour of sound (1), bomb -hour period (1), door renovation (1)	111	19
<i>5) Others</i>	Bananas (2), between two fingers (1), rubber (1) month (1) fields (1), liver (1), shoes (1), yesterday (1) Ataturk (1), cotton (1), dad (1)	12	11

Table 1 shows that the participants produced a total of 59 metaphors.

It was found that the common metaphors related to the concept of heart were in the categories of function ($f=111$) and shape ($f= 68$). These common metaphors about heart were found to be pump, clock, balloons and apples.

The heart-related pump metaphors are exemplified by the following statements of the students: «Heart is like a pump, because it pumps blood to our body.», « Heart is like a pump, because it stores blood. ».

The heart-related clock metaphors are exemplified by the following statements of the students: «Heart is like a clock, because it sounds like a clock.», « Heart is like a clock, because it beats tick tock like a clock.».

The heart-related balloon metaphors are exemplified by the following statements of the students: «Heart is like a balloon, because it is soft and it swells and falls. », « Heart is like a balloon, because there are balloons in the shape of hearts.».

The heart-related apple metaphors are exemplified by the following statements of the students: «Heart is like an apple, because its shape is like an apple».

Table 2: Metaphors related to vesselconcept developed by the students

Vessels			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1) Analogies Regarding the Shape	Rope (48), snake (6), means (6), item (5), line (3), wood (2), the cable (2), pasta (2), broom (1), the wire (1), volleyball net (1), flute (1) nib (1), neck (1), rubber (1), wool (1), a number (1) caterpillar (1), leaf (1) long bar (1), roller (1), worms (1), hair (1), small intestine (1), wolves (1), the cylinder (1), lamppost (1) intra- hand (1)	94	28
2)Analogies Regarding the Color	Dye (2), color (3), yellow (1)	6	3
3) Analogies Regarding the Functionality	Pipe (51), hose (16), the pipette (4), the heating pipe (2), the gas pipe (1), the bridge (1) sewer pipe (1), trachea (1)	77	8
4) Others	Iron (1), the board (1), the balloon (1) blood (1), the sponge (1) a thin (1), the driver (1), waste 1	8	8

Table 2 shows that the most frequent category is the shape category in terms of both frequency and the number of metaphors. On the other hand, the category of function was found to have high frequency, but the number was low.

In the category of shape, the most frequent metaphors were about the concepts of pipe, rope and hose.

The example statement for the metaphors about the concept of pipe is as follows: «Vessels are like a pipe, because they are cylinder like pipes».

The example statement for the metaphors about the concept of rope is as follows: «Vessels are like a rope, because they are thin and long like ropes».

The example statement for the metaphors about the concept of hose is as follows: «Vessels are like a hose, because blood passes through vessels and water passes through hose».

Table 3: Metaphors related to blood concept developed by the students

Blood			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1) Analogies Regarding the Shape	Liquid (3), the liquid beverage (2), sea (1), oil (1), river (1)	8	5
2) Analogies Regarding the Color	Cherry juice (27), red (20), red paint (10), flags (10), juice (9), red watercolor (4), pomegranate juice (3) of apple juice (2), take the flag (2), turnip juice (2), ketchup (2), strawberry pudding (1), strawberry juice (1) silvery red dye (1), cherry juice (1), tomato juice (1), strawberry milk (1) tea (1) dye (1), rose (1), cherry (1), arm (1) color (1), strawberry (1)	104	24
3) Analogies Regarding the Shape-Color	Red rope (4), red water (7)	11	2
4)Analogies Regarding the Functionality	Water (74), providing heating (1), oxygen (1), food (1)	77	4
5)Others	Frame (1) blood (1), a flat tray (1), car (1), the vessel (1), insects (1), magic water (1)	7	7

Table 3 presents the blood-related metaphors produced by the participants. It was found that a total of 42 metaphors was produced about blood.

The most frequent blood-related metaphors were in the category of color. More specifically, blood-related metaphors included the categories of water, cherry juice and red. The blood-related water metaphors are exemplified by the following statement of the students: «Blood is like water, because we could not live without water like without blood». The blood-related cherry juice metaphors are exemplified by the following statement of the students: «Blood is like cherry juice, because both are red». The blood-related red color metaphors are exemplified by the following statement of the students: «Blood is like red, because the color of blood is red».

Table 4:Metaphors related to lungs concept developed by the students

Lungs			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1) Analogies Regarding the Shape	Beans (7), the world (3), stone (3), rectangular (3), a lot of beads (2), ball (2), round (2), the butterfly's wings (2), eggs (2), lemon (1), half of an apple (1), wood (2), that the bottle (2), the ear (1), a triangle (1), pads (1), cherry (1), butterfly (1), shape (1), the cage (1), apartments (1), half a loaf of bread (1) month (1), half potatoes (1), bread (1), half a triangle (1), peanuts (1), raindrop (1), cake slice (1)	48	29
2) Analogies Regarding the Color	Coal (1), motor (1), white (1), black (1)	4	4
3) Analogies Regarding the Shape-Color	White bottle (1), white hands (1)	2	2
4)Analogies Regarding the Functionality	Sponges (18), the balloon (17), oxygen (1), where breathes the man (1), filter (1) clean air to breathe (1) and air pump (1) factory (1), pumps (2), broom (3), rubber (1) steam engine (2), the air motor (1)	50	13
5)Others	handmade paper (2), a stethoscope (1), hose (1), extended wand piece (1), milk Top (1), lung kidney (1) stops above (1), thin (1), shoes (1), book (1), heart (2), flowers (1), an eraser (1), plate (1), pipette (1), cucumber (1), the gas box (1), colon (1), the pouch (2), footwear (1), paper (2), bracelets (1), two brothers (1) minute and scorpions (1), half of the apple (2), two infants (1), Turkey (1)	32	28

Table 4 indicates that the participants developed a total of 78 metaphors related to lungs.

It was found that the most frequent metaphors related to lungs were in terms of shape and function of this organ. The most frequent concepts used in these metaphors were sponge, balloon and beans.

The lungs-related sponge metaphors are exemplified by the following statements of the students: «Lungs are like a sponge, because a sponge sucks water and lungs suck weather», «Lungs are like a sponge, because it breathes».

The lungs-related balloon metaphors are exemplified by the following statement of the participants: «Lungs are like a balloon, because lungs swell when we breath».

The lungs-related beans metaphors are exemplified by the following statements of the participants: «Lungs are like beans, because their inside is threshold», and «Lungs are like beans, because they are the same».

Table 5:Metaphors related to windpipeconcept developed by the students

Windpipe			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1)Analogies Regarding the Shape	Pipe (70), hose (13), item (6), the pipette (4), tree branch (4), the vessel (3), the air tube (4), water pipe (3), the letter y (3), long pipe (2), toilet tube (2), rope (2), tube (1), the flue (1), snake (1), shaft (1), a thin tube (1), separate means (1), y pipe (1), a thin strip (1), the rod (1), pepper (1), tubes (1), a (1), garden hose (1), holes (1), nails (1), the cable (1), small tube (1), tubes (1), the bottle (1), gas pipe (1), wood (1), the irrigation tube (1), spine (1), the cylinder (1), the railway shaft (1), round needle (1), fork tube (1), slings (1), the funnel (1), serrated pipe (1), the tunnel (1)	147	43
2) Analogies Regarding the Functionality	Breathing (5), air (3), opening and closing the hose (1), nose (1), air machine (1), steam engine (1), aeration (1), the rotating propeller fan (1), the wind (1), passage (1)	16	10
3)Others	Broom (3), fountain (3), balloons (2), the screen (1), water ISIC (1), suspended (1), flush the tube (1), vacuum cleaners (1), gap (1), linings (1), a small piece of wood (1), cucumbers (1), letter (1), a long flag (1) profit (1), squash (1), apartments (1), iron (1) me (1), renal -dependent water (1)	25	20

The metaphors about windpipe were found to be related to the shape of this organ. Table 5 shows that the concepts related to such metaphors are pipe and hose.

The windpipe-related pipe metaphors are exemplified by the following statement of the participants: «Windpipe is like a pipe, because it carries something inside». This metaphor was found to be developed in regard to the shape, but some participants developed it in related to the function of the organ.

The windpipe-related hose metaphors are exemplified by the following statement of the participants: «Windpipe is like a hose, because its shape is like a hose».

Table 6:Metaphors related to throatconcept developed by the students

Throat			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1) Analogies Regarding the Shape	Pipe (19), thick pipe (5), an eraser (3), cylinder (3), the ball (3), pin (2), a thick thread (2), hose (2), round (2), bone (2), snakes (1) stove pipe (2), headband (1), the head (1), snake head (1), fat hose (1), long rope (1) water pipe (1), apartments (1), small chickpeas (1), flute (1), wolves (1), the world (1), sticks (1), tires with a round shape (1), a flexible foam (1), punch (1),the throat inflating (1), bumpy pipe (1), the pen housing (1), metal round pipes (1), the pipette (1), the coil (1), two guiding the tube (1), the vacuum cleaner hose (1), bean (1), giraffe (1), item (1), the bottle (1), the worm (1), the wire (1), iron stone (1), large vessels (1), the balloon neck (1), the frame (1)	79	45

2) Analogies Regarding the Functionality	Cover (6), pharynx (2), water bottle cover (2), speakers (2), machinery (2), passage (1) crossroads (1), sore throat (1) lift (1), with two doors tunnel (1), trampoline (1) automatic (1), supermarket door (1), the plug (1), thick substance (1), a small fountain (1), whistling (1), breathlessness one (1) horn (1), spring (1), horn (1), audio (1) bridge (1) meal last place (1), fountain nozzle (1), small caps (1)	36	27
3)Others	Human (2), iron (2), big bone (2) is better (1), dough (1), item (1), a thorny rose stem (1), a straight line (1), light (1), mild (1), dough (1), thick stone (1), a lot of bull (1), carpets (1) round (1), outlet (1), saliva (1), food (1) paper (1), the hands (1)	23	20

Table 6 indicates that the metaphors about throat are produced in related to the shape and the function of this organ. It also shows that although these metaphors have high number, their frequency is low, suggesting that the participants developed varied metaphors about this organ. The most frequent concepts related to such metaphors are found to be pipe and cover.

The throat-related pipe metaphors are exemplified by the following statement of the participants: «Throat is like a pipe, because something passes through both ».

The throat-related cover metaphors are exemplified by the following statement of the participants: «Throat is like a cover, because it covers windpipe while swallowing».

Table 7: Metaphors related to pharynx concept developed by the students

Pharynx			
Categories	Metaphors	Frequencies of Metaphors	Number of Metaphors
1) Analogies Regarding the Shape	Items (3), the hose (3), the piece of meat (3), the rope (2), the short pipe (2), the buckle (2), bottle (2), plate (2), serrated pipe (1), thick rope (1), frogs (1) oven mitt (1), a thin stick (1) rectangular (1), frames (1), apartments (1), pear (1), rings (1), sausages (1), the hook (1), a small bone (1)	32	21
2) Analogies Regarding the Functionality	Pipe (10), two doors (9), cover (4), food (3), saliva (3), swallow (3), arm (2), junctions (2) chew the food (2) wells (2), passage (1), slides (1), window (1), inhalation (1), air (1), water (1), neck (1), the machine (1), opening and closing positions (1), swallowed thing (1), sliding plastic (1), a straight line (1), the cabinet (1), reagent (1), the filter (1), water (1)	56	26
3)Others	The ball (3), a vacuum cleaner (2), bedroom (2), projectors (1), suspended (1), stone (1), rubber (1), balcony iron (1), sponges (1), sweaters (1), blood pressure monitor (1), h (1), bone (1), mucus (1), tongue (1), something genus (1), seed (1), plum (1), car (1) nail (1), white (1), the plug (1), banana (1), the iron (1), a bent (1), a needle (1), the dishwasher (1), screws (1), wires (1), a telephone (1), tire (1), two conductors (1), cotton (1), soap (1),	38	34

Table 7 shows that the participants developed a total of 81 metaphors related to pharynx.

The pharynx-related metaphors were found to be concerned with the shape and the function of this organ. The mostly used categories about pharynx-related metaphors were pipe, cover and two doors.

The pharynx-related pipe metaphors are exemplified by the following statement of the participants: «Pharynx is like a pipe, because something passes through both».

The pharynx-related two-door metaphors are exemplified by the following statement of the participants: «Pharynx is like two doors, because one opens to esophagus and the other opens to windpipe ».

The pharynx-related cover metaphors are exemplified by the following statement of the participants: «Pharynx is like a cover, because something passes through both».

DISCUSSION and CONCLUSIONS

The aim of this study was to identify the metaphors developed the fourth grade students about organs that are covered in the science course. The findings showed that metaphors are useful in determining information and images of students about the organs analysed. There are similar studies on metaphors (Balci, 1999;Saban, 2004; Saban, et al., 2006;Semerci, 2007; Öztürk, 2007; Aydoğdu, 2008; Cerit, 2008; Saban, 2009;Aydın, 2010).

It was found that the heart-related metaphors were mostly concerned with the function and shape of this organ, which were produced through analogies. Although the category of shape was employed in much more varied metaphors, the category of function was used in much more metaphors (Table 1).

The vessel-related metaphors produced by the participants were found to be based on the shape of the organ (Table 2). In the analogies based on the function of the organ there was no reference to those entities carried by vessels such as blood, nutrition or oxygen. There were only references to transfer devices such as pipe or pipe-like entities.

It was found that blood-related metaphors of the participants were closely connected to colors (Table 3). It suggests that the participants did not have enough information the role of blood and that they emphasized the color of it. In the category of function, the blood-related metaphors were mostly concerned with water (f=77). It seems that the participants identified it with water.

It was found that lungs-related metaphors of the participants were closely connected to the shape of this organ (Table 4). These metaphors were followed by those connected to the function of the organ. It was observed that these metaphors connected to the shape of lungs were not sufficient to have mental framework of the organ. On the other hand, those lungs-related metaphors based on the function seem not to account for the function of the organ.

It was found that windpipe-related metaphors were mostly produced with the concepts of pipe and hose (Table 5). The students perceived this organ as having the function of transmitting something.

The metaphors about throat were found to be based on the shape of it (Table 6). However, these metaphors were mostly insufficient. Because the participants likened the shape of throat to the shape of windpipe. It suggests that the participants did not have enough information about the position and shape of throat. Some of the metaphors based on the function of throat indicated that this organ had a function in producing voice. It suggests that the functions of throat were not correctly perceived by the majority of the participants.

The pharynx-related metaphors were found to be concerned with the shape and the function of this organ (Table 7). Those related to the shape of this organ showed that the participants did not comprehensively understand it. The other metaphors based on the function of pharynx indicated that the participants comprehended the functions of it. However, there were other metaphors about this organ produced in terms of other points.

Cerrahet al (2005) analyzed the knowledge of student biology teachers about systems in human body in the context of secondary education programs. There are studies on misconceptions about systems in human body (Yılmaz, 1998; Tekkaya et al., 2000; Kwen, 2005; Güngör & Özgür, 2009).

However, the perceptions and metaphors about organs have not been studied frequently. One of such studies was carried out by Güngör and Özgür (2009) and they analyzed student misconceptions about digestive system through questionnaires (in which the participants were asked to draw it) and through semi-structured interviews.

Şeyihoğlu and Gencer (2011) analysed the organ-related metaphors developed by the third-grade students in the context of life sciences course. They concluded that the participants mostly used their immediate environment to conceptualize these metaphors and that they were not so successful in this endeavor. They found that the students produced organ-related metaphors using analogy in terms of shape.

Lakoff & Johnson (2003) argued that the construction of metaphors is significantly influenced by experiences (as cited in Yaylagül, 2010) and teaching materials (such as visuals, simulations), teaching methods and techniques (such as analogy), as well as imagination of students.

In the study it was also found that the participants employed the images of the familiar objects to produce metaphors, such as pump, clock, balloon, pipe and ball. Therefore, it can be argued that social environment has significant effects in the development metaphors. The reason for the metaphors based on the shape of organs can be related to the insufficient information of the participants about organs.

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