Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.8, No.7, 2017

Pupils' Understanding of Food Concept: The Assessment of Children's Preconceptions Ideas about Food

Fulya OZTAS[1] Haydar OZTAS[2]
1. Selcuk University, Vocational High School, Konya/Turkey
2. Necmettin Erbakan University, Meram/Konya

Abstract
This paper explains students' ideas about food as a scientific concept that a questionnaire was administered to 40 secondary level students. The findings have been shown that in students' mind food was essential for living, growth and supplying energy. Also students could accept the idea of food could be in liquid form. Students' understanding of the biological concept of food was anthropocentric and not applied across living organisms in heterotrophs (animals) or autotrophs (plants) as a whole.Many students confused water food or not. Mostly water not accepted as a food because of it does not yield energy for organisms. It looks a vital point that to emphasizing food as any substance (in solid or liquid state), can obtainable energy during respiration during alive activity.
Keywords: Food, misconceptions, secondary pupils

Introduction

The learning is a highly complex process involving an individual interacting with external environmental and internal cognitive factors. Presently, cognitive learning theorists seem to be able to account for more of the learning processes than behaviorists (Simpson & Arnold, 1982). Their (cognitivists) ideas will thus form the framework in the investigation of some Turkish Secondary school students' understanding on the scientific concept of food in the biology curriculum.

The constructivist viewpoint emphasizes that a learner's prior knowledge greatly affects learning because he modifies, organizes and stores information not necessarily in the same way he received them. Either the learner abandons his prior experiences and learning completely (which is rare) when confronted with formal instruction or more commonly, there will be some form of syncretism (Gilbert, Osbrone & Fensham, 1982). Thus, alternative frameworks or misconceptions arise and these can act as impediments to science learning.

Other labels that are used to describe misconceptions in science, used often interchangeably, include spontaneous reasoning, children's science, alternative frameworks, naive ideas and preconceptions. Misconceptions (Driver, Guesne & Tinberghian, 1985; Gilbert, Osbrone & Fensham, 1982) share some characteristics. Such as food is anything edible or food could be in one situation is not food in another. Self-centered and anthropocentric thinking such as food to human food or teleological approach as food is food because it is edible.

The topic on food was chosen to investigate students' misconceptions because it is fundamental to understanding other related concepts in biology, for example respiration, nutrition and photosynthesis (Lee & Diong, 1999). Furthermore, all these concepts of biology can be found in the spiral curriculum in the school syllabus from primary to tertiary levels with many misconceptions.

Materials and Method

A questionnaire survey was administered to totally 40 Secondary 8th Grade students in order to sample students' ideas on the scientific concept of food from Turkey. The students aged 14 to 15 years groups and a total sample, 23 girls and 17 boys who study a combined science (Biology, Chemistry and Physic) for previous two years.
The questionnaire modified from Lee & Diong (1999) which used previously a similar research includes six main questions (Table 1). These items included chosen and free reply questions (Treagust, 1988). The questionnaire was administered to the application 8. Grade students' class and respondents were given 40 minutes to complete the questionnaire. The frequencies and percentage distributions of replies were given Table (2-5).

Table 1. The questionnaire applied to students.

1.	***The usual food for daily nutrition how could define ?"***
2.	***Why is eating an important animal activity?***
3.	***A man was injured in a car accident and taken to hospital in an unconscious condition. Since he cannot eat, he was put on an intravenous drip of glucose and saline (that is a needle is inserted into a vein through which the solutions were introduced). Is the man taking in food? Explain your answer as fully as possible.***
4.	***What happens if a person eats only bread for one month?***
5.	***Living things cannot survive without water. Would you group water under the term "food"? YES, water is a food because (explain as fully as possible) NO, water is not a food because (explain as fully as possible)***
6.	***A list of items given below and answer the questions as directed: Tick (/) if you think it is a food, cross (x) if you think it is not a food. Why are the items you have ticked called food? Why are the items you have crossed out not called food? Give your reasons.***

Results and Discussion

In this study the replies of students for six main questions analyzed and whole replies' frequencies and percentage distributions given Table (2-5).

The first question was" The usual food for daily nutrition how could define?" (Question 1).

Student definitions of food Frequency (n=40) gives energy only 6 gives energy, 18 gives energy to live and growth, 7 gives us energy, and to full up, to 6 to make strong 3 non answer (Table 2).

Table 2. Student definitions food concept for daily life.

	f	*%*
Only energy supply	*6*	*15.00*
Gives us energy to live and growth	*18*	*45.00*
Gives us energy, and to full up	*7*	*17.5*
to make us strong	6	15.00
Non answer	3	7.5

The finding appears to be agreed definition of food (Barker & Carr, 1989) food gives useful energy to living organisms. Previous studies it has been shown that food usually acceptable firstly for maintenance of life, and growth, tissue repair and reproduction (Bishop, Roth & Anderson, 1986; Bushell & Nicholson, 1985; Mayes, 1988). In this study a main part of students think of food give them energy for live and growth (45%). The everyday conception of food was not used for surviving manner (Ferrer et. al. 1990). It is possible to suggest that the food concept was variable according to students.

Six of pupils respondents (15%) gave not given main answer (Simpson & Arnold, 1982) when they mentioned that food either gave energy only or in addition to doing something else (Table I).

Previously Simpson and Arnold (1982) found that the reply of student mostly indicate energy in relation to food it can be eaten, consumable, contains nutrients and foods are prerequisites for survival. In general there is a general common view that consuming more food is often associated with well growing.

It has been suggested that students should be taught the food concept in functional terms as organic matter which provides energy for tissue metabolism and allocation of stored energy for growth (Bishop, Roth and Anderson, 1986) .

Q2. Why is eating an important our activity?

The aim of eating food was in order to supplying energy for our life maintains. But energy-giving nature of food showed much lower values.

Table 2. ***Students replies for question "Why is eating an important our activity?"***

	f	***%***
Only energy supply	9	22.5
Gives us energy to live and growth	15	37.4
Gives us vitamins	5	12.5
Fill stomach and make us strong	9	22.5
No answer	2	5.00

It seems that students believe food conception gives energy but energy. But they mostly ignore other functions of food such as making survive, growth and repairing. Previous studies have shown that (Simpson & Arnold, 1982) a third of 14-16 year olds from their sample thought that energy comes from food. Some students (22.5 %) claimed that food consumption which did not go beyond digestive processing. They think food for to fill stomach and make strong. They have completely missed the critical point of eating food. A possible factor might have been the clichéd saying "eat to live, not live to eat" (Lee & Diong, 1999).

Q3. A man was injured in a car accident and taken to hospital in an unconscious condition. Since he cannot eat, he was put on an intravenous drip of glucose and saline (that is a needle is inserted into a vein through which the solutions were introduced). Is the man taking in food? Explain your answer as fully as possible.

The fifty five of respondents correctly believed that the man was indeed taking in food (Table 3). These students have believed that the intravenous drip was a substitute or some kind of food. These students think liquid glucose is a food, even if it is not passed through the gut or blood system by intravenous drip.

Table 2. Student responses for Q3 on whether an intravenous drip was considered to be food.

	f	*%*
Not food		
Glucose & saline not supply energy	*8*	*20.0*
glucose provide energy	*22*	*55.0*
Saline gives emery	*7*	*17.5*
No answer	*3*	*7.5*

Q4. What happens if a person eats only bread for one month?

Table 3. Student responses for Q4 on the concept of a balanced diet.

	f	
Unbalanced Diet	***26***	***65.0***
Fall Ill	***6***	***15.0***
Grows Fat	***8***	***20.0***
Dies	***0***	
No Answers	***0***	

This is a content knowledge question and it was relatively well answered with 26 students (65 %) describing it as an unbalanced diet (Table 3). The other responses were falling ill (15%) and grows fat (20%). These may be depending of daily family and media comments that breed could lead to obesity.

Q5. The water is essential for living things. Do you think water is a food? YES, water is a food because (explain as fully as possible) NO, water is not a food because (explain as fully as possible)

Table 4. Student responses for Q5 on whether water was a food.

	f	*%*		*f*	*%*
Food			***Not food***		
Water is a liquid food	*12*	*30.0*	*It is necessary thirsty*	*7*	*17.5*
Water is food and necessary for digestion	*8*	*20.0*	*Water is vital for digestion*	*9*	*22.5*
Water supply energy	*2*	*5.0*	*Water not contains energy*	*2*	*5.0*

Table 4 shows that the biggest fractions of students believe water is a food (30%). Some other parts are tin the same believe that water is a food (water is food and necessary for digestion 20% and water supply energy 5%). This is openly a misconception that could possible source different environmental factors (Bishop, Roth & Anderson 1986). There is a conflicting over water food or not food on students' minds' that some fractions of student actually knows that water is a vehicle for digestion foods. For this fraction of students water considered necessary for digestion (22.5 %).

Q6. A list of items given below and answer the questions as directed: Tick (/) if you think it is a food, cross (x) if you think it is not a food. Why the items you have ticked are called food? Why are the items you have crossed out not called food? Give your reasons.

In the minds' of students there was a strong relationship between being edible of any item and supplying energy. It is generally accept that paper, soil, wood, chewing gum was not useful for supplying energy and they were inedible (100%). They are not food because they not give energy but others such as bread (100%), grass (27.5 %), milk (95%), fruit juice (62.5%), seed (62.5%) and vegetables (67.5%) are accepted as food (whole or partially) because energy source.

Table 5. Student responses for Q6 arranged from the least to the most "food-like".

	Yes	***%***	***No***	***%***	***It is food because***	***Not food because***
Paper	*40*	*100*	*0*	*0*	-	*Not give energy, inedible*
Soil	*40*	*100*	*0*	*0*	-	*Not give energy, inedible*
Wood	*40*	*100*	*0*	*0*	-	*Not give energy, inedible*
Chewing gum	*40*	*100*	*0*	*0*	-	*Not give energy, inedible*
Seed	*25*	*62.5*	*15*	*37.5*	*It gives energy, Edible*	*Not give energy, Edible*
Grass	*29*	*72.5*	*11*	*27.5*	*It gives energy, Edible*	*Not give energy,*
Fruit juice	*25*	*62.5*	*15*	*37.5*	*It gives energy, Edible*	*Not give energy Edible,*
Milk	*38*	*95.0*	*2*	*5.0*	*It gives energy, Edible*	*Not give energy*
Vegetables	*27*	*67.5*	*13*	*32.5*	*It gives energy, Edible, Stop hunger*	*Not give energy, Edible*
Bread	40	100	*0*	*0*	*It gives energy, Edible, Stop hunger*	-

The Table 5 indicated some questionable results that for instance chewing gum is a food since it contains sugar but whole students not accept it as food. Previous findings show similar results, Lee and Diong, (1999) found less than 40% of their students believed it to be not food . It has been reasoned that students mostly considering an animalistic conception of food; food being something for man or animals.

As can be seen Table 5, students believed that food was food because it was edible (teleological approach). In this study the fruit juice and milk were preferred as food, contrary to our some other studies (Ferrer et al.,1990). Bread, as these authors have found, was considered very food-like by Turkish children as it main source of energy.

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