How sensitive teachers are in elementary and secondary science classes in terms of technology and environmental ethics

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Abstract

This study aimed to determine the sensitivity of science teachers towards technology and environmental ethics. The study group comprised science teachers and classroom teachers working in the city of Mugla in 2016–2017, and data were collected using a 36 item Likert technology and environmental ethics questionnaire. Cronbach's alpha reliability coefficient of the questionnaire was calculated as 0.8. For analysis of data, percentages, arithmetic mean, standard deviation, *t*-test, one-way variance analysis and frequencies were used in the SPSS 20 program package. The responses given to the questionnaire items were analysed in terms of the branches of the participating teachers. The responses given to the items regarding benefits to living things differ significantly in favour of the classroom teachers. The item with which the participating teachers agreed to the highest degree was, 'Teaching individuals how to utilise resources most effectively by getting to know environment should be a part of education'.

Keywords: Ethical sensitivity, teachers, technology ethics, environmental ethics.

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1. Introduction

Morality is defined as the needs of society, human habits directed to interests, traditions-customs and publicly accepted self-formed prohibitions and evaluations. As a domain of moral philosophy, ethics is a branch of philosophy exploring these behaviours philosophically and trying to explain and evaluate them. In other words, it is an act of saying something about morality (Aydin, 2015, p. 27). The concept of ethics exploring the bad and the good can be explained in general by means of three approaches. The first of these is the applied ethics investigating how ethical standards, principles, values, ethical dilemmas and selections that arise in certain professions are applied to a certain issue (Resnik, 2004, p. 35). The second approach is meta-ethics (analytic ethics), investigating whether ethical standards, values, principles and theories can be verified or not, their nature and meanings of the concepts related to moral terms. While meta-ethics seeks answers to questions such as 'why is it good?' or 'what do we mean by good or right for a particular action?', at the same time it deals with the theoretical issues of understanding and validating behaviours. The third approach is the normative ethics seeking answers to questions such as 'what should be?', 'how to act?', 'what is right/wrong?' and 'what is good/bad?' with ethical theories including ethical principles and ethical rules. It includes the field of study in which questions are asked about which general norms, standards, principles, concepts, values and theories are important in determining or dealing with acceptable behaviours in terms of morality (Arslantas, 2015).

1.1. Teacher and ethics

According to Akbas (2008), morality, ethics, self-esteem, feelings of appreciation, values, expectations and attitudes are included within affective education. Besides cognitive objectives, schools have affective objectives that should be accomplished by their students. One of the teachers' duties is to teach values explicitly stated in the school programme, to discipline pupils in accordance with the established rules and to contribute positively to their moral development (Akbas, 2008). To do so, the teacher should primarily be equipped with ethical formation and be highly aware of ethical issues (Ceyhan, 2013). It is therefore important that teachers have the ability to analyse their own actions and have the ability to make ethical decisions (Arslantas, 2015). Apart from being able to be ethical in terms of professional qualifications, teachers should teach some ethical approaches to their students. The teaching profession is not only focused on transferring information but also requires emphasis on ethical issues (Ottekin-Demirbolat & Aslan, 2014). For example, within science education there are gains associated with the learning area of science-technology-community-environment learning, which deals with ethical elements in educational programmes. One of them is related to biotechnology in the 4th topic of the 5th unit of the 8th grade science course '8.5.4.1. He/she can discuss the negative and positive effects of biotechnology applications today by using research data'. There is also another one which is in the 5th unit of the science topics taught by the classroom teacher '4.4.5.2. He/she can explain the adverse effects of noise pollution on human health and environment'. In such discussion processes, the ethical thinking is of great importance in determining and directing good behaviours. At that point, teachers' ethical sensitivities come to the fore. Ethical sensitivity is an important element in deciding and understanding ethical problems and requires conscious interest in ethical thinking and attaching importance to this issue (Yildirim & Kadioglu, 2007). Ethical sensitivity plays an important role in the moral adequacy of teachers, and this issue should be taken into account in the teaching profession, which prepares individuals for the future (Kuusisto, Tirri & Rissanen, 2012).

All attitudes and behaviours that are effective in given decisions are influenced by the social environment, including the school life of the individual. On ethical judgements, personal experiences and families (Keskin-Samanci, Ozer-Keskin & Arslan, 2014), regional differences, ethical culture, interacted environment (Forsyth, O'Boyle & McDaniel, 2008) and character (Ki, Gonzenbach, Choi & Lee, 2012) are influential. The person's gender is also influential on ethical decision-making processes (Wuensch, Jenkins & Poteat, 2002). In this regard, the research has revealed that females have a

greater tendency to make ethical decisions than males (Ki et al., 2012; Lau & Haug, 2011). It was found that the age is also influential on making ethical decisions (Wuensch et al., 2002) and older people make more ethical decisions than younger ones (Ki et al., 2012). The research also showed that cultural life and the environment in which people are living are affecting ethical decisions by shaping moral values (Forsyth et al., 2008; Jung, 2009).

While teachers are training students, who will work in different professional groups in the future; they should take great care for their students to be good citizens who can display good behaviours in the face of dilemmas. It is clearly known that in the technology world, which is faced with a new development with each day, there are situations leading individuals to dilemmas particularly in the fields of biotechnology and information technologies. While researching this issue, though many topics have been encountered, technology and environmental ethics have particularly come to the forefront.

Popular headings and the ethical problems caused by them are as follows: The power possessed by genetic technologies has led to emergence of some ethical problems such as distortion of the natural balance of the human body, gene pollution, the risk of using genetic information as a biological weapon, works to create a superior human or human labour to be worked in hard works, gender discrimination, inability to establish a standard medical care quality, insurance agencies' increasing their premium rates (Akman & Tuncer, 2012, p. 83; Demir, 2013). When the issue of ethics is examined in the field of medicine, it is seen that the most controversial issues are the increasing number of people waiting for organ transplantation, artificial organs and transplanting organs between different species (Ceyhan & Sahin, 2015). The design, construction and supervision errors of engineering works can cause accidents in daily life and big disasters such as earthquakes can cause greater devastation due to such errors. After such events, it has been determined that there is a need for ethics education in engineering and some studies are needed in this subject (Kline, 2002). The issue of ethics that we encounter in many fields is also a subject of study in the aviation sector. Its aim in this area is to train individuals who regard flight and passenger safety as the most important principle while aiming to improve airline maintenance technicians, academicians and cabin crews individually or organisationally (Cantekin, Bilada & Durmus, 2015). Since almost all individuals in society are users of information technology, they are expected to demonstrate the required sensitivity in solving ethical problems arising from this technology (Zeybek & Beyhan, 2014).

Another important focus of our study is the environmental ethics which was brought to the fore, especially in the late 20th century, when environmental problems adversely affected human life. Williams (2016), who works in the field of science and technology education, investigated the most popular topics in technology education in the past 8 years, both in conferences and in journals. This study investigated a total of 1,187 articles presented and published in 2006–2013 in several conferences and journals in England, America, Australia, New Zealand and the Netherlands. In the Dutch journal 'International Journal of Technology and Design Education' in 2006–2013, the most researched topic was the environment. In the American journal 'Journal of Technology Studies' in 2011–2013, the greatest emphasis was put on the topic of online learning within the context of information technologies. In the 'Biannual Technology Education Research Conference' held in Griffith University in Australia in 2006–2010 the highest number of presentations was made on the topic of values and beliefs in technology education. The same topic became the most discussed topic in this conference in 2006–2013. The most discussed topics in the 'International Symposium on Ethics of Environmental Health' symposium focusing on the environmental ethics are: food, health and environment, ethical issues in relation to the environment, effects of radiation on human health, risks posed by the modern technology for human health and ethical principles to be followed by humans for a healthy environment (*Second International Semposium on Ethics of Environmental Health*, 2016).

2. Methodology

2.1. Participants and Sampling

The sampling of the current study comprised of 3rd and 4th grade classroom teachers and science teachers working in schools in the city of Mugla (n = 75).

2.2. Data collection tools

The data of the current study were collected using the Technology and Environmental Ethics Questionnaire developed by researchers and field experts to determine the participants' ethical sensitivities towards technological and environmental issues. The participants responded to the questionnaire items by marking one of the alternative options: 'strongly disagree', 'disagree', 'agree', 'strongly agree'.

2.3. Data analysis

In the data analysis, the percent (%), mean (M), standard deviation (SD) and frequency (N) were determined utilising the SPSS 20 software package. A t-test and one-way variance analysis (ANOVA) were also conducted. For multiple group comparisons, homogeneity of variance was assessed by Levene's test. The t-test was used in the examination of the gender variable for the survey and scale items; ANOVA was used in the examination of the branches of the participating teachers.

Investigation of the data obtained from the questionnaire in relation to the participants' branches revealed that the group for which the highest number of significant differences was found in favour of the classroom teachers is 'Minding benefits for living things'.

Table 1. *t*-test results according to branch

Item no	Branch	N	M	SD	t	P
Q1	Classroom teacher	31	3.7	0.46	−3.557	0.001
	Science teacher	44	3.0	0.96		
Q2	Classroom teacher	31	3.7	0.461	−2.380	0.024
	Science teacher	44	3.4	0.545		
Q11	Classroom teacher	31	3.7	0.461	2.291	0.041
	Science teacher	44	3.3	0.837		

The responses given to three items in the group of minding benefits for living things significantly differ in favour of the classroom teachers ('I adopt a conscious approach towards technology and environment' M_C = 3.7, M_s = 3, $t_{(-3.557)}$, p < 0.05, 'Environmental consciousness encourages individuals to take the responsibility of their own behaviours' M_C = 3.7, M_S = 3.4, $t_{(-2.380)}$, p < 0.05, 'Environmental issues should be considered as a whole not for only humans but also for other living and non-living things' M_C = 3.7, M_S = 3.3, $t_{(-2.291)}$, p < 0.05).

Based on the findings of the genetics questionnaire, means (M) and percentages for several items are summarised in Table 2.

Table 2. Means and frequencies of the questionnaire items

Item	Mean	Percentage (%)			
		Strongly disagree	Disagree	Agree	Strongly agree
1. I adopt a conscious approach towards technological and environmental issues	3.32	5.3	1.3	44	48
2. Environmental consciousness encourages individuals to take the responsibility for their own behaviours	3.54	—	1.3	42.7	56
10. Even if there are some environmental risks I approve of countries' using their own natural resources	2.13	25.3	45.3	20	9.3
11.Environmental issues should be considered as a whole not only for humans but also for other living and non-living things	3.50	4	1.3	34.7	60
12. I support regulations to be made to protect the habitat of turtles (Carettacarettas)	3.66	—	—	33.3	66.7
13. It is a necessity in today's world to open natural habitats to human settling	2.17	26.7	45.3	12	16
18. Teaching individuals how to use resources efficiently by knowing the environment should be a part of education	3.76	—	—	24	76
26. Humans are posing a threat to the productive potential of natural resources by overusing and misusing them	3.74	—	—	25.3	74.7
32. In the case of human utility, natural resources such as plant and animal species and caves and travertine can be spoiled or destroyed	1.97	44	26.7	17.3	12
34. Biotechnology is for human use and scientists should be allowed any type of biotechnological research and application	2.45	12	42.7	30.7	13.3
36. I am against installing wind tribunes in fertile agricultural lands	2.93	10.7	18.7	36	33.3

Means and frequencies were calculated by considering the items with which the participants agreed the most and the least. The items with which the participants most agreed were found by summing the items marked as agree/strongly agree and the items with which the participants least agreed were found by summing the items marked as disagree/strongly disagree. The items with which the participants agreed the most in the Technology and Environmental Ethics Questionnaire are: 'I support regulations to be made to protect the habitat of turtles (Carettacarettas)' (*M* = 3.66, 100%), 'Teaching individuals how to use resources efficiently by knowing the environment should be a part of education'. (*M* = 3.76, 100%) and 'Humans are posing threat to the productive potential of natural resources by overusing and misusing them' (*M* = 3.74, 100%). The items with which the participants agreed the least are: 'Even if there are some environmental risks I approve of countries' using their own natural resources'. (*M* = 2.13, 29.3%), 'It is a necessity in today's world to open natural habitats to human settling'. (*M* = 2.17, 28%), 'In case of human utility, natural resources such as plant and animal

species and caves and travertine can be spoiled or destroyed'. (*M* = 1.97, 29.3%) and 'Biotechnology is for human use and scientists should be allowed for any type of biotechnological research and application' (*M* = 2.45, 44%).

3. Discussions and conclusion

When the responses to the Technology and Environmental Ethics Questionnaire are examined in terms of gender and branch variables, it is understood that the gender variable does not make a significant difference in the opinions of the teachers. Likewise, Kahyaoglu (2009), as a result of his study exploring the pre-service teachers' opinions about science and technology and environmental issues, concluded that their opinions do not vary significantly by the gender variable. Gercek (2016) conducted a study to determine the participants' perception of the environmental ethics and found that there is no significant difference between the male and female participants' perceptions. Ahi & Ozsoy (2015), in their study exploring the elementary school teachers' attitudes towards the environment, revealed that female teachers have more positive attitudes than males. When the responses of the participants to the questionnaire items were examined in terms of the branch variable in the current study, it was found that responses given to three items in the group of minding benefits for living things significantly differ in favour of the classroom teachers. When similar studies are examined in terms of the branch variable, it is seen that Kahyaoglu (2009) investigated the pre-service science teachers and classroom teachers' perceptions of the connection between science and technology and environmental problems and found that the pre-service elementary science teachers have stronger opinions about the items that science and technology always involve some ambiguous thoughts, science and technology are the main causes of environmental problems and at the same time they are the main means of solving these problems than those of the pre-service classroom teachers. A high level of agreement with the item 'Teaching individuals how to use resources efficiently by knowing the environment should be a part of education' indicates the importance attached to education in human life. What is aimed through education on technology and environmental issues should be to raise awareness and develop sensitivity. According to Ozpinar, Kazeskeroglu and Oz (2010), depending on the department the students attend their ethical conceptions differ; particularly the participants having taken some training about ethics provide much more effective and conscious responses, indicating the importance of education.

Yilmaz and Ogretmen (2016) did a study to discover the pre-service biology teachers' level of information about gene technology and sources of information and concluded that regardless of whether they have taken some training about gene technology, high majority of the participants have low levels of information about gene technology; that is, they feel inadequate on this issue. Therefore, the awareness of both teachers and pre-service teachers should be raised about these issues and then some activities should be organised to enhance their sensitivity. According to Hayirlidag, Arslan and Buken (2015), 'new products' to be manufactured through gene technology should be evaluated very well in terms of consumer behaviours. They also stress that while great care should be taken to shape consumers' behaviours, a consistent policy needs to be followed in our country in terms of both production and consumption of genetically modified organisms (GMOs) and seeds. Thus, a highly conscious society can be created and their sensitivities can be enhanced. Akgul, Afacan and Mertoglu, (2013) conducted a study to determine the elementary school science teachers' awareness of GMOs and found that high majority of them do not have enough information about GMOs and biotechnology and that they are not much knowledgeable about the ethical aspects of these issues. They suggested that studies should be conducted to determine and raise the awareness of genetically modified products and the effects and applications of biotechnology.

4. Suggestions

Rapidly developing technology in today's conditions has led to increasing damage to the environment, necessitating measures to be taken in this regard. It is important to educate environmentally conscious people who use technology efficiently in environmental issues posing greater dangerous for future generations. Therefore, first teachers need to be sensitive to technology and environmental issues. As such, courses to teach ethical issues at education faculties should be incorporated into the programmes of these faculties. Within universities, ethics associations should be established and they should organise informative activities. Thus, teachers with high ethical sensitivity can be trained and future generations can be made more environmentally sensitive. In elementary education, in courses especially the ones addressing science issues, activities should be organised to raise students' awareness of ethics. Discussion environments should be created by leaving students in dilemmas. Thus, they can develop their own sensitivities by conducting intellectual activities to reach the correct behaviour. In this connection, the best guidance can be offered by teachers having a high level of ethical sensitivity.

Acknowledgements

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