JOURNAL OF BALTIC SCIENCE EDUCATION
ISSN 1648-3898

CONCEPTS OF VEGETABLE AND FRUIT IN PRESCHOOL AND ELEMENTARY EDUCATION

Hüseyin Eş

Abstract. *The purpose of this study was to investigate the way the concepts of fruit and vegetable are presented in teaching materials, used in pre-school education and in the textbooks of life sciences and science and technology courses in elementary education, in addition to the students and teachers' knowledge and opinions related to these concepts. Qualitative research techniques were used in this study. The sample of the study comprises the students receiving education in pre-school and elementary education and the teachers serving at these levels. 258 students and 83 teachers took part in this study. A survey, which was developed by the researcher, including two forms, was administered. Teaching materials in pre-school education and course books in elementary education were also used as data sources. When the research findings are considered, it stands out that these concepts have different definitions in different fields and thus, they have no common definitions. This situation seems to have been reflected in the teaching materials used both in pre-school and elementary education. Also, it is seen that there are important differences between teachers' opinions about these concepts.*

Key words: *concept learning, concepts of fruit and vegetable, science education, teaching materials.*

Hüseyin Eş
Sinop University, Turkey

Introduction

Science is defined as "trying to discover the nature while searching, forming an organized information group that has an effect and applicability on society" (Ministry of National Education (MEB) 2012f). The student, trying to give meaning to the nature, meets the concepts (Schoenfeld, 1992). The concept is the common name of numerous events, objects, ideas that have similar properties or phenomena, that have widespread special attitude (Çepni, 2011). Concepts, especially for science teaching, have a great importance. And learning without conceptual understanding will not be more than memorization (Singler and Saam, 2006; Snowman and Biehler, 2003). Notwithstanding, the concepts learned out of school may be far from scientific facts, this case may be quite dangerous for science teaching (Ausubel, Novak and Hanesian, 1978; Driver, 1989). In some cases the opinions of the authors and/or teachers may, vaguely, affect students' concept learning and may cause misconception (Barras, 1984; Gilbert, Osborne and Fensham, 1982; Mintzes, 1984, 1989; Osborne, Bell and Gilbert, 1983; Pines and West, 1986). Related to this, Yip (1998) states, that the reasons that may be the source of misconception, due to because of students' wrong opinions caused by their daily experience, language usage style of the students, the misconception that the students learn at learning environment, course books and teachers. Misconception frequently appears the factor that blocks semantic learning, since it blocks restructuring that new learned knowledge and disjoins the meaning among the conceptions (Bahar, 2003).

Misconceptions are seen very often in science fields that are wide and expansive. Some of them are not related to students' personal experience or learning, (Barrass, 1984; Cho, Kahle and Nordland, 1985; Sanders, 1993; Storey, 1989, 1990; Veiga, Costa Pereira and Maskill, 1989) and some consist of the misconceptions that the students get in their daily life experience

(Driver, Squires, Rushworth and Wood-Robinson, 1994). These misconceptions, that the students get in their daily life experience, without taking science education at school atmosphere, should be certainly be taken into account during the formulation of teaching process by the teachers (Yip, 1998). Especially, many studies related to misconception have been done in the biology field. But it is seen, that those are the studies major in the subjects such as cell, plant respiration, photosynthesis, osmosis and diffusion, genetics and ecology (Bacanak, Küçük and Çepni, 2004; Çokadar, 2012; Köse, Ayas and Taş, 2003; Özay and Öztaş, 2003; Şensoy, Aydoğdu, Yıldırım, Uşak and Hançer, 2005; Temelli, 2006; Yıldırım, Nakiboğlu and Sinan, 2004). Additionally, there are studies related to plants, especially the concept "plant" (Barman, Stein, McNair and Barman, 2006; Türkmen, Dikmenli and Çardak, 2003; Uşak, 2005) vitality of plants (Kwon, 2003; Stavy and Wax, 1989; Tamir, 1997) and floral plants and the studies, analyzing the misconceptions of plant growth as well (Biddulph, 1984; Christdiou and Hatzinikita, 2005; Lin, 2004; Mutlu and Özel, 2008; Yangin, Sidekli and Gokbulut, 2014). But, even if some misconceptions related to fruit concept are mentioned in a part of these studies, a study researching the concepts of fruit and vegetable, especially in the context of their relationship, and the opinions of teachers and students about them, hasn't been seen in the science field.

Nonetheless, in the cognitive psychology and child development fields there are significant studies, especially related to which category people include the concepts in (Estes, 2004; Hampton, 1988; Hampton, 2012; Machery, 2011; Nguyen and Murphy, 2003; Storms, De Boeck, and Ruts, 2001). In the mentioned studies, related to people's conceptual understanding, it is seen that people can include a concept into more than one category (such as vegetable and fruit) and they see misconception during this process. Related studies show, that while people decide in which category will a concept be, it is effective how much it (tomato, for example) carries the specialties of that category (for example, is it a vegetable or fruit) which means it is a good sample or not. Also, it can be said that people's perception of the related concept is directly determining while they are classing the concepts. So, it should be considered that the concepts can be described either individually or in some cases differently among the fields. For instance, fruit is accepted as one of the generative organs of herbal organs in life science and it is described as ovary diversified after the impregnation and a group consists of seeds it wraps (Çakır, 2001). But there is not any plant description that accepts the concept vegetable as a part of plant in botany (Çakır, 2001; Güneş, 2006; Kesercioğlu, 2004; Vardar and Seçmen, 1993). Also, Özyurt (1992) described vegetable as a general name that is given to the plant organ, that is eaten sometimes cooked and rarely uncooked, and he divided fruit morphologically into six parts such as the fruits that benefit from their roots, trunks, leaves, flowers, fruits and seeds. When the biology concept dictionary (Karol, Suludere and Ayvalı, 2000) is analyzed it is seen, that vegetable is described as a general name given to the plant organs such as root, trunk, leaf, flower and fruit that make fungus if they are left to be rotten, generally green, eaten cooked or uncooked.

In the nutrition science, the vegetable is assembled into groups according to the parts produced from the plants such as tubers (potato), root (carrot, celeriac, beet, radish), onions (leek, onion, garlic), shoots (asparagus, dill, parsley) leaf (cabbage, spinach, lettuce), flowers (artichoke, cauliflower, okra), fruits (tomato, eggplant, marrow) fruit and seeds together (bean, horse bean, green peas) (Bayrak, 2011). Moreover, the vegetables are divided into groups according to their colors such as green, red, yellow and orange, white and purple (Bayrak, 2011). Bayrak (2011) states, that the practical discrimination of fruit and vegetables is done so, that the ones, eaten as food and salad, are vegetables, the ones, eaten as sweet, are fruit. Ketenoğlu, Obalı, Güney and Güven (2003) stated, that the limit between vegetable and fruit is not certain, even if some writers want to separate fruit as a ligneous plant, the one year plants melon and watermelon should also be included in fruits. Yet, there are sources that accept melon and watermelon as a vegetable, the fruit of which is eaten (MEB, 2007). This classification difference may be sensed as a problem at first sight and it may be felt to do a common classification. But the different criteria should be taken for granted while any classification is done. But, there should be prepared learning environments with planned strategy and gradually, that the students can understand this difference.

Fruit is a very important organ in the concepts of life circle of floral plants. Also, the concepts fruit and vegetable have an undeniable importance in concepts of nutrition. No matter which side is, (botany or nutrition) both sides are important subjects that are in the context of pre-school and basic training. That's why these concepts should be learned properly.

As seen above, in the literature, there are many studies on misconceptions. In this study, however, there are several differences from the previous ones. First of all, this study differing from basic misconceptions (such as mass and weight) reveals that different disciplines have different approaches about the concept developing process and the potential effects to the educational environment. Secondly, the concepts focused in this study

are analyzed in their change during the process from preschool to the end of basic education. Third, the study investigates these concepts in teaching materials and their potential effects on concept learning. Lastly, different classifications done by teachers of different branches analyzed these concepts and their potential effects on concept learning. With all these, this study is aimed at researching the teachers' and students' opinions and knowledge about the concepts of fruit and vegetable as presented in teaching materials used in pre-school education and in science and technology books (student workbook, course book and teacher's guide). In accordance with this aim the following questions were tried to be answered:

1. How are the concepts of fruit and vegetable presented in teaching materials used in preschool and elementary education?
2. How do the teachers and students classify the plant parts that they can often see in their daily life and teaching materials as part of fruit and vegetable class?
3. How do the teachers define the concepts of fruit and vegetable and what are the opinions about the curriculum related to these concepts?

In accordance with the answers got from the research, the question how the concepts fruit and vegetable are perceived in preschool and elementary education, has comprehensively been analyzed. In the light of derived discoveries, it has been recommended to correct the misconceptions, if there are, and how the concepts fruit and vegetable should take part in the curriculum.

Methodology of Research

In this study, the qualitative research paradigm is applied. A sample of the study, data sources and data analysis is mentioned in detail below.

Sample

This research focused on concepts fruit and vegetable in preschool and elementary education. That's why the sample of this study consists of the students and the teachers of preschool and elementary education. In Turkey, elementary education consists of two levels, which are called primary schools and middle schools. Both primary and middle school education is taken in four-year periods. The data in this study were collected in the period of 2013 and the 2014 academic year. There are 258 students and 83 teachers in the sample. See the class level of the students in "Table 1"

Table 1. Range of the students according to their study level.

	Preschool	Primary School				Middle School			
	Preschool	1st	2nd	3rd	4th	5th	6th	7th	8th
Student Number	12	31	27	24	19	34	46	32	33

The students in sample are the ones in Sinop Central point public school. That public school was preferred because of its satisfactory facilities to be able to carry out the study, representation of middle class in socioeconomic level of the region it is in, and because it is available to collect data with the numbers of the students in the classroom. For these reasons purposive sampling was used. Purposive sampling based on previous knowledge of a population and the specific purpose of the research, investigators use personal judgment to select a sample (Fraenkel and Wallen, 2006).

See the distribution of teachers participating in research in "Table 2".

Table 2. Distribution of teachers participating in research.

		Gender		Graduation Department				Professional Experience			
		Female	Male	Preschool	Grade	Science	Other	0-5	6-10	11-15	16+
Department	Preschool	9	3	12				8	4		
	Grade	34	24		57		1	11	19	14	14
	Science	9	4			13		7	4	1	1

The sample consists of the teachers working in village schools of Sinop Province central point and city center and the ones accepted to answer the survey voluntarily. The total number of the schools that the teachers work is 11. These schools are considered according to accessibility criterion during data collection. To increase the sample representativeness, both the teachers working in central or rural schools have been reached.

Research Tool

The research tools are explained in the following two subchapters.

Teaching Materials

In the research, preferably, teaching materials involving the concepts fruit and vegetable in four preschool training institutions and the course books, workbooks and teacher guide books of science and technology classes and life science classes of elementary education were used as data source. See the teaching materials analyzed within the context of the research.

Table 3. Teaching materials analyzed within the context of the research.

		Material		
Level		Kind	Class	Prepared by
Preschool		Presentation	Preschool	Teacher
		Poster	Preschool	Private Publisher
		Book	Preschool	MEB
Primary School	Lesson life sciences	Teacher guide book	1, 2 and 3	MEB
		Student course book	1, 2 and 3	MEB
		Student workbook	1, 2 and 3	MEB
	Lesson Science & Technology	Teacher guide book	4	MEB
		Student course book	4	MEB
		Student workbook	4	MEB
Middle School	Lesson Science &Technology	Teacher guide book	5, 6, 7 and 8	MEB
		Student course book	5, 6, 7 and 8	MEB
		Student workbook	5, 6, 7 and 8	MEB

As a part of the research, four schools, training preschool were visited and the teachers were asked the teaching materials that they use related to the concepts fruit and vegetable. Also, the materials of science boards were analyzed. The books used in elementary education are published by the Ministry of Education. These books are preferred because they are used all around Turkey. The reason of choosing the classes named Life Sciences and Science Technology in these classes include many concepts of nutrition and biology.

Survey

In the research two sheets developed by the researcher and shaped after taking 3 experts of science education opinions were used, one of them is visual; the other one consists of open-ended questions. The visual sheet was applied to 258 students studying there and 83 teachers. Open-ended question sheets applied to 83 teachers. In visual sheet used in the research there are sample pictures printed colorfully and four options related to these pictures. Those options, are respectively, "fruit", "vegetable", "other" and "I don't know". The option "other" is put into the sheet in order not to limit the participants just with option "vegetable" and "fruit". The participants were asked to mark the fruit cartridge if they think that the visual related to a plant part in the pictures is the fruit, or if they think it is vegetable they were asked to mark vegetable cartridge, to mark I don't know cartridge if they don't know, and if they think that it is another concept they were asked to write what it is down into another cartridge.

In the process of determining the items formatting the visual sheet, preferably, the class materials used in preschool and elementary education were analyzed. In these materials, fruit and vegetable visuals, frequently used, were determined. After that with these visuals the other visuals, that the students can see most likely in their daily life, were determined according to their degree of development and the region they live in. Nonetheless, it is cared to put the parts of plant, root, stump, leaf, and fruit among the items. The plant parts, that took part in the visuals are respectively like this; strawberry (fruit), marrow (fruit), watermelon (fruit), eggplant (fruit), cucumber (fruit), grape (fruit), tomato (fruit), pepper (fruit), carrot (root), lemon (fruit), lettuce (leaf), onion (stump), green onion (leaf), orange (fruit), spinach (leaf), potato (stump). The sheet was evaluated with 3 experts in science education. In accordance with the evaluation, it is approved to print the sheet colorful and with the names under the visuals, in order to increase the intelligibility of the visuals. The visuals were presented as a single page, beginning from 2nd class, written their names and classified randomly. Visual sheet applied to the teachers, as well. Preschool and 1st grade students are among the students that the sheet was applied to. Those students' literacy status was taken into account. That's why those students were asked their opinions by showing the visuals one by one, each in one page. The answers were recorded by the researcher and transferred to the sheet. Also, teachers were asked two open-ended questions.

1. What is the definition of the vegetable and fruit concepts?
2. Do you think that the context of the curriculum, course books, workbooks and teacher guide books in teaching vegetable and fruit are enough? Why?

Data Analysis

During the data analysis process, the following methods were applied. In the teaching materials, taken as a first data source in the research, since the presentation style of the concepts fruit and vegetable was the object of this study, a content analysis, focused on these concepts, has been done. In this context, some kinds of documents such as, course books, newspapers, novels and pictures, can be analyzed with content analysis. There are two ways of content analysis. While the researcher determines the category he wants to analyze beforehand, in the second one he can determine these categories during the content analysis process (Fraenkel and Wallen, 2006). In the research, because the concepts fruit and vegetable were determined as research topic, teaching materials were analyzed with the first way. In this process all the words, sentences, phrases and visuals include fruit and vegetable concepts. Content analysis was preferred for the aim of getting descriptive information about the concepts fruit and vegetable. The data about these concepts that are a research topic, were taken from teaching materials used in preschool education and course books, workbooks and teacher guide books of Life Sciences and Science-Technology Classes used in basic education.

The analysis of the answers given to the visual form in the survey, that is, the second data source of the research was done quantitatively and the frequency of how participants classify the visuals (fruit–vegetable, etc.) was determined. These frequency distributions were pictured according to the study degrees of students (preschool, primary school and middle school students) and according to the branches of the teachers. The reason, why the students were not considered separately according to their classes in their degrees, is because the teaching of fruit and vegetable concepts is in preschool period and related acquisition that let them learn the concept fruit is in the level of middle school, 5th and 6th grade.

The analysis of the answers that teachers gave to open-ended questions in the survey was done qualitatively with the open coding method. Open coding is described as the process of determining and categorizing of the

phenomena that data indicate (Struass and Corbin, 1998). Analysis process was started with the aim of establishing an available coding system by revising the answers as a whole. In a related process, after each teacher's answering papers were numbered with abbreviations to represent their branch (for instance PS1 for a preschool teacher), they were evaluated one by one and all the conceptual phrases explained with words, sentences or paragraphs were coded shortly. In this stage of the analysis the first code list was revised to be made more meaningful and it was restructured more reasonably (Bogden and Biklen, 2007; Gay, Mills and Airasian, 2006). By this way, the codes that have so close meanings were unified under definite subjects, so repetitions were avoided, and new and shorter subject wholes that will simplify the data classification were being made. In the last stage of the analysis these subjects were grouped under more abstract phrases (categories) (Creswell, 2005; Maxwell 2005; Strauss and Cobin, 1998) related perceptions, questioned by the way of open-ended questions were being tried to be stated obviously.

In the process of analysis, one of the categories reached and the subjects under this category are shown in "Table 4" as a sample.

Table 4. Sample of categories and subjects.

Category	Subject
Nutrition	Consumption Style
	Consumed Part
	Nutritive Speciality

In table 4, it is illustrated how the subjects, reached by the analysis of the answers teachers gave to open-ended questions, were formed.

Sample subject: Consumption Style.

Teacher expression: "… are the ingredients used as salad ingredients. (PS2).

(Code: salad ingredients)

Teacher expression: "cannot be cooked, eaten uncooked … (GT1)

(Code: can't be cooked)

Teacher expression: "the plants generally eaten cooked (GT10)"

(Code: can be cooked)

Since they explain a similar situation with their consumption style, code 1, code 2 and code 3 were unified under "Consumption Style" subject. Similarly, the codes with close meanings in the first code list unified under subjects. The subjects reached similarly "Consumption Style", "Consumed Part" and "Nutritive Specialty" were grouped under "Nutrition" category and presented in the diagnostic part of the research.

Results of Research

The Concepts of Fruit and Vegetable in Teaching Materials

Class materials, used in the context of research topic in the four preschool education institutes that were visited. Some of these materials are the ones made by teachers, the others are the ones prepared by Ministry of National Education (2011). When these materials were analyzed, it was seen, that all the visuals given as an example for fruit, are convenient for the description of the fruit given in literature related to biology. But the fruit part visuals of some vegetables are given as an example of a vegetable. These examples are shown in Table 5.

Table 5. Fruits given as an example of a vegetable.

PowerPoint	Poster	Book
Fruit of tomato	Fruit of tomato	Fruit of tomato
Fruit of pepper	Fruit of pepper	Fruit of pepper
	Fruit of cucumber	Fruit of cucumber
Fruit of eggplant	Fruit of eggplant	
Fruit of green peas	Fruit of green peas	
Fruit of marrow		
Fruit of lemon		

When Table 5 is analyzed, it has been seen, that the fruit part of tomato and pepper plants in three materials, fruit part of cucumber plant in poster and book, fruit part of eggplant and green pea plants in PowerPoint presentation and poster, fruit part of lemon plant in a PowerPoint presentation, have been given as vegetable example.

The frequency of vegetable and fruit concepts in course books, workbooks and teacher books used in basic education has been shown in Table 6.

Table 6. The frequency of vegetable and fruit concepts in books.

	Course book								Workbook								Teacher guide book							
technology	Life Sciences Science and technology				Science and technology				Life Sciences				Science and technology				Life Sciences				Science and technology			
Concept	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Vegetable	0	4	2	5	22	1	4	5	1	0	1	0	15	0	1	0	13	2	11	1	22	7	12	3
Fruit	1	7	6	20	30	36	25	16	1	0	1	0	20	6	2	7	16	4	11	9	25	28	18	3

(MEB, 2012a; 2012b; 2012c; 2012d; 2012e; 2012f; 2012g; 2012h)

When Table 6 is analyzed it is seen, that vegetable and fruit concepts are frequently used in both course books, workbooks and teacher's guide books. Whereas, the vegetable concept is mostly seen in the 5th grade course book, workbook and students' book, the fruit concept is mostly seen in the 6th grade course book and teacher guide book, and in the 5th grade workbook. Nonetheless, teaching of fruit and vegetable concepts don't take place in the Life Sciences Curriculum. Fruit concept has been described accordingly to fruit description in botany in accordance with some acquisitions, such as: "it explains the function of the parts of the floral plant" acquisition in the 6th unit called "Let's see and know Live world" of the 5th grade in Science and Technology curriculum, and " it explains the function of flower by showing its parts in the sample, disk, scheme" and "it shows with the examples that many fruits and seeds are food source for animals and human beings" acquisition in the1st unit called "propagation, growth and development of livings." of the 6th grade science and technology curriculum (MEB, 2012e; 2012f). However, students haven't been given any description or explanation about the vegetable concept in preschool and basic education curriculums.

Here are some examples of fruit and vegetable concepts approached in books: (i) the students are asked to paint the fruits and vegetables in pictures in their own colors in nature in an activity of Life Science Lesson 1st grade student workbook (MEB, 2012a). There are fruits of eggplant, lemon, apple and pepper plant and root of the carrot plant in the pictures. (ii) In Science and Technology Lesson, the 4th grade course book, there is an explanation "such as, vegetables as eggplant, pepper dried to be eaten in winter gets rotten because of sun heat (MEB, 2012d), and there is a fresh fruit of pepper and a dried one's picture on the left of the related page. The dried part is the fruit part of the plant. (iii) In Science and Technology Lesson , in the 5th grade course book, while it is explained which vitamins are in which commodities, the vegetable concept is used frequently, but it is conspicuous that the fruits of the plants are pictured while the pictures of vegetable concept are shown (MEB, 2012e). (iv) In Science and Technology Lesson, in the 5th grade teacher guide book there is an explanation saying "such fruit as carrot, apple should

be eaten by biting." (v) Although in Science and Technology Lesson, in the 6th grade teacher guide book, there is an explanation as "students should be reminded that tomato, cucumber, pepper, etc., are the fruits of the plant (MEB, 2012f) in Science and Technology Lesson, in the 7th grade course book unit called Light, tomato is described as vegetable in an activity called "Let's search and get ready" (MEB, 2012g). As we see in the examples of the books, one of the most important organs of education period includes expressions that may cause misconceptions about vegetable and fruit concepts for the students.

Classification the Concepts of Fruit and Vegetable

The results of visual sheet applied to students are shown in Table 7. In the table, vegetable is "V", fruit is "F", other is "O" and I don't know is "DK".

Table 7. Student Visual Sheet Data.

Visual	Preschool				Primary School				Middle School			
	V (f)	F(f)	O(f)	DK(f)	V (f)	F (f)	O (f)	DK (f)	V (f)	F (f)	O (f)	DK (f)
Strawberry	3	8	0	1	5	94	0	2	4	141	0	0
Marrow	7	3	0	2	85	6	0	10	136	8	1	0
Watermelon	4	7	0	1	13	87	0	1	4	141	0	0
Eggplant	10	0	0	2	92	4	0	5	137	6	0	2
Cucumber	9	2	0	1	87	11	0	3	121	22	0	2
Grape	2	9	0	1	9	91	0	1	3	142	0	0
Tomato	9	2	0	1	80	18	0	3	109	33	0	3
Pepper	12	0	0	0	89	9	0	3	138	5	1	1
Carrot	9	3	0	0	82	19	0	0	133	9	1	2
Lemon	8	1	0	3	76	15	0	10	78	52	2	13
Lettuce	10	1	0	1	89	5	0	7	141	3	0	1
Onion	10	2	0	0	89	11	0	7	139	2	1	3
Green onion	7	3	0	2	86	5	0	10	144	1	0	0
Orange	5	7	0	0	13	87	0	1	7	136	1	1
Spinach	6	0	0	6	80	2	0	19	142	2	0	1
Potato	11	1	0	0	81	14	0	6	130	6	1	8

When the Table 7 is analyzed it is seen, that the fruit parts of strawberry, watermelon and grape plants are accepted as fruit by most of the students. Also, the fruit parts of marrow, eggplant, cucumber, tomato and pepper plants are accepted as vegetable by most of the students. Lettuce, onion, green onion, spinach and potato are accepted as vegetable by most of the students. Lemon is characterized as vegetable in a high rate in the preschool and primary level. This rate is 53.79% in middle school, students marked "other" choice for carrot, onion and potato and said they were roots of the plant and marrow and pepper were leguminous seeds. About lemon 2 and about orange 1 students indicated that they were citrus. Visual Sheet Data of Teachers are shown in Table 8.

Table 8. Teachers Visual Sheet Data.

Visual	Preschool				Grade				Science			
	V (f)	F (f)	O (f)	DK (f)	V (f)	F (f)	O (f)	DK (f)	V (f)	F (f)	O (f)	DK (f)
Strawberry	0	12	0	0	2	55	1	0	0	13	0	0
Marrow	9	1	0	2	49	7	0	2	5	8	0	0
Watermelon	0	12	0	0	1	56	1	0	0	13	0	0
Eggplant	12	0	0	0	53	3	0	2	7	6	0	0
Cucumber	10	0	1	1	43	11	3	1	3	10	0	0
Grape	0	12	0	0	0	58	0	0	0	13	0	0
Tomato	11	0	1	0	42	13	3	0	2	11	0	0
Pepper	12	0	0	0	53	5	0	0	5	8	0	0
Carrot	11	0	0	1	52	4	1	1	10	3	0	0
Lemon	5	7	0	0	12	45	0	1	2	11	0	0
Lettuce	12	0	0	0	57	1	0	0	13	0	0	0
Onion	10	0	0	2	55	3	0	0	13	0	0	0
Green Onion	12	0	0	0	57	1	0	0	13	0	0	0
Orange	0	12	0	0	1	57	0	0	0	13	0	0
Spinach	12	0	0	0	57	1	0	0	13	0	0	0
Potato	11	0	0	1	56	1	0	1	13	0	0	0

When the Table 8 is analyzed it is seen, that the plant strawberry, watermelon, grape and orange are accepted as fruit by all the teachers, no matter what their departments are. About strawberry and watermelon, just one grade teacher, who marked the option "other", wrote that "it is a vegetable of which fruit is eaten". Also, carrot, lettuce, onion, green onion, spinach and potato are classified as vegetable by most of the teachers of all departments. But most of preschool teachers and grade teachers classify the marrow, cucumber, tomato and pepper plants' fruit part as vegetables, while most of science and technology teachers classify them as fruit. While the fruit of eggplant if classified as a vegetable by almost all of the preschool and grade teachers, half of science and technology teachers classify it as a vegetable, the other half does it as fruit. While the fruit of the lemon is classified as fruit by nearly half of preschool teachers, other half classifies it as a vegetable; it is accepted as fruit by most of the grade teachers and science and technology teachers. Moreover, for cucumber 2 grade teachers, for tomato 3 grade teachers and, for carrot 1 grade teacher uses the expression "both vegetable and fruit". And, 1 preschool teacher, and 1 grade teacher for cucumber, 1 preschool teacher for tomato uses the expression "the vegetable of which fruit is eaten".

Defining the Concepts of Fruit and Vegetable

In the open-ended sheet applied to teachers, the question "describe the vegetable and fruit concepts" was described by 10 preschool teachers out of 12, 54 grade teachers out of 58, all of 13 science and technology teachers. 2 preschool and 4 grade teachers said they did not know the descriptions.

In Table 9, see the subjects and categories formed by open coding of 77 teachers.

Table 9. Descriptions of teachers about vegetable and fruit concepts.

Category	Subject	Preschool				Grade				Science			
		Fruit		Vegetable		Vegetable		Fruit		Vegetable		Fruit	
		f	%	f	%	f	%	f	%	f	%	f	%
Nutrition	Consume way	7	70	6	60	45	83.33	32	59.26	5	38.46	3	23.08
	Consumed part	0	0	0	0	7	12.96	3	5.56	4	30.77	0	0
	Nutritious facility	3	30	5	50	4	7.41	13	24.07	3	23.08	6	46.15
Liveliness	Formal features	3	30	1	10	4	7.41	0	0	1	7.69	0	0
	Growth from flower	0	0	0	0	1	1.85	10	18.52	2	15.38	8	61.54
	Grass-ligneous stump	3	30	3	30	11	20.37	15	27.78	3	23.08	3	23.08
	Seeds	2	20	2	20	2	3.70	12	22.22	4	30.77	6	46.15

The descriptions made by teachers are categorized as nutrition and liveliness. Nutrition category consists of the subjects consume way, consumed part and nutritious facility. Liveliness category consists of formal features, growth from flower, grass-ligneous stump and seed subjects.

When the Table 9 is analyzed it is seen that the most used subject of vegetable description is consume way, that takes place in nutrition category. While 7 of vegetable descriptions, 70% made by 10 preschool teachers, considering consume way, this rate is 83.33% for grade teachers and 38.46%, for science teachers. Here is an example of vegetable description made by a preschool teacher:

> "*Vegetable is part of the plant can be eaten, cooked. However, some vegetables can be eaten without being cooked (tomato, cucumber, lettuce, green onion etc.) (PS5).*"

As we see in this description teachers describe vegetables as the parts of the plants eaten after cooked. Nonetheless, teachers express that this description does not include any plant parts they know as a vegetable. In fruit description of preschool and grade teachers the most common subject is, again, consume way while in description of science teachers' most common subject is the growth from the flower. Here is a description of a science teacher:

> *"The thing consists of plant's flower is called fruit (ST6)."*

The subject growth from flower is never used by preschool teachers' descriptions, but in 18.52% of grade teacher descriptions. Just like the following example. Some descriptions focus on plant's consuming parts:

> *"… If the plant's leaves or roots, or itself is eaten it is a vegetable. If the plant's fruit, not itself, is eaten then it is fruit (GT21)."*

The commonality of these descriptions is plant parts out of the pieces called fruit in botany, described as a vegetable. This subject is not seen in preschool teachers' vegetable descriptions, but it is seen in 12.96% of grade teachers' descriptions, 30.77% of science teachers' descriptions.

In fruit concept descriptions this subject is seen just in 5.56% of grade teacher descriptions. In the descriptions, another prominent subject, under nutrition category, is nutritious facility.

Here are two sample description of this.

> "*… Sugar rate of vegetables is less* (GT20)."
> "*The ovary of floral plants grows; they become hydrous and succulent and make the fruit. It is full of vitamins* (ST3)."

As it is seen in these descriptions an important part of teachers take sugar and vitamin rate into consideration while describing the concepts of fruit and vegetable.

Another category that descriptions held is liveliness category. One of the subjects that take place under liveliness category is formal features. While a grade teacher used the colors in vegetable description, a preschool teacher mentioned about fruits being crusty.

"*Vegetable is generally green, orange and red* (GT32)."
"*Fruits are crusty, … foods* (PS3)."

Another important subject to describe fruit and vegetable concepts is grass-ligneous stump subject. The following two descriptions can be made for this:

"*Vegetables are generally one year grass plants* (GT27)."
"*The products grow up on trees called fruit* (ST9)."

Another subject specially used by science teachers in the description is seed subject. The following description can be given as an example of it:

"*They are the things, including plant seeds inside* (ST10)."

A case draws attention in these descriptions is concern pip. Just like following description, this concept was used in the meaning of seed by some other teachers. Also, the description of a grade teacher is important thanks to the point it draws attention.

"*I think that it is a concept settled down in an unconscious, according to the descriptions majority use in daily life. For instance, vegetables are used for making salad. There are generally vegetable meals, etc.* (GT5)."

That teacher draws attention that the concepts vegetable and fruit are acquired by social learning cultural activities.

The answers to open-ended question asked to teachers "Do you think that the contents of teaching programs, course books, workbooks and teacher guide books are enough? Why? Analyzed three categories such as "not enough", "partly" and "enough" occurred as well.

This question was answered by 10 of 12 preschool teachers, 52 of 58 grade teachers and 12 of 13 science teachers. Within this context, the answers of teachers are listed in Table 10.

Table 10. Opinions about teaching programs, course books, workbooks and teacher guide books.

	Not enough		Partly		Enough		Total	
	f	%	f	%	f	%	f	%
Preschool	8	72.73	1	9.09	2	18.18	11	100.00
Grade	39	75.00	1	1.92	12	23.08	52	100.00
Science	8	66.67	0	0	4	33.33	12	100.00
Total	55	73.33	2	2.67	18	24.00	75	100.00

When the Table 10 is analyzed, it is seen that 73.33% of teachers, no matter what their departments are, find the curriculums, course books, workbooks and teacher guide books not enough about vegetables and fruit concepts. This rate for preschool teachers is 72.73%, grade teachers' 75.00%, and science teachers' 66.67%.

To this open-ended question 5 preschool, 29 grade teachers and 4 science teachers answered shortly such as "enough", "not enough" "yes" or "no". The other 47 teachers justified their answers. The subjects occurred with open coding of these teachers' descriptions. The analysis results are shown in Table 11.

Table 11. Explanations about teaching programs, course books, workbooks and teacher guide books.

Category	Subject	Preschool (f)	Grade (f)	Science (f)
	Hard to learn	1	2	
Enough	Social learning is enough	1		
	Simplicity		1	
Partly	Classification lack	1	1	
	Explanations not enough	1	5	6
	No classification		9	3
	Teacher's proficiency		7	1
	There is a misconception	1	3	
Not enough	No related topic		1	2
	Visuals not enough	1	1	
	Proposed activities are not enough	1	1	
	No description	1		
	Examples are wrong	1		

When the Table 11 is analyzed, it is seen that the teachers, who think that curriculums, course books, workbooks and teacher guide books are satisfactory, mostly use the subject "hard to learn". Here is an example explanation of this subject.

> "*… In primary school programs the context is little, but I don't think that it needs to be much. It has to be in high school or bachelor, master programmes* (GT11)."

As it is seen in this explanation, teachers used this subject in their expressions. They think that teaching of fruit and vegetable concepts in preschool and primary school levels is satisfactory, and they should be discussed in higher levels. Also, another grade teacher thinks the topic is easy, so curriculums, course books, workbooks and teacher guide books are satisfactory. A preschool teacher thinking that the context is satisfactory, says that it is enough to learn the topic in social life, not at school. A preschool and a grade teacher said, that the descriptions of fruit and vegetable concepts were made but they were missing. So, it could be added in the explanations of teachers, who said the curriculums, course books, workbooks and teacher guide books are not satisfactory, the most repeated reason is the explanations of concepts are missing and they are superficial. The following explanations can be given as an example for this:

> "*I think it is generally superficial. The context should be improved* (GT28)."

Another prominent reason is, that there is not any classification in order to separate the concepts fruit and vegetable. The following explanation for this:

> "*There is not mentioned about the classification of plants and fruits in the context of Science lesson teaching program* (ST12)."

One of the reasons used mostly in the explanations is teacher proficiency. Following an explanation, there is an example of this.

> "*As my knowledge is limited I cannot comment. If I write this as a teacher it means the knowledge is not enough* (GT38)."

Another reason taken into consideration by teachers is concept confusion.

"*Not enough. Pictures are limited. No enough information below the pictures. Especially in the 1st degree, the subjects such as fruit and vegetable discrimination are not given importance. Our curriculum talks about fruit and vegetable discrimination in the 6th class. Note: I have just learnt what fruit and vegetable are thanks to you. I noticed that the things we learned in daily life were wrong* (GT37)."

With this explanation the teacher indicates that, especially, the things we learn in our daily life affect our educational life. It is among teachers' explanations that concept confusion reacts our educational life as wrong examples:

"*Not enough. We noticed it with this survey. Vide: 1st Class Turkish book, page 68* (GT36)."

When the book that the teacher pointed is analyzed, there seems an activity called "kid and game" on page 68 (MEB, 2012i). In this activity, the fruit of the tomato plant is mentioned as a vegetable.

Discussion

When the research results thought it is seen, that the fruit and vegetable concepts are mostly used in preschool and elementary education. However, it is seen that the teaching programs handled as a part of the research don't include the vegetable concept in preschool and elementary education, teaching of fruit concept is done, according to biology, in the 5th and the 6th grades. Eliason and Jenkins (2003) indicated that "science" is a part of our daily life and so science teaching should be associated with daily life and united with the programme. It can be counted as an important deficiency that concepts such as fruit and vegetable, which we use both in daily life and as a reflection of daily life to the teaching materials, are not used in the contents of our curriculum. Some teachers take into consideration, that learnings of these concepts occur by the effect of daily life. This would cause concepts that are not based on scientific information to occur. Also, it is indicated, that teaching without understanding the concepts completely cannot achieve significant learning (Sigler and Saam, 2006; Snowman and Biehler, 2003). According to this result, it can be concluded, that our students mostly see vegetable and fruit concepts, but they don't have enough scientific information about what they are.

Also, in the literature search done in the beginning of the research it is greeted, that these concept descriptions in different fields are different and they don't have a common description. This is seen in course book used both in preschool and basic education. For instance, even if published by the same publishing house, it is seen that a visual given as fruit in a material can be given as vegetable in another one. Many researchers compel that writers and/or teachers vaguely, can affect students learning the concepts in the wrong way (Barras 1984; Gilbert, Osborne, and Fensham, 1982; Mintzes, 1984, 1989; Osborne, Bell, and Gilbert, 1983; Pines and West, 1986). According to these results we see, that it is necessary to be more careful about preparing the teaching materials and the materials should be analyzed by a common approach of all lessons.

Context confusion may be the result of different reasons (Yip, 1998). Storms, De Boeck and Ruts (2001) indicate that some concepts such as fruit, bird, vehicle and sports are explained by daily language, I mean by the dominant language in the place that is lived. Researchers show that children learn good examples of categories better than weak ones (Heider, 1971; Mervis, 1987; Murphy, 2002; Rosch, 1973). For instance, for fruit category "apple" can be given as a good, "strawberry" middle, and "fig" weak example. In daily language, it does not sound to say "tomato is a fruit" as well as saying "apple is a fruit" (Rosch, 2011). Hampton (1991), similarly, indicates that "apple" is a very good example of fruit, but it is not possible to say the same thing for "olive" and, he asks this question: "If all the things in a category have the same quality, why olive cannot be given as example for fruit". Roch and Mervis (1975), indicate that the qualities of examples in a category may be similar to the quality of examples in another category. If we want to sample this, marrow is an available example of fruit category in botany, but as it is cooked it has the same qualities as the examples of vegetable category (for example, spinach), that's why it is not a good example for fruit category and people cannot classify it as fruit.

In the research Hampton (1991) did, it clearly appears that there is concept confusion about examples, whether they are fruit or vegetable category. A participant, looking at the example, said "I really don't think that it is fruit, and I don't think that it is vegetable either; but it should be one of these." Similarly, in this research, as we see in Table 8, some teachers used the explanation "both vegetable and fruit" for the carrot. A similar research,

Nguyen and Murphy (2003) did, show that preschool children could count the vegetable and fruit examples they are given to the different categories and they don't focus on just one category. In departmental literature search it is seen, that the similar confusion occurs about vegetable and fruit concept descriptions in different countries, as well. They are differently described or sampled in different lessons. It was even a court case if tomato was a fruit or vegetable (Findlaw, n.d.). Classifying the plants as a fruit or vegetable, it is certainly not a decision we instructors can take. However, it is not a good attitude to avoid teaching of these concepts because of this confusion. In this case, explaining these concepts according to student levels can be accepted as the most logical solution so learning so, learning environment can be established to help students understand that these concepts can be perceived differently in different lessons.

When the results of visual form are analyzed it is seen, that fruit parts of strawberry, watermelon, grape and orange plants are accepted as fruit by most of the students and teachers, whereas, the fruits of marrow, cucumber, tomato and pepper plants are accepted as vegetable by most of preschool and grade teachers, and fruit by most of science and technology teachers. In this case, it can be inferred, that preschool and grade teachers' perception of fruit and vegetable concepts in closer to nutrition science, sciences and technology teachers' perception is closer to biology. It is also seen, that students' perception of these concepts in preschool and primary levels does not change in middle school age. However, floral plants take place in science and technology curriculum accordingly biology in the 5th and the 6th level of middle school and students are expected at least to know fruit concept in life science. But, the results of the survey point that students couldn't learn this. In parallel with research results Kete (2006) indicates, that the students of the 7th grade characterize the ones picked up from the tree as fruit, the ones picked up from the soil as a vegetable.

When we think it is hard to intervene the daily experience of the students. It is seen, that teachers and course books have an important role to remove concept confusion about vegetable and fruit concepts. Some researchers point, that teachers also learn from course books (Ball and Cohen, 1996; Remillard, 2000). From research results it is clear, that teachers also see themselves not enough certain about vegetable and fruit concepts. For instance, after indicating that he does not know the concepts sufficiently, a teacher said about the information in books:

"*If as a teacher, I write, it means the information is not sufficient.*"

This may be understood like this, as well "If it was in curriculums or books I would already know." In context, it is conspicuous that both curriculum and course materials are supportive factors for teachers during in-service process.

When teachers' vegetable and fruit descriptions are analyzed it is seen, that the descriptions of preschool and grade teachers are closer to nutrition science. Descriptions of science and technology teachers, especially of fruit, are closer to life science. This meshes with the results of visual sheet. Fruit concept is very important, especially in the life cycle of plants and if it is not understood what fruit is, it means the life cycle of a plant cannot be understood completely, either. Mutlu and Özel (2008) indicate that candidates of grade teacher have insufficiency about floral plants growth and development topics. Uşak (2005) indicates the same thing for candidates of science teacher. It is an undeniable reality that teachers', who are one of the most important factors of the education system, achievement or failure affects the system directly. For these reasons, both candidates of teachers and teacher training during both prevocational and professional life are quite important.

Conclusions

When the results of the study are considered, it is seen that the concepts of fruit and vegetable are often used in teaching materials. However, it is clear that the teaching of these concepts is not enough. Just for meaningful learning, the concepts used in learning process must be used appropriately. Thus, the teaching of these concepts, plays a crucial role in science curriculum.

Different science fields may have different approaches in the process of producing, developing and using scientific concepts. That is, various disciplines may present concepts differently. The concepts of fruit and vegetable can be given as a clear example for this, since these concepts are described differently in nutrition science and botany. By using these concepts, the process of concept development can be better understood.

When the results of the study are analyzed, it is seen that teachers of different branches describe the concepts of fruit and vegetable differently. However, education must be considered as a holistic approach. In different educa-

tion periods, different and opposite knowledge is one of the most important handicaps of meaningful learning. Hence, the training and assessment activities for pre-service and in-service teachers are vital issues that must be taken into account. In doing so, it can help teachers to be in coordination while they teach.

Moreover, it is important to consider an interdisciplinary approach during the process of teaching material preparation. By this way, students can be provided with consistent teaching materials during the period of preschool, primary school, middle school and the rest.

References

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). *Educational psychology: A cognitive view.* New York: Holt, Rinehart & Winston.

Bacanak, A., Küçük, M., & Çepni, S. (2004). İlköğretim öğrencilerinin fotosentez ve solunum konularındaki kavram yanılgılarının belirlenmesi: Trabzon örneklemi. [Primary school students' misconceptions about photosynthesis and respiration subjects: a case for Trabzon]. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 17,* 67-80.

Bahar, M. (2003). Biyoloji eğitiminde kavram yanılgıları ve kavram değişim stratejileri. [Misconceptions in biology education and conceptual change strategies]. *Kuram ve Uygulamada Eğitim Bilimleri, 3* (1), 27-64.

Ball, D. L., & Cohen, D. (1996). Reform by the book: What is-or might be-the role of curriculum materials in teacher learning and instructional reform? *Educational Researcher, 25* (9), 6–8.

Barman, C., Stein, M., McNair, S., & Barman, N. (2006). Students' ideas about plants and plant growth. *American Biology Teacher, 68* (2), 73-79.

Barrass, R. (1984). Some misconceptions and misunderstandings perpetuated by teachers and textbooks of biology. *Journal of Biological Education, 18* (3), 201-206.

Bayrak, C. (Ed.). (2011). *Anne çocuk beslenmesi. [Mother and child nutrition].* Eskişehir: T.C. Anadolu Üniversitesi Yayınları.

Biddulph, F. (1984). *Pupils' ideas about flowering plants. Learning in Science Project (Primary)*. (Working Paper No. 125), (ERIC Document Reproduction Service No. ED 252406).

Bogden, R. C., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods*. Boston: Allyn & Bacon.

Cho, H., Kahle, J., & Nordland, F. (1985) An investigation of high school biology textbooks as sources of misconceptions and difficulties in genetics and some suggestions for teaching genetics. *Science Education, 69*,707-719.

Christdiou, V., & Hatzinikita, V. (2005). Preschool children's explanations of plant growth and rain formation: A comparative analysis. *Research in Science Education, 35*, 471-495.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Upper Saddle River, NJ: Pearson Education, Inc.

Çakır, M., (2001). *Canlılar bilimi. [Science of the living things].* Ankara: Nobel yayın dağıtım.

Çepni, S. (Ed.)., (2011). *Kuramdan uygulamaya fen ve teknoloji öğretimi. [From Theory to application science and technology teaching]*. Ankara: Pegem Akademi

Çokadar, H., (2012). Photosynthesis and Respiration Processes: Prospective Teachers' Conception Levels. *Education and Science, 37* (164), 81-93.

Driver, R. (1989). Students' conceptions and the learning of science. *International Journal of Science Education*, *11*, 481-490.

Driver, R., Squires, A., Rushworth, P., & Wood-Robinson, V. (1994). *Making sense of secondary science.* London and New York: Routledge.

Eliason, C., & Jenkins, L. (2003). *A practical guide to early childhood curriculum, 7.th Ed*. Upper Saddle River, NJ: Prentice Hall.

Estes, Z. (2004). Confidence and gradedness in semantic categorization: Definitely somewhat artifuctual, maybe absolutely natural. *Psychonomic Bulletin & Review, 11,* 1041-1047.

FindLaw. For Legal Professionals. (n.d.). [available online at: http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=US&vol=149&invol=304], Retrieved on January 30, 2013.

Fraenkel, J. R., & Wllen, N. E. (2006). *How to design and evaluate research in education (Sixth Edition)*. New York: McGraw-Hill Companies.

Gay, L. R., Mills, G. E., & Airasian, R. (2006). *Educational research: Competencies for analysis and applications* (8th ed). Upper Saddle River, NJ: Pearson/Merrill/Prentice Hall.

Gilbert, J.K., Osborne, R.J., & Fensham, P.J., (1982). Children's science and its concequences for teaching. *Science Education, 66*, 623-633.

Güneş, T. (2006). *Genel biyoloji. [The general biology].* Ankara: Anı yayıncılık.

Hampton, J. A. (1988). Disjunction of natural concepts. *Memory & Cognition, 16,* 579-591.

Hampton, J. A. (1991). The combination of prototype concepts. In Schwanenflugel, Paula J. (Eds). *The psychology of word meanings* (pp. 1-16). England: Lawrence Erlbaum Associates.

Hampton, J. A. (2012). Thinking intuitively: The rich (and at times illogical) world of concepts. *Psychological Science, 21*, 398-402.

Heider , E. R. 1971 . Focal color areas and the development of color names. *Developmental Psychology, 4*, 447-455.

Karasar, N. (2000). *Bilimsel araştırma yöntemi (12. Basım). [Scientific research method (12. Ed.)].* Ankara: Nobel Yayın Dağıtım.

Karol, S., Suludere, Z., & Ayvalı, C. (2000). *Biyoloji terimleri sözlüğü. [The glossary of biology terms].* Ankara: Atatürk Kültür, Dil ve Tarih Yüksek Kurumu Türk Dil Kurumu Yayınları 2. baskı.

Kesercioğlu, T., (Ed.), (2004). *Canlılar bilimi*. *[Science of the living things].* Ankara: Anı yayıncılık.

Kete, R. (2006). 6. sınıf fen bilgisi biyoloji konularında kavram yanılgıları. [Misconceptions in 6th grade science]. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, 19*, 63-70.

Ketenoğlu, O., Obalı, O, Güney, K. ve Geven, F. (2003). *Ekonomik bitkiler*. *[Economic plants].* Ankara: Bizim büro basımevi yayın dağıtım.

Köse, S., Ayas, A., & Taş, E. (2003). Bilgisayar destekli öğretimin kavram yanılgıları üzerine etkisi: fotosentez. [The effects of computer-based instruction on misconceptions: photosynthesis]. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 14*, 106-112.

Kwon, Y. R. (2003). *Exploring korean young children's ideas about living things.* Unpublished doctoral dissertation, Pennsylvania State University, Pennsylvania, USA.

Lin, S. (2004). Development and application of a two-tier diagnostic test for high school students' understanding of flowering plant growth and development. *International Journal of Science and Mathematics Education, 2*,175-199.

Machery, E. (2011). Concepts: A Tutorial. In R.Belohlavek and G.J.Klir (Eds.)*, Concepts and Fuzzy Logic* (pp. 13-44). Cambridge: MIT Press.

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Mervis, C. B. (1987). Child-basic object categories and early lexical development. In U. Neisser (Eds.), *Concepts and Conceptual Development: Ecological and Intellectual Factors in Categorization*, (pp. 201–233). Cambridge: Cambridge University Press.

Milli Eğitim Bakanlığı (MEB). (2007). *Mesleki eğitim ve öğretim sisteminin güçlendirilmesi projesi, bahçecilik alanı sebzecilik modülü*. *[The project of strengthening the system of vocational education and training, gardening field vegetable module].* Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2011). *Çocuk gelişimi ve eğitimi, okuma-yazmaya hazırlık çalışmaları*. *[Child development and education, preparation for literacy].* Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012a). *İlköğretim hayat bilgisi 1 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 1 life sciences]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012b). *İlköğretim hayat bilgisi 2 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 2 life sciences]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012c). *İlköğretim hayat bilgisi 3 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 3 life sciences]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012d). *İlköğretim 4 fen ve teknoloji öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 4 science and technology]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012e). *İlköğretim 5 fen ve teknoloji öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 5 science and technology]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012f). *İlköğretim fen ve teknoloji 6 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 6 science and technology]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012g). *İlköğretim fen ve teknoloji 7 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 7 science and technology]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012h). *İlköğretim fen ve teknoloji 8 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 8 science and technology]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Milli Eğitim Bakanlığı (MEB). (2012ı). *İlköğretim Türkçe 1 öğretmen kılavuz kitabı*. *[Teacher guide book of elementary 1 Turkish]*. Ankara: Milli Eğitim Bakanlığı Yayınları.

Mintzes, J. J., Trowbridge, J. E., Arnaudin, M., & Wandersee, J. H. (1991). Children's biology: studies on conceptual development in the life sciences. In Glynn, S., Yeany, R., & Britton, B. (Eds.), *The psychology of learning science (*pp. 179-202). Hillsdale, NJ: Lawrence Erlbaum.

Mintzes, J. J. (1984). Naive theories in biology: children's concepts of human body. *School Science and Mathematics*, *84* (7), 548-555.

Mintzes, J. J. (1989). The acquisition of biological knowledge during childhood: an alternative conception. *Journal of Research in Science Teaching*, *26* (9), 823-824.

Murphy, G. L. (2002). *The big book of concepts*. Cambridge, MA: MIT Press.

Mutlu, M., & Özel, M. (2008). Sınıf öğretmen adaylarının çiçekli bitkilerin büyüme ve gelişimi konuları ile ilgili anlama düzeyleri ve kavram yanılgıları. [Preservice elementary teachers' understanding levels and misconceptions related to the grow and development of flowering plants]. *Kastamonu Eğitim Dergisi, 16*(1), 107-124.

Nguyen, S. P., & Murphy, G. L. (2003). An apple is more than just a fruit: Cross-classification in children's concepts. *Child Development, 74,* 1783-1806.

Osborne, R. J., Bell, B. F., & Gilbert, J. K. (1983). Science teaching and children's views of the world. *European Journal of Science Education, 5*, 1-14.

Özay, E., & Öztaş, H. (2003). Secondary student's interpretations of photosynthesis and plant nutrition. *Journal of Biological Education, 37* (2), 68-70.

Özyurt, S. (1992). *Ekonomik botanik*. *[Economic botany].* Kayseri: Erciyes Üniversitesi Yayınları.

Pines, A., & West, L. (1986). Conceptual understanding and science learning: an interpretation of research within a sources of knowledge framework. *Science Education, 70* (5), 583-604.

Remillard, J. (2000). Can curriculum materials support teachers' learning? Two fourthgrade teachers' use of a new mathematics text. *The Elementary School Journal, 100*, 321–350.

Rosch, E. (1973). On the internal structure of perceptual and semantic categories. In T. M. Moore (Eds.). *Cognitive Development and the Acquisition of Language*, (pp. 111-144). New York: Academic Press.

Rosch, E. (2011). "Slow Lettuce": Categories, Concepts, Fuzzy Sets, and Logical Deduction. In R.Belohlavek and G.J.Klir (Eds.) *Concepts and Fuzzy Logic,* (pp. 89-120). Cambridge: MIT Press.

Rosch, E., & Mervis, C. B. (1975). Family resemblances: Studies in the internal structure of categories. *Cognitive Psychology 7*, 573-605.

Sanders, M. (1993) Erroneous ideas about respiration: the teacher factor. *Journal of Research in Science Teaching, 30*, 919-934.

Schoenfeld, A. H. (1992). Learning to think mathematically: problem solving, metacognition, and sense-making in mathematics. In D. Grouws (Ed.), *Handbook for research on mathematics teaching and learning* (pp. 334-370). New York: Macmillan.

Sigler, E. A., & Saam, J. (2006). Teacher candidates' conceptual understanding of conceptual learning: from theory to practice. *Journal of the Scholarship of Teaching and Learning*, *6* (1), 118-127.

Snowman, J., & Biehler, R. (2003).*Psychology applied to teaching* (10th ed.). Boston: Houghton Mifflin.

Stavy, R., & Wax, N. (1989). Children's conceptions of plants as living things. *Human Development, 32*, 88-94.

Storey, R. (1989) Textbook errors and misconceptions in biology: photosynthesis. *The American Biology Teacher, 51*, 271-274.

Storey, R. (1990). Textbook errors and misconceptions in biology: cell structure. *The American Biology Teacher, 52*, 213-218.

Storms, G., P. De Boeck, & W. Ruts (2001). Categorization of novel stimuli in wellknown natural concepts: A case study. *Psychonomic Bulletin & Review, 8*, 377 – 384.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications Inc.

Şensoy, Ö., Aydoğdu, M., Yıldırım, H. İ., Uşak, M., & Hançer, A.H. (2005). İlköğretim öğrencilerinin (6., 7. ve 8. sınıflar) fotosentez konusundaki yanlış kavramların tespiti üzerine bir araştırma. [An investigation to identify the misconceptions of elementary school students (sixth, seventh and eighth grades) about photosynthesis]. *Milli Eğitim Dergisi, 33* (166), 213-223.

Tamir, P. (1997). Studying children's conceptions of life: An example of research carried out by preservice science teachers. *Journal of Science Teacher Education, 8* (4), 241-256.

Temelli, A. (2006). Lise öğrencilerinin genetikle ilgili konulardaki kavram yanılgılarının saptanması. **[**Determination of misconceptions concerning genetic subjects of high school students]. *Kastamonu Eğitim Dergisi, 14* (1), 73-82.

Türkmen, L., Dikmenli, M., & Çardak, O. (2003). İlköğretim öğrencilerinin bitkiler hakkındaki alternatif kavramları. [Primary school students' alternative conceptions about plants]. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi, 5* (2), 53-70.

Uşak, M. (2005). *Fen bilgisi öğretmen adaylarının çiçekli bitkiler konusundaki pedagojik alan bilgileri. [Prospective elementary science teachers' pedagogical content knowledge about flowering plants]*. Yayınlanmamış doktora tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Vardar, Y., & Seçmen, Ö., (1993). *Bitki morfolojisinde temel bilgiler.[The basic information on plant morphology].* İzmir: Bilgehan basımevi.

Veiga, M., Costa Pereira, D., & Maskill, R. (1989) Teachers' language and pupils' ideas in science lessons: can teachers avoid reinforcing wrong ideas? *International Journal of Science Education, 11*, 465-479.

Yıldırım, O., Nakiboğlu, C., & Sinan, O., (2004). Fen bilgisi öğretmen adaylarının difüzyon ile ilgili kavram yanılgıları. [Science teacher candidates' misconceptions about diffusion]. *BAÜ Fen Bilimleri Enstitüsü Dergisi, 6*(1), 79-99.

Yip, D. Y. (1998). Teachers' misconceptions of the circulatory system. *Journal of Biological Education. 32* (3), 207-215.

Received: *May 24, 2014* Accepted: *September 12, 2014*

Hüseyin Eş PhD., Assistant Professor, Sinop University, Faculty of Education, Sinop, Turkey.
Fax: +90 0 368 271 55 30.
E-mail: esfen55@gmail.com, huseyines@sinop.edu.tr
Website: http://sinop.edu.tr/akademikbirimler/fakulteler/egitim/personel/huseyin_es.asp