

Mirror, Mirror on the Wall: Prospective Mathematics and Science Teachers' Use of Metaphors to Conceptualize and Understand Reflective Thinking

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ABSTRACT The aim of this study is to investigate prospective teachers' use and conceptualization of metaphors on reflective thinking. This study analyses the metaphorical conceptions of reflective thinking concepts of 71 PTs in a course on "Principles and Methods in Instruction". Metaphors produced regarding reflective thinking fall under 9 categories and a total of 62 metaphors were produced. Most frequently used metaphors were those of "mirror" and "machine".

INTRODUCTION

How do we reflect our thoughts? The answer to this question is apparently relative. Ways of thinking are, like fingerprints, peculiar to individuals. Thinking can be broadly defined as an individual's giving of meaning to their environment. One may not reflect every thought that crossed their minds during thinking on paper, themselves or others. Reflection, in fact, is an action which happens as a result of higher level thinking and contributes to an individual's thinking system causing the individual to think on a higher level and which provides information as to the validity of solutions originating from an individual's own thoughts. Therefore, every individual will produce ideas in accordance to their ways of sense making and will reflect this should they choose to do so. And this is where reflective thinking gains importance.

Reflective thinking, in its broadest sense, is an individual's self-assessment and questioning of his or her learning/teaching and thinking processes by thinking deeply about the past/future and present experiences and thinking about what they can do to solve the problems that emerge out of that questioning and self-assessment. While this skill is important for everyone, it is of vital importance for teachers because education needs planning and it cannot be done haphazardly. In addition to good planning, a teacher, one of the most important cogs in the educational machinery, has to have the ability to implement these plans efficiently and continually question themselves before, during

and after these processes and strive for the best. Therefore, in order for teacher to gain from reflective thinking it is necessary that they understand the concept of reflective thinking concept. This must be defined well so that the individuals obtain it and it will be applied in activities inside and outside the classroom. But there are some debates in the literature regarding reflective thinking. There are a lot of different perspectives and definitions for reflective thinking. There is no one common definition of reflective thinking. In this subject, Rodgers (2002) stated "*without a clear sense of what we mean by reflection, it is difficult to research the effects of reflective teacher education and professional development on teacher's practice and students' learning, an essential question that must be addressed*" (p. 843).

Reflective thinking is an abstract concept and at the same time it does not have a common definition. This will bring much confusion in regard to the concept. It needs to have a common language that everybody could easily understand. Metaphorical concepts can play a facilitating role in this process. Metaphors, a very efficient way of teaching abstract concepts, can be used because metaphors are a part of the thinking process and are related to concepts. To date, many studies can be found on metaphors generally conducted on "teaching", "teacher", "school", "student" concepts. (Saban 2010; Saban et al. 2007; Hagstrom et al. 2000; Martinez et al. 2001; Gurney 1995). The studies, which specifically seek out the metaphors that conceptualize the abstract concepts, which people have

difficulty understanding because of their complex nature, are scarce (Andriessen and Gubbins 2009). The current study focuses on the investigation of metaphors produced by prospective teachers and determines the most frequently used metaphor on Reflective Thinking. Answers to the following questions were sought in order to achieve this aim:

- ♦ Under what categories do the metaphors created by students regarding the “Reflective Thinking” concept fall when grouped by their similarities?
- ♦ What are the metaphors the prospective teachers use to define “Reflective Thinking”?
- ♦ What is the most frequently used metaphor on “Reflective Thinking”?

Metaphors as a Tool for Exploring Abstract Concepts

Metaphors can be defined as expressions of the abstract concepts by associating them with concrete concepts. Metaphors are a way of thinking and abound in any language system (Lakoff and Johnson 1980). Metaphors reflect how a person perceives the world and looks at things around him. Metaphors, similes, analogies and models all share similar characteristics. They are all comparisons, they all use information dissemination of one thing over another and they are all products of a language (Tripp 1990).

Metaphors slightly differ from simple similes, models and analogies. The reasons why similes and models are created are obvious and can be summed up as follows (Low 2008: 215);

- ♦ to find interesting and lasting labels for difficult concepts
- ♦ to shed light on an ambiguous, abstract or complicated concept
- ♦ to further an idea or
- ♦ to determine the problems through a special conceptualization and bring about some changes afterwards.

Analogies do not have to have cause and affect relationships and if there is an analogy between two concepts, it does not affect the casual relationship between the two concepts that construct this analogy (Gentner and Jezior-ski 1993). In other words, an analogy does not influence how the two concepts relate to each other, whereas a metaphor affects the relation-

ship between concepts that have a relationship to each other.

Conceptual metaphor theory could be a powerful device for this study in order for us to share with others how to understand people who conceptualize their meanings from their insights about complex phenomena. Lakoff and Johnson (1980, 1999) stated that conceptual metaphors play a powerful role in conceptualizing abstract concepts like “time”, “knowledge”, and “love”. In this process, target domain refers to metaphors that are used to define a concept. Lakoff (1993) stated that a domain experience helps to understand things in very different domain of experience in the conceptual metaphor process. He detailed it with the metaphor of “love” as a “journey” for an example in this situation. In this example, metaphor has a corresponding connection from a source domain (journey) to a target domain (love) (Lakoff 1993). In other words, the entities that are related to the “love” domain correspond with the journey domain entities. Mapping is a relationship set in which the entities of a concept produce a set of corresponding entities in the metaphor that is claimed.

Further than that, a concept in a target domain evokes another concept in the source domain; the concept in the target domain includes the other concept entities in the source domain. This process makes it easy to understand how the concepts make connections from a concept to sub concepts. Therefore, metaphors can be used in educational settings as facilitators (Yob 2003).

Metaphors are an efficient way to facilitate understanding of complicated concepts. Marshall (1990: 129) used metaphors “not only as tools of expressing an idea but also as a heuristic tool which incorporate the factors directed at new forms of interaction and creative possibilities”. Thinking process is realized through words and concepts in the mind. Therefore, it can be argued that our thinking and production capacity is limited with the words we know. We tend to make literal sense of a metaphor when we first hear it and when we fail to understand it we try to interpret it metaphorically. Psycho-linguistic experiments show that this process takes longer than other linguistic processes (Knowless and Moon 2006: 54). Of course, the process in which individuals perceive and interpret the indirect relationship between ideas and metaphors takes longer than direct interpretation.

Schön names metaphors as “Generative Metaphors”. This is in the form; ‘A is B’. (For example, “education is bread making”) This form is used less frequently than a verb, a noun or an idiom while talking. The concept, which Schön (1993) developed and named “Generative Metaphors” and which is an efficient narrative approach, is based on the fact that a person will spontaneously reveal what they have told about the situation they are influenced by conceptualizing the metaphor at the top of their brains and problems. At this point, it is also important to understand what kind of an indication method a metaphor creates in the mind of the narrator. While the listener senses and conceptualizes this method, they should turn the metaphor into an intelligible one and make various changes on it (quoted, Low 2008: 213) People can produce metaphors with a natural ease (Stren 2000:1). Individuals can easily create metaphors out of concepts they have focused on in daily life.

The human brain, a language production tool, is thought to have deeper mechanisms in order to define a metaphor as a cognitive process. These processes can be defined in two ways: 1) as a cognitive process in which new concepts are expressed and offered. 2) as a cultural process in which a language changes itself (Mac Cormac 1985: 5). As a cognitive process, metaphors enable individuals to think in novel ways. According to Provenzo et al. (1989: 551), metaphors may go beyond the boundaries of scientific language and explanation through their capacity to shed light on meaning in complicated structures. They may make it possible to derive meaning from a concept at a higher level when, especially, they are used in complex structures. In other words, metaphors can easily be used when an individual has difficulty visualizing and making sense of a concept.

Metaphorical thinking can be used as a tool of reflection in both education and psychological treatments and this can be more useful than analytical thinking (Cohen-Or and Gidron 2007: 3). Because, by creating a metaphor, an individual both engages in reflection and attaches meaning to a concept they did not understand before through that metaphor. And the metaphors created during this process can turn into an efficient tool to teach the same concept later. Metaphors can be also perceived as a cultural process in which a language plays a vital role. This means people think in their native language

more easily. So, they can produce metaphors according to their habits and ways of thinking. Lakoff and Johnson (1980: 22) stated, “the most fundamental values in a culture will be coherent with the metaphorical structure of the most fundamental concepts in the culture”. Metaphors vary in every language.

Understanding how PTs perceive reflective thinking can contribute to a teacher training system. Besides, Methods can be developed to improve reflective thinking skills and facilitate understanding about it. The reflection and its results are an important part of a free soul and a culture. Reflection is thus more than just a learning tool (Gelter 2003: 343).

Reflective Thinking Concept

The first systematic studies on this concept were based on Dewey’s “reflection” idea. Dewey (1910: 1) defines reflective thinking as purposefully seeking the basis of a belief and investigating the suitability of that basis in order to support the belief. Schön (1983) provides a lot of information on a reflective teacher in his book “The Reflective Practitioner”. The two terms Schön coined about reflective thinking are especially important for teachers. These are a) “reflection-on-action”, which means that an individual looks back on their actions and reflects on them and b) “reflection-in-action”, which means that an individual reflects on the action while they are doing it (Schön 1983). That a teacher has this skill is essential for their students both to realize their potentials at the top level and to acquire this skill themselves.

Reflective thinking is a skill that can be taught at all levels of education. It can be taught through various strategies. Reflective thinking does not exist as a separate subject in the curriculums of schools at which PTs study but rather, it occupies a certain place in the contents of some other subjects. The biggest problem is that it is difficult to understand it since it is an abstract concept. The concept of reflective thinking that has tremendous importance should, in the first place, be explained well. There are many different interpretations on the meaning of reflective thinking (Pierson 1998; Gelter 2003; Thorpe 2004; Rodgers 2002; Yaffe 2010).

Zeichner and Liston (1996) emphasize that there are different understandings of the reflective thinking concept and these are derived from

their natural contexts. Jones (2010) defined reflection as “a process of critically examining one’s past and present practice as a means of building one’s knowledge and understanding in order to improve practice” (p.593). Pierson (1998) considered reflection as “a purposeful intersubjective process that requires the employment of both calculative and contemplative thinking” (p. 169). Lasley (1992) stated that, “reflection refers to the capacity of a teacher to think creatively, imaginatively and at times, self critically about classroom practice” (p. 24). Nissila (2005) considers reflection a tool by which teachers recognize themselves and thereby accept responsibility for their experiences and through which they create their own personal system of knowing and acting. Korthagen (1999) defines reflection “as the mental process of structuring or restructuring an experience, a problem or existing knowledge or insights (p. 193). Reflection generally is perceived as a device for the professional development of teachers not as a cognitive activity (Stokking et al. 2003).

Bella (2004) considered that all of the understandings of reflective thinking have certain points in common. All of them agreed that reflective thinking includes concepts involving inquiry, creativity, decision-making, investigation, selection, and conclusion making. Reflection, the individuals critiquing of life situations and issues, results in conclusions drawn from these experiences through which the individuals critique themselves and apply what they have learned to other life situations (Brookfield 1993). Rodgers (2002) listed the issues rising from a lack of a common definition of reflection:

“There are four problems associated with the lack of a clear definition of reflection. First, it is unclear how systematic reflection is different from other types of thought. Second, assessing a skill that is vaguely defined. Third, without clear picture of what reflection looks like, it is difficult to talk about it. The lack of common language means that talking about it is either impossible, or practitioners find themselves using terms that are common but hold different meanings or are different but have overlapping meanings. Finally, without a clear sense of what we mean by reflection, it is difficult to research the effects of reflective teacher education and professional development on teachers’ practice and students’ learning, an essential question that must be addressed” (p.843).

Harrison et al. (2005) due to the vagueness of the term, reflective thinking is commonly difficult (I’anson et al. 2003) to understand and clarification is needed regarding which activities are involved in this process. Reflection skills are important tools for the professional development of learners (Spilkova 2001). It is expected that this current study will contribute some practical metaphors to the reflective thinking concept and this will thus be a small, but efficient step, toward creating a common language for reflective thinking in order to make it easily understood.

METHODOLOGY

Participants

In order to become a teacher in Turkey, you have to be a graduate of a faculty of Education or you have to complete a non-thesis master’s degree program (which incorporates Pedagogical Formation subjects) successfully if you are a graduate of a faculty of Science and Arts. Prospective teachers (PTs) of this program take pedagogical formation subjects and they do not have to write a thesis to complete the program. The participants in this research is comprised of 71 PTs who were doing non-thesis master’s degree study in science branches of secondary education (PTs) and who took “Principles and Methods of Education” course in the Fall Semester of 2008-2009 Academic Year at Education Faculty, Gaziosmanpaşa University. These PTs came from different educational majors: Math (52 %), Biology (17 %), Chemistry (31%). The papers of 9 students did not qualify for analysis because they did not complete the question. The data, therefore, was obtained from only 62 students and thus assessed. The ages of prospective teachers ranged from 18 to 27 years; 37 of which were females and 25 of which were males.

Data Collection and Analysis Process

The participants, in the framework of “Principles and Methods of Instruction” subject, were lectured for 4 hours, giving only a half-hour break in the middle, on “Reflective Thinking” since it is an abstract concept and difficult to understand. In this lecture, reflective thinking is presented, as are also the applications that are functional in the classroom for K-12. Contemporary

research about reflective thinking and group discussions on its importance, were also done. Lecturing occurred before the gathering of data because the prospective teachers had never received courses in pedagogy within their academic studies. It is assumed that they do not have any concept about reflective thinking. These prospective teachers had studied only the courses within their particular majors. After the lecture was over, the students were handed out sheets of data collection regarding metaphors and they were asked to complete open-ended sentences such as; "I compare reflective thinking to,because:....." or " Reflective thinking is like....., because:....."

This research was designed according to qualitative design and metaphors produced by the prospective teachers were analysed through the metaphor analysis and content analysis. In addition to the author, help from an educational scientist was acquired in the process of analysing and interpreting the metaphors the prospective teachers created. Their responses were classified and the expert developed categories. The consistency between classification and categorization was sought in order to maintain validity, reliability, and consensus on the metaphors and categories was established. The analysis of the metaphors was done in the following order: (1) identification of the metaphors (2) classification of them (3) categorization and (4) maintaining validity and reliability.

Nine categories were formed according to the reasons why the PTs wrote the metaphors they did after the metaphors were determined and classified alphabetically. How the metaphors conceptualized reflective thinking was examined and the names of the categories were decided. In order to maintain reliability, the nine categories and their meanings were written down on a separate sheet of paper after 47 metaphors were listed alphabetically. An educational scientist was then asked to put metaphors in relevant categories. The differences and similarities between the researcher's and the expert's categorizations were determined. Following this, the formula was used to establish inter-rater reliability "Reliability level=Agreement/Agreement+Disagreement" (Miles and Huberman 1994: 64). The educational scientist put 2 metaphors (fridge, prism) under a different category than the researcher did. In this case, the reliability

level was found to be $47/(47+2)=0.96$. Then, the metaphors were grouped under these categories and their frequencies and percentages were calculated.

Participants were given 15 min to provide their metaphors on the reflective thinking concept. Data were collected from 71 students but data collection sheets from 9 students were not assessed for the following reasons; they did not write any metaphors (for example, "I understood reflective thinking very well. It is very useful"). They wrote metaphors but did not state the reason (for example, "It is like a glass"). They wrote more than one metaphors (for example, "We can like it to a doctor, a patient or even pills"). They did not offer any metaphors (for example, "It is not like anything"). They did not respond in any way. Frequencies and percentage analysis techniques were done with the metaphors collected from 62 students.

RESULTS

Conceptual Categories

The prospective teachers that took part in the research offered 47 different metaphors regarding reflective thinking. These were grouped under 9 different categories. Categorization was done according to the reasons given by the PTs to explain the metaphors and also to the characteristics of reflective thinking. Therefore, similar metaphors may have been put under different categories. These categories are as follows;

- ♦ Individual's mental and affective growth process
- ♦ Combination of different ways of thinking
- ♦ Critical thinking
- ♦ Self-realization process
- ♦ Critical reflection of self thinking and learning style
- ♦ Cognitive and affective awareness
- ♦ Structuring information process
- ♦ Self regulation
- ♦ Contribution to success

The categories with the most metaphors were: "Combination of different ways of thinking" (15 metaphors), "Critical reflection of self thinking and learning style" (17 metaphors), "Individual's mental and affective growth process" (12 metaphors). The most recurring metaphors were: "mirror"(9 times), machines (6 times), lens

(2 times), constructivism (2 times), sculptor (2 times), light (2 times), invention (2 times) and parents (2 times). Machine metaphors were assessed under two different categories since they were used in different meanings. The categories formed according to the responses from prospective teachers and the number of metaphors in each category is given in Table 1.

Table 1: Reflective thinking categories and the metaphors produced

Categories number	Metaphor	%
Critical reflection of self thinking and learning style	17	27.4
Combination of different ways of thinking	15	24.2
Individual's mental and affective growth process	12	19.4
Self regulation	5	8.1
Self-realization process	3	4.8
Cognitive and affective awareness	3	4.8
Contribution to success	3	4.8
Structuring information process	2	3.2
Critical thinking	2	3.2
Total	62	100.0

As it can be seen in the Table, the prospective teachers produced a total of 62 metaphors regarding "reflective thinking". The majority of these metaphors correspond to "Combination of different ways of thinking", "Critical reflection of self thinking and learning style", "Individual's mental and affective growth process", "Self regulation". The other metaphors, though relatively fewer, fell under the categories; "Self-realization process", "Cognitive and affective awareness", "Contribution to success", "Critical thinking" and "Structuring information process" below, the metaphors the prospective students used are assessed in order.

The Metaphors the Prospective Teachers Use to Conceptualize "Reflective Thinking"

The findings in this group are given by grouping them according to their categories. The prospective teachers produced a total of 62 metaphors regarding "reflective thinking" (see Appendix). The categories with a higher number of metaphors are given in decreasing order in separate tables. The categories with fewer metaphors are given in decreasing order in Table 2.

In the Table, 15 different metaphors are used in the category of "Combination of Different Ways of Thinking". These metaphors are the metaphors that describe the ways of thinking

Table 2: The metaphors the prospective teachers used regarding reflective thinking in terms of "combination of different ways of thinking"

Metaphors	N	%
Machines	3	20
Wheat	1	6.6
Paragliding	1	6.6
A different look on the world	1	6.6
Multi-legged table	1	6.6
Refrigerator	1	6.6
Alarm clock	1	6.6
Shirt	1	6.6
Cell	1	6.6
Concave lens	1	6.6
Spider	1	6.6
Invention	1	6.6
Sea	1	6.6
Total	15	100.0

Table 3: The metaphors the prospective teachers used regarding reflective thinking in terms of "critical reflection of self thinking and learning style"

Metaphors	N	%
Mirror	9	53.0
Star-lit nights	1	5.9
Human Psychology	1	5.9
Echo of sound	1	5.9
Prism	1	5.9
Reflection of light by glass	1	5.9
Lens	1	5.9
Microscope	1	5.9
Telescope	1	5.9
Total	17	100.0

Table 4: The metaphors the prospective teachers used regarding reflective thinking in terms of "individual's mental and affective growth process"

Metaphors	N	%
Parents	2	16.6
Sculptor	2	16.6
The first man's way of thinking	1	8.3
A baby's growth	1	8.3
Unveiling of a personality	1	8.3
An object made of play-dough	1	8.3
Lego games	1	8.3
Tree	1	8.3
Growth of a sapling	1	8.3
Water	1	8.3
Total	12	100

which reflective thinking contains. The most recurrent metaphor is the "machines" metaphor with a 20% frequency.

The category "Critical reflection of self thinking and learning style" is like the general defini-

tion of reflective thinking. As it can be seen in the Table 3, 9 of the 17 metaphors the prospective teachers used were “mirror” metaphors. And it has the biggest percentage (64.5%).

A total of 12 metaphors regarding “Individual’s mental and affective growth process” were produced. The most recurrent metaphors were those of parents and sculptor with a percentage of 16.6% (Table 4).

Five different metaphors regarding the category “Self regulation” were produced. All of them had at the same percentage (Table 5).

Table 5: The metaphors the prospective teachers used regarding reflective thinking in terms of “self regulation”

<i>Metaphors</i>	<i>N</i>	<i>%</i>
A dress made by a tailor	1	20
A functioning factory	1	20
An water-filled armchair	1	20
Machines	1	20
Image Maker	1	20
Total	5	100

In the Table 6, the other categories of reflective thinking and the metaphors regarding each category produced by prospective teachers are summed up. As it can be seen in the Table, 3 metaphors regarding Self–realization, Contribution to success, Cognitive and affective awareness categories each and 2 metaphors regarding Structuring information and Critical thinking categories each were produced.

What is the Most Frequently Used Metaphor on “Reflective Thinking”?

The categories with the most metaphors are as follows: “Combination of different ways of

thinking” (15 metaphors), “Critical reflection of self thinking and learning style” (17 metaphors), “Individual’s mental and affective growth process” (13 metaphors). And the most recurrent metaphors are as follows: “mirror” (9 times), machines (6 times), lens (2 times), constructivism (2 times), sculptor (2 times), light (2 times), invention (2 times) and parents (2 times). The categories in which the most metaphors were produced were the ones that emphasized the most remarkable qualities of reflecting thinking. According to results, “mirror” and “machines” were the most recurrent metaphors, which reflect the functional qualities of reflective thinking that can be used in daily life. Therefore, it can be said that the most frequently used metaphor is “mirror” and “machines”.

DISCUSSION

Metaphors have always drawn the attention of philosophers and psychologists. Although their use is controversial, they are widely used and accepted as suitable cognitive devices today (Mac Cormac 1985: 5). They can also be used for teaching and understanding a concept. They are sometimes used as an analysis method (Freed 2003, Parsons et al. 2004; Saban et al. 2007), sometimes they aim to determine the effects of cultural images on the general public (Sementelli and Abel 2007), sometimes they aim to determine educational-cultural edge (Gorodetsky and Barak 2008), and sometimes, the metaphors used on a particular topic can be the subject of a research (Parsons et al. 2004).

In this research, how an abstract concept such as reflective thinking is perceived by pro-

Table 6: The metaphors the prospective teachers used regarding reflective thinking in terms of “self-realization process”, “cognitive and affective awareness”, “contribution to success”, “structuring information process” and “critical thinking”

<i>Self-realization Process</i>	<i>N</i>	<i>%</i>	<i>Structuring Information Process</i>	<i>N</i>	<i>%</i>
Self-realization	1	33.3	Constructivism	2	
Yunus Emre	1	33.3	<i>Contribution to Success</i>	<i>N</i>	<i>%</i>
Shaping students	1	33.3	Success	1	33.3
Total	3	100	Fox	1	33.3
<i>Cognitive and Affective Awareness</i>	<i>N</i>	<i>%</i>	A new invention	1	33.3
Improvised acting	1	33.3	Total	3	100
Light	1	33.3	<i>Critical Thinking</i>	<i>N</i>	<i>%</i>
Brain storming	1	33.3	Critical thinking	1	50
Total	3		Direction fining with a map	1	50
Total	2	100	Total	2	100

spective Turkish teachers was investigated. Thus, it was intended both to contribute to teacher training programs which promote the concept of reflective thinking by establishing how reflective thinking is perceived by prospective teachers who had graduated with different academic majors. Metaphors are considered to be powerful mental devices of understanding and teaching a highly abstract, complicated and theoretical fact (Yob 2003). The metaphors put forward in this research and their frequencies have gained a position in which varying comments can be produced on the most frequently used metaphor. Kottkamp (1990: 191) defines metaphors as “meanings strong and flexible for reflection”. Therefore, metaphors can be used efficiently to understand such an abstract concept as “reflective thinking”.

The prospective teachers came up with 62 metaphors. Since some of them were the same metaphors, there were 47 different metaphors. Under the category of the combination of different ways of thinking, the most reoccurring metaphor was machine. The “refrigerator” and “alarm clock” could be considered machines. PTs might compare the machine metaphor to the functions of the brain and perhaps this metaphor could, therefore, refer to the cognitive function of reflective thinking. In this category, through these two metaphors: a different look on the world and invention, the abstract nature of reflective thinking is evidenced. “Multi-legged table” seems to represent different thinking styles with each leg. Similarly, “shirt” may also represent different ways of thinking with its plus shape. Wheat, paragliding, cell, spider and sea perhaps represent the reality that thinking is one of the most vital skills that people must have in order to live in the world.

Under the “critical reflection of self-thinking and learning style” category the most recurring metaphor was mirror. The other metaphors have a relationship with mirror through their concrete construct. For example, star-lit nights, prisms, reflections of light by glass, lenses, microscopes, telescopes and mirrors all reflect something and also all of them are concrete objects. But human psychology and echo of sound interestingly are abstract objects for reflecting. Reflective thinking is indeed an abstract concept. But the reflection phase could be considered a concrete skill due to that it has a concrete result that everyone could easily see. This may be an argument for

choosing concrete metaphors for the reflection phase. The abstract metaphors may give attention to the complex and hardly understood structure of the concept of reflective thinking. It should be noted that almost all of the metaphors were chosen from the science field, which is to be expected since the Pts came from the science subjects departments.

Another category was the individual’s mental and affective growth process and in this category the most recurring metaphors were parents and sculptors. Almost all metaphors, interestingly, are about shaping something. Shaping things are like reflective thinking in that both guide and form an individuals’ thinking.

While the metaphors of tree and water might give attention to the vital importance of reflective thinking, the metaphor of the “first man’s way of thinking” may point to a human-being who is always searching for everything and gaining experience from everything. This is consistent with the reflective activity in the nature of man, which is constantly researching and struggling to find the best.

Under the self-regulation category all metaphors had similar percentages. The shaping of things was indeed in the framework of reflective thinking. The water-filled armchair might represent the relativity of reflective thinking for each person in that each individual with their unique nature, shaped the arm-chair. In these four categories: Self-realization process, contribution to success, structuring information process, and critical thinking all of the metaphors had the same percentage levels. As it relates to the self-realization category, it seems that from the writings of one of the most famous Sufi poets, Yunus Emre, there exists evidence that he applied these practices in his life and works¹. So, PTs might think he managed his realization process. In addition to this, looking at the relationship between the metaphor of light and the metaphors of improvised acting and brainstorming it can be inferred the meaning of enlightenment may effect an individual’s cognitive and affective awareness.

In the critical thinking category, there are two metaphors. While the “critical thinking” metaphor refers to the real meaning of critical thinking, the “direction finding with a map” metaphor may refer to gaining critical thinking skills by a tool.

According to the overall results of this study, the recurring metaphors were “mirror”, “ma-

chines", "lens", "constructivism", "sculptor", "light", and "invention and parents" metaphors. The fact that different metaphors were produced can point to a good level of metaphorical thinking. Metaphors shape our perceptions and thoughts and they can influence our actions in real life (Collins and Green 1990). Every experience adds to our mental potential and thus cultivates it. According to Kövecses (2002: 60) our experiences, along with the physical world, serve as a natural and logical basis for us to understand more complex knowledge fields. Therefore, reflective thinking and the act of reflecting in our educational experiences can be easier with metaphorical thinking.

Metaphors were analysed to find out about the most frequently used metaphors were determined to be "mirror" (64.5%) and "machinery" (20%) metaphors. This is a very significant finding. Moser (2000: 4) points out that metaphor analyses are not only important for self-reflection, guessing and communication but they also provide a mental basis which influences our cognition of ourselves and everything around us. So, the most recurrent metaphors in a study can show that the cognitive experiences of students produce similar results. In addition, Cohen (2005) also used the "mirror" as a metaphor for the reflective practitioner. As Cook-Sather (2003b) demonstrated, the metaphorical level is a reflexive act. The metaphors could have been perceived in the same way because reflective thinking carries reflective action in itself.

In the same way, the "Mirror" metaphor was thought to have a religious significance in Zhuangzi in Chinese culture. They were seen as things that respond to their environment in active and dynamic ways rather than passively reflecting the objects (Cline 2008: 338). This, in fact, is an act that is to be done by the reflective thinking individual. Therefore, comments regarding the understanding of the mirror metaphor and reflective thinking in different cultures may be quite similar. This supports both a multicultural educational approach and the idea that different cultures, in fact, have ways that may not be overly different. This may give us reason to hope that differences will further diminish in time as a result of globalization.

According to Schmitt (2005), a word or an idiom is defined as a metaphor if it is used in a meaning other than its generally used literal meaning. Its literal meaning comes from the sen-

sory and cultural experience and it is often transferred into a second meaning that is abstract. In other words, this may be resulting from similar cultural and educational experiences. Craig (2005: 195) maintains that "people use metaphors naturally to share and improve their knowledge. Students generally compared the reflecting stage of reflective thinking to a mirror. The examples the students gave for the mirror metaphor centre around collecting and reflecting data, reflecting it according to one's own awareness level and the ideas of enabling to see shortcomings and positive sides as a result of reflection. It is clear from the machinery metaphor that reflective thinking is comprised of different ways of thinking and it focuses on multidimensional thinking and choosing and using one or two of these different ways of thinking suitable for the situation. So, it can be argued that such aspects of reflective thinking as awareness, finding shortcomings and positive sides, assessment, using the suitable ways of thinking for the problems faced and possessing multidimensional thinking skills are better understood and reflected. Lakoff and Johnson (1980: 193) define metaphors as "one of the most important tools we have to partially understand something we can not totally grasp". Although the other metaphors listed among the findings of this research, too, can be used to teach reflective thinking, the concept can be understood better if mirror and machinery metaphors are used.

IMPLICATIONS FOR TEACHER EDUCATION

This study has some limitations. First, the sample was selected from just one college of education. Second, the researcher did not come across any research literature that had been previously done in the area of reflective thinking metaphors. Such literature would have provided some comparisons from which comments on intercultural relationships could be made. However, there are some findings that contribute to the existing literature about teaching reflective thinking as an abstract concept through metaphors.

There are a lot of studies on metaphors as an efficient way of educational material (Robert and Bullough 1991; Bozlk 2002; Eppler 2006; Saban 2004, 2008, 2009; Toremén and Dos 2009). Cook-Sather (2003a) explains what role metaphors play in education. There is a place in this metaphori-

cal structure for personal metaphors which capture our individual contents. Metaphors can be used in education, especially for teaching abstract concepts. Structuralist learning states that learning increases if students can engage in academic contents by creating their own analogies (Low 2008: 216). Apart from this, teachers, too, can use metaphors for their personal developments. Miller et al. (2002) suggest that the educators who want to investigate their own personal applications should study personal metaphors.

Metaphors could be used for teacher education as pedagogical tools. In order to obtain reflective thinking and practice skills first it is important to understand the exact meaning of reflective thinking as a vital skill for teachers. It is almost impossible to teach a concept without knowing it very well. Someone could say it doesn't make sense so I don't understand. The results of this study revealed that some metaphors can be used for reflective thinking such as: "mirrors", "machines", "lenses", "constructivism", "sculptors", "light", and "invention and parents". I think these metaphors could be useful in learning about the reflective thinking concept.

CONCLUSION

Presently, the importance of teacher training is understood at the universal level. This study may be a small but, nonetheless, a confident step toward understanding in the service or pre-service teachers' perception of academic concepts through metaphors. So, investigating how metaphors are perceived culturally may contribute both to our understanding of multicultural education and the ways of perception in different cultures. For future research, studies could be done to determine which metaphors might be useful in understanding reflective thinking cross culturally.

RECOMMENDATIONS

Metaphors on other topics such as reflective teacher, reflective education can be investigated. The efficiency of metaphors obtained as a result of such research should be investigated by using them in teaching this concept.

- ♦ Metaphors on reflective thinking should be investigated on different groups of teach-

ers and students and the findings obtained from bigger and different samples should be compared and contrasted.

- ♦ The perceptions of reflective thinking in different cultures should be investigated and studied in terms of intercultural differences. Researches that identify cultural differences and similarities with respect to certain metaphors should be done. Reflective thinking metaphors, which are produced in a certain cultural environment may be used in a different cultural settings in order to see their effect.

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APPENDIX

Some Exemplar Metaphors for 9 Categories

Category 1: Individual's Mental and Affective Growth Process

- Parents

"It is like parents. Because, it is a wonderful thing which involves self-sacrifice, emotions, patience and logic". "It is like parents. Because, they, too, try to raise and educate their children by providing all kinds of information".

- Sculptor

"It is like sculptor's relation to his work. A teacher shapes their students just as a sculptor chisels their busts into shape, stepping back and admiring the end product". "It is like a sculptor's work. A teacher takes personal traits of their students into account when teaching them, just as a sculptor does so with the material they work with". The first man's thinking

- A baby's growth

"It is like a baby's growth. A baby watches, thinks about and interprets what he/she sees around and carry them into action when he/she learns to speak."

- An object made of play-dough

"It is like an object made of play-dough. An object that is malleable. A child can change it as his outlook improves and he learns new things".

- Water

"It is like water. Like water, it is very beneficial to human beings and it is a very important factor for growth. Growth is impossible without water. Likewise, reflective thinking is essential for the development of students.

Category 2: Combination of Different Ways of Thinking

- Machines

"Reflective thinking is like a time machine. Different ways of thinking can go back to any time and can study the results they want and obtain necessary data."

"It is like a machine which wrongs go into and corrects come out of. I have different ways of thinking and in my opinion, it is like a machine which transforms you. Because, you receive feedback and criticism from the people around you and you make corrections in accordance with them. Wrongs go in and corrects come out." "It is like a washing machine. Different ways of thinking and personal differences are important. Students at different growth periods are given different assignments. You can not wash white linen and colorful laundry together. Reflective thinking teacher is detergent, managers are conditioner and students are laundry."

- Paragliding

"It is like doing paragliding. In the beginning, you only perceive what you see but then, you begin to look from different points of view when you practice it."

- A different look on the world

"It is looking on the world differently. I perceive things at a high level of thinking in a way it offers a multitude of meanings, it is not a single dimension thinking".

- Multi-legged Table

"It is like a multi-legged table. Different ways of thinking are the legs of this table. It stands up thanks to these legs; thought, interpretive skills, comparison and problem-solving".

- Cell

"It is like a cell. Different ways of thinking are together. The cell renews and improves itself. All the constituents of a cell work together. Each part has a certain goal. Cell does not work well when a few of its parts do not work properly. Reflective thinking is the same."

- Concave lens

"I liken it to a concave lens. Different ways of thinking are together. A concave lens converges light beams and forms images accordingly. Likewise, reflective thinking converges many ideas and makes use of the best one among them."

Category 3: Critical Thinking

- Critical thinking

"It is like direction finding with a map. It is like someone trying to reach her/his destination with the help of a map. It is both fun and inquisitive".

Category 4: Self Realization Process

- Self-realization process

"It is like Yunus Emre. He was a self-fulfilled man. His tolerance and efforts to realize himself exist in reflecting thinking, as well".

Category 5: Critical Reflection of Self Thinking and Learning Style

- Mirror

"It is like mirror, reflecting an exemplary image. If a teacher has the reflective thinking skill, they set good examples for their students".

"It is like a mirror. If you send a light beam into a mirror, it sends it back to you. Likewise, a student sends you back what you teach them."

"It is like a mirror. We see pleasant things about ourselves when we look into a mirror just as we would like to see pleasant things in our students".

"It is like a concave mirror. A concave mirror gathers the light. Reflective thinking enables students to gather information in their brains".

"It is like a mirror. A mirror, too, reflects".

"It is like a mirror. It reflects one's outstanding sides and flaws. If you evaluate your pros and cons as if you are looking in a mirror, you become aware of your shortcomings".

"I compare it to a mirror. The fact that one knows and constantly improves themselves is very much like looking in a mirror and tidying oneself up. A teacher both wants to be a good teacher and raise productive individuals".

"It is like a mirror. I think students' rate of learning increases in such an environment".

"It is like various kinds of mirrors. The fact that reflective thinking is performed in different ways is like obtaining different images in different mirrors."

- Human Psychology

It is like human psychology. You are reflected as you are and you become as you are reflected. Because, humans reflect and are reflected".

- Prism

"It is like a prism. It detracts white light into different colours and concentrates them back into white light. It both reflects and concentrates".

- Microscope

"It is like a microscope. A microscope enables us to see in detail and we can find answers to our questions. Reflective thinking gives you this".

Category 6: Cognitive and Affective Awareness

- Improvised acting

"It is like improvised theatre because it is important to be both creative and natural and to reflect it to the society. One should be well aware of their capabilities. Because the role one wants to play depends on this".

Category 7: Structuring Information Process

- Constructivism

"It is like the shaping of information in mind by a student. Helping shape information meaningfully in the mind is a more advanced tool".

Category 8: Self-regulation

- A dress made by a tailor

"It is like a dress made by a tailor. Formation of oneself, doing customized changes whenever one likes".

- A water-filled armchair

"It is like a water-filled armchair. It is like a structure that contours human body. Students will sit in it in the right way".

- Machines

"It is like blow dryer. It dries first and then gives shape. Reflective thinking, like a blow drier, shapes students".

- Image Maker

"It is like an image maker. An image-maker gives necessary touches to people according to their personal traits. Reflective thinking shapes people according to their unique characteristics".

Category 9: Contribution to Success

- Fox

"It is like a cunning fox. A fox makes plans and thinks about what it can do to achieve its goals and as a result of these efforts, it gets what it wants".