

# Class Teacher Candidates' Opinions on Genetically Modified Organisms (GMO)

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## Abstract

This study was conducted to determine the Class teacher candidates' opinions on Genetically Modified Organisms. The study was carried out with 101 teacher candidates who were studying in the 3rd grade of Ağrı İbrahim Çeçen University Classroom Teacher Department in 2016-2017 academic year. Of the students who participated in the survey, 56 were girls and 45 were males. Six open-ended questionnaires were used as data collection tools in the survey. In the study, students' opinions on genetically modified organisms were analyzed contextually. Analysis was carried out by calculating the percentage and frequency on the designated categories for each question. In the study, it was concluded that the prospective teachers had knowledge about GMO concept and their usage areas, but did not know about their harmful effects especially to the environment. It has also been determined that classroom teacher candidates have no knowledge of the GMO cultivating and legal arrangements for importing them into the country. How more effective the socio-scientific issues in education faculties is among the recommendations of this study.

**Keywords:** GMO, Class teacher candidates' opinions

## 1. Introduction

It is known that sociological issues are increasingly a part of our lives. Socio-scientific issues are controversial scientific issues that there are disagreements among people and scientists, uncertainties in scientific knowledge, risk and benefit analyzes were made, and social dimensions that people have to decide, both locally and globally (Ratcliffe and Grace, 2003). Nuclear power plants, cloning, global warming and GMO foods are just some of the sociopolitical issues. GMO which was the subject of this study is the organism that made by altering the gene sequence of a living thing or by transferring genes from various bacteria, viruses, animals, and plants to this organism (WHO, 2005). As the production and use of GMOs spread rapidly in recent years, the application areas of these products are expanding to be almost everywhere in life (Özdemir, 2007). However, GMOs have found the widest use in agriculture. Since the first commercialization of GMO crops in 1996, producers have increased the cultivation area of GMO crops by at least 10% every year (Olhan, 2010). There are different opinions on how to obtain nutrients from GMOs. While some scientists have pointed out that this would be a major health and environmental hazard in the future, some scientists believe that this technology does not pose any risk, especially for the rapidly growing population, where nutrient needs are cheaper and healthier. This situation shows the sociolinguistic nature of GMO foods (Kılınc et al., 2013). Many studies have reported that the learning environments based on socio-scientific themes lead students to improve their understanding of science concepts (Klosterman & Sadler, 2010), made students' learning interesting (Zeidler et al., 2009), improve the students' positive attitudes toward science (Lee & Erdogan, 2007), improve students' decision - making and problem solving skills (Sadler & Zeidler, 2005; Topçu et al., 2014).

Therefore, informed decision-making about socio-scientific issues can be said to be an important part of science literacy as the main vision of science education. (Topcu, Muğaloğlu, & Güven 2014). For this reason, science education course "Science Technology Society and Environment" which is updated in 2013 has been included in "Socio-scientific issues" sub-learning field (MEB, 2013). With this curriculum, the science class started to be taught from the third year of primary school. This situation makes the thoughts of socio-scientific subjects of class teacher candidates more important. This study was conducted to determine the opinions of classroom teacher candidates on genetically modified organisms from socio-scientific conclusions.

## 2. Method

The special case method was used in this study. The special case method allows an in-depth examination of an event. The situation to be investigated can sometimes be a school, a person or a group (Wellington, 2000). This method focuses on the nature of a situation and allows the use of different data collection techniques such as questionnaires, interviews (Çepni, 2009).

### 2.1. Sample

This study was carried out with 101 students studying in the 3rd grade of Ağrı İbrahim Çeçen university

classroom teaching department. Of the students who participated in the survey, 56 were girls and 45 were girls.

### 2.2. Data collection tools

A questionnaire created by the researchers benefitting from the literature was used as a data collection tool in this study. The questionnaire is a model that can reveal current situations such as opinions, attitudes, interests, skills and abilities of a group (Büyüköztürk, 2014). In this study, six open-ended questions about GMOs were asked to teacher candidates. While the questions were being developed, the literature on the subject was firstly searched and a pool of questions was created for the survey questions that could be used in the study. Questionnaires to be used for the study were then determined together with a specialist. Survey questions were reviewed by a language expert and made final after the necessary arrangements were made.

### 2.3. Analysis of Data

The data obtained from this study were subjected to content analysis. The answers given by the teacher candidates to the questions were carefully examined by the researchers and similar explanations made for each question were collected under the same category. In the study, more than one given meaningful responses to some survey questions were included in different categories. The percentages and frequencies for each level of the generated categories were calculated and presented to the reader with the tables. Analysis of the data showed that 85% of the results of the two investigators were consistent with each other.

## 3. Findings

In this section, the analysis results of the answers given by the questionnaire survey of classroom teacher candidates were tabulated and presented to the reader. The categories that were formed in the direction of analyzing the answers given by the teacher candidates to the question “What do you understand from Genetically Modified Organism?” are presented in Table 1.

Table 1. The categories formed in the direction of the answers that teacher candidates answered the question “What do you understand from Genetically Modified Organism?”

	Frequency	Percentage %
Differentiate the structure of the organization	5	5
Get more products	7	7
Hormonal food	7	7
Genetically modified food	28	28
Organisms played with the originality	35	34
Mutated organism	19	19
<b>Meaningless/No answer</b>	<b>5</b>	<b>5</b>

As shown in Table 1, 35% of the teacher candidates used the phrase “Organisms played with their originality ” to answer the question, while 28% used the phrase "food played with genetics". While the proportion of the "mutated organism" expression was 19%, the proportion of "getting more products" was 7% and "differentiating the organism's structure" was 5%. The proportion of teacher candidates who respond meaningless or not to answer this question was 5%.

The categories created in the analysis of answers given by preservice teachers the question “In what areas are genetically modified organisms used?” are presented in Table 2.

Table 2: The categories created from the answers given by preservice teachers to the question “In what areas are genetically modified organisms used?”

	Frequency	Percentage %
Used in agricultural field	41	41
Used in fruit and vegetable production	22	22
Used to extend shelf life	15	15
Used in all living organisms	13	13
Used to combat agricultural pests	9	9
<b>Meaningless / no answer</b>	<b>9</b>	<b>9</b>

As seen in Table 2, 41% of the candidate teachers answered the question "In which areas GMO is used", 22% of them were answered the same question using "Used in fruit and vegetable production" expressions. The proportion of the expression "used for prolonging shelf life" was 15%, while the expression "used to combat agricultural pests" was 9% and the proportion of "used throughout living organisms" was 13%. The percentage of teacher candidates whose answer was meaningless or no answer this question is 9%.

Table 3 shows the categories that were formed in the direction of the analysis of answers given by teacher candidates in the question whether they could give examples of genetically modified products.

Table 3: The categories that were formed from the answers given by teacher candidates to the question whether they could give examples of GMOs

	Frequency	Percentage %
Corn	48	48
Rice	21	21
Soybean	10	10
FEEDS	11	11
Fruits and vegetables	14	14
Canola	8	8
<b>Groundnut</b>	<b>5</b>	<b>5</b>

As seen in Table 3 ,48% of the preservice teachers answered "corn" and 21% answered "rice" the question "Can you give examples to GMOs?" The proportion of "fruits and vegetables" was 14% while the proportion of "feeds" is 11% and the proportion of "soy" was 5%. The proportion of teacher candidates whose answer was meaningless or no answer this question was 5%.

The categories created in the analysis of answers given by teacher candidates the question “For what purpose are genetically modified organisms used in agriculture?” are given in Table 4.

Table 4: Categories of teacher candidates' responses to the question of what purpose GMO is used in agriculture.

	Frequency	Percentage %
For carrying the desired characteristics of the product	2	2
To get more products in a short time	25	25
To increase efficiency	48	48
To earn more money in an economic sense	14	14
For the product to be resistant	8	8
<b>Meaningless / no answer</b>	<b>7</b>	<b>7</b>

As seen in Table 4, 48% of the prospective teachers answered the question “what purpose GMO is used in agriculture” using "To increase efficiency" and 25% of them answered the same question using "to get more products in a short time". The ratio of "to earn more money in an economic sense" was 14 % while the ratio of 8% "for the product to be resistant" and 2% for " for carrying the desired characteristics of the product" was realized. The proportion of teacher candidates who do not answer the question or their answers were meaningless were 7%.

The categories that were formed in the direction of analyzing the answers given in the question “What could be the potential harm to the human health of genetically modified organisms by preservice teachers?” are given in Table 5.

Table 5: Categories of teacher candidates' responses to the question of possible damage to the human health of the GMO

	Frequency	Percentage%
Hormonal disorders	29	29
Ineffectiveness of antibiotics	9	9
Risk of cancer	57	57
Deterioration of human metabolism	5	5
Obesity	20	20
Decrease in body resistance	6	6
Unpredictable Disturbances	2	2
<b>Meaningless / No answer</b>	<b>14</b>	<b>14</b>

As seen in Table 5, 57% of the candiate teachers who answered the question "What are the possible damages to human health of GMOs" have answered "Risk of cancer" and 29% of them have answered "Hormonal disorders". While the proportion of "obesity" was 20%, the proportion of "Antibiotics ineffectiveness" was 9%, "decrease in body resistance" 6% and "Unpredictable disturbances" was 2%. The ratio of the teacher candidates whose respond meaningless or not to answer this question was 14%.

The categories formed in the analysis of the answers given in the question “What are the possible damages to the environment of genetically modified organisms?”are given in Table 6.

Tablo 6: The categories created by the answers that teacher candidates answered the question “What are the potential harmful effects of GMO to the environment of the?”

	Frequency	Percentage %
Ecosystem degradation	20	20
Destruction of natural species	9	9
Disruption of the natural equilibrium	29	29
Decrease of soil productivity	19	19
Degradation of the natural structure of the soil	10	10
<b>Meaningless / No answer</b>	<b>20</b>	<b>20</b>

As can be seen in Table 6, 29% of the teacher candidates answered the question of "What are the possible harmful effects of GMOs on the environment?" using "Disruption in the eastern equilibrium" and 20% answered using "Ecosystem deterioration". The ratio of "reduction of soil fertility" was 19% while the expression "degradation of natural structure of soil" was 10% and "the disappearance of natural species" was 9%. The percentage of prospective teachers whose answer was meaningless or not to answer this question is 20%.

The categories created in the analysis of the answers given by the teacher candidates to the question “Do you think there is a legal regulation on the cultivation of genetically modified organisms in our country and the entry into our country? If so, do you have information about this arrangement?” are given in Table 7.

Tablo 7: The categories created from the answers given by the teacher candidates to the question “Do you think there is a legal regulation on the cultivation of genetically modified organisms in our country and the entry into our country? If so, do you have information about this arrangement?”

	Frequency	Percentage %
There are legal regulations but I do not have information	34	34
No legal regulation	41	41
No knowledge	20	20
<b>Meaningless answer</b>	<b>5</b>	<b>5</b>

As Table 7 shows, 42% of the prospective teachers use the phrase "no legal regulation" while 34% answered the question using the phrase "there are legal regulations but I do not have the knowledge" and the rate of "no knowledge" is 20%. All of the candidates who have said that “there are legal regulations” stated that “i do not have information about the regulation”. The proportion of the teacher candidates who do not answer or their answers meaningless are 5%.

#### 4. Conclusion and Discussion

This study was conducted to determine the opinions of classroom teacher candidates about genetically modified organisms. Genetically modified organisms according to Chao (2007); Is defined as "different quality organisms resulting from the introduction of new features by living organisms through the alteration of the gene sequences possessed by living things through some biotechnological methods". When table 1 is examined, it was seen that 35 % of teacher candidates answered the question “ What do you understand from the word GMO?” by using the phrase “Organisms played with their originality”. For the same question, 28 % of them answered "Food played with genetics", 19 % answered "Mutated organism" and 5% using "differentiating the organism's structure". Even if these statements are not entirely correct, they are considered to fit the GMO definition in the basic sense. In this study, it is seen that 7% of the prospective teachers answered the question using the expression "hormonal food". Ergin, et al. (2008) and Uzunkol (2012) reported that the students described the GMO concept as “hormonal food”. While 12% of the teacher candidates responded to the question using expressions not directly related to the definition of GMOs, the proportion of the teacher candidates who gave meaningless answer or not answered the question was 5%. Therefore, it can be said that teacher candidates have a basic knowledge of GMO concept. In the studies . Sorgo ve Dolinsek (2009), Kılınç & Sönmez (2012) ve Koçyiğit (2015), it is stated that teacher and teacher candidates are generally knowledgeable about GMOs and that this knowledge is not influenced (Koçyiğit, 2015) by gender, age and department factors. Therefore, it can be said that the study overlaps with the literature in this respect.

It is seen in Table 2 that classroom teacher candidates use expressions related to different uses of GMOs in the study. Apart from the expressions "used in the field of agriculture", "used in the production of fruit and vegetables", the percentages having the highest percentage of the question are also used for "prolonging the shelf life and used to combat agricultural pests ". Teacher candidates in the study gave 69% corn and rice "as an example to the GMO. "Fruits and vegetables", "feeds", "soya" and "canola" are also among the other expressions used. When we look at the answers to the questions about the GMOs in agriculture, it is seen that the expressions "to increase the yield" and "to obtain more products in a short time" have the highest percentage. Apart from this, it is seen that "the product is resistant" and "the product has the desired characteristics" are used by the teacher candidates at least. Taking advantage of these data, it can be concluded that teacher candidates have knowledge

about GMO usage areas and best known examples. This situation is thought to be due to the fact that the written and visual headings give a lot of news about GMOs.

In the study, survey questions about the possible harms of the GMO to human health and the environment have the highest category (meaningless/question-answering) of the teacher candidates. Among the possible damages to the human health of GMO Teacher candidates' expressions were also included "cancer risk", "hormonal disorders" besides "obesity", "antibiotics are ineffective", "reduction of body resistance" and "unpredictable diseases". The ratio of the teacher candidates who respond meaninglessly or not to answer this question was 14%. The proportion of the "harm in the natural equilibrium" and "degradation of the ecosystem" in relation to the harmful effects of the GMO to the environment was 49% in total. "The reduction of soil productivity", "deterioration of soil materials", "extinction of native species" were expressions used by other teachers to answer the question. The percentage of prospective teachers who respond meanlessly or not to answer this question was 20%. From this point onwards it can be concluded that teacher candidates have lack of knowledge about GMOs harmful effects on human health and especially the environment.

"Is there a legal regulation on cultivation of GMO in Turkey and entry into the country?" 42% of the prospective teachers responded by using the phrase "there is no legal arrangement" while the proportion of the respondents who answered the question by using the "no knowledge" statement was 20%. 34% of the candidates answered the question using the phrase "There is a regulation but I do not have the knowledge about it". The proportion of the teacher candidates who do not answer or answer the question meaninglessly was 5%. It was understood from this that 66% of prospective teachers were not aware of GMOs and related regulations. It was also seen that 34% of the teacher candidates who stated that there is a legal regulation about GMOs but I do not have any information about the regulation. From this, it can be concluded that class teacher candidates do not have knowledge about GMO regulation. Koçyiğit (2015) reported that close to the whole of the society have no knowledge about organizing GMOs.

The Biosafety Law, which is included in the Official Gazette GMO related regulations, was published as Law No. 5977 in the Official Gazette No. 27533 dated 26 March 2010 (Ünal 2013). According to this law;

- Marketing the GMO and its products without approval,
- Use or use of GMOs and products contrary to the decisions of the Board,
- Production of genetically modified plants and animals,
- The use of GMOs and products outside the scope and purpose determined by the Board within the scope of marketing,
- Use of the GMOs and their products outside the purpose and scope determined by the Board in the context of marketing,
- GMOs and their products are prohibited to be used in baby food and infant formula, follow-on foods and follow-on formula and in additional baby and additional small child foods. Up to now 3 GD soya and 16 GD maize varieties have been approved for feed purposes. There are no GMOs have been approved for the purpose of food.

## 5. Recommendations

In this study carried out in order to determine the opinions of classroom teacher candidates about the genetically modified organisms, it was concluded that the prospective teachers have had no information about the harmful effects of the GMO especially on the environment. It has also been determined that more than half of the classroom teacher candidates were not aware of the GMO training and legal arrangements for entry into Turkey. In this context, it is thought that it may be useful to put lessons that will raise awareness about Socioscientific aspects, especially in the departments of education faculties such as Classroom and science teaching departments. The inclusion of socioscientific issues in the community service practices included in the education programs in the education faculties may be effective in terms of behavior development.

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