



JOURNAL
OF BALTIC
SCIENCE
EDUCATION

ISSN 1648-3898 /Print/

ISSN 2538-7138 /Online/

Abstract. *The aim of this research was to (1) compare the effectiveness of OIDDE (Orientation, Identify, Discussion, Decision, and Engage in Behavior) learning model and conventional learning models in improving bioethics knowledge; (2) compare the effectiveness of OIDDE learning model and conventional learning models in improving ethical decision-making abilities; (3) comparing the effectiveness of OIDDE learning model and conventional learning model in improving ethical attitudes. The research design was a quasi experimental non-equivalent control group design pre-test post-test. The research population was the second semester students of the biology pre-service teachers' department of biology education of the FTTE Muhammadiyah University of Malang. Sampling was done by simple random sampling and obtained 76 students were divided into 37 students in the experimental group and 39 students in the control group. Data collecting is carried out through bioethical knowledge tests, and ethical decision-making, and scoring of ethical attitudes. Data were analyzed by ANCOVA, Kolmogorov-Smirnov, and unpaired T test. The results showed that there were significant differences in the effectiveness of achieving improved bioethics knowledge, ethical decision making, and ethical attitudes between OIDDE and conventional learning models, namely the effectiveness of OIDDE learning models higher than conventional learning models.*

Keywords: *bioethics knowledge, biology pre-service teachers, ethical attitudes, ethical decisions, OIDDE learning model.*

Atok Miftachul Hudha

*State University of Malang & Muhammadiyah
University of Malang, Indonesia*

Mohamad Amin

State University of Malang, Indonesia

Sutiman Bambang Sumitro

Brawijaya University of Malang, Indonesia

Sa'dun Akbar

State University of Malang, Indonesia

THE EFFECTIVENESS OF OIDDE LEARNING MODEL IN THE IMPROVEMENT OF BIOETHICS KNOWLEDGE, ETHICAL DECISION, AND ETHICAL ATTITUDE OF BIOLOGY PRE- SERVICE TEACHERS

**Atok Miftachul Hudha,
Mohamad Amin,
Sutiman Bambang Sumitro,
Sa'dun Akbar**

Introduction

Bioethics is a key opening point in examining ethical dilemmas on the 'aspects of life, among other ethical dilemmas: such as environment, health, medicine, as well as the ethical dilemmas of life and animal welfare. A bioethics study contains values, morals and ethics that are essential for shaping the ethical behavior of human power in the 21st century. Maftuh (2016) states that the 21st century requires human resources that behave ethically. Ethical behavior must be established early from school through learning in the classroom, but according to Hudha (2015) bioethics has not been part of the study of learning in the classroom, especially, in biology field and biology education.

Bioethics in Indonesia has not yet developed extensively as an interdisciplinary or multidisciplinary study, whereas according to Forte (2012) bioethics is a broad interdisciplinary field study and not a specific discipline. Bioethics also addresses the values, morals, and ethics of life (Minarno, 2010, 2012). However, it has not been widely developed at various levels of education either integrated into special studies. Therefore, bioethics needs to be taught at various levels of education with various methods (Helland, 2002), and at least taught to adolescents, high school students, and students to be able to apply well towards other people and living things on earth (Iancu & Anitei, 2014). As a part of the philosophical point of view (Berger, 2005), bioethics discusses the relationship between humans and humans or humans with other living beings who must respect each other (Kusmaryanto, 2015).

The absence of bioethics that is integrated with biology learning becomes the factor of not socialized knowledge of bioethics, so the knowledge of bioethics becomes low. In the findings, Hudha, Amin, Sumitro, and Akbar (2017) show that as many as 75% of the 123 biology teacher students know



only bioethics as a vocabulary, and 25% of respondents do not know about bioethics. Furthermore, Hudha (2015) states that 100% of student respondents never make ethical decision-making related to bioethics dilemma. It underlies the importance of bioethics to be taught to students, in order for them to have the competence of bioethics knowledge and ethical decisions, to be able to be ethical.

Knowledge is a central point to achieving progress (Mihaela, 2009), because knowledge will build science (Maftukhin, 2015), and the continuity of knowledge encourages the continuity of decision-making (Urbancová & Urbanec, 2012). Likewise, with ethical knowledge, a person can be used to create the moral space needed for ethical decision-making (Pollard, 2015). Ethical decisions can not be done with limited and superficial knowledge but must be with skills, sensitivity, ethical knowledge, life experiences, virtues and information, and commitment (Nora, Deodato, Vieira, & Zoboli, 2016). Thus, the improvement of bioethics knowledge and ethical decisions is very important and can be pursued through learning bioethics issues (Klungland, 2002), in the form of a discussion of moral dilemmas (Sihkabuden, 2004), and effective discussion is through a small group of 4-5 people in a heterogeneous environment (Arends, 2012). The discussion is one of the important stages in the syntax of the OIIDE learning model because, through discussion, it will support the meaningful learning process. In the process of discussion, there will be interdisciplinary and collaborative learning, which will create meaningful learning conditions (Janarto, 2010), and will place students with diverse backgrounds and abilities to work together in small groups to achieve common goals (Mahmudi & Pd, 2006).

Along with the development of science and technology, the learning of bioethics becomes important given to biology pre-service teachers. Chowdhury (2016) argues that giving moral, ethical, values and character education studies in the curriculum of science and teaching are important to face technological progress and globalization. The study of bioethics on biology pre-service teachers can be done by integrating the courses in the field of biology, such as zoological courses as one branch of biology. Bioethics integrated with zoological courses can be implemented to solve ethical dilemmas of bioethics on the ethical problems of human behavior in treating animals as well as the use of experimental animals as well as human behavior for animal welfare.

Integration of bioethics in biology courses can be done to instill five essence of virtue, which is to act wisely, do justice, dare to take risks, love life, and do honesty. These four essences of virtue constitute the content of characters that support moral behavior and are used to help solve the problems of bioethical ethical dilemmas on the development of biological research results, as well as biotechnology products other than using bioethics. Thieman and Palladino (2013) point out, the implications of biological research and the application of biotechnology, especially those related to medical science have led to biological ethics called bioethics.

The learning process depends on the role of the teacher who becomes the agent of change for the student's personality. Teachers in the 21st century are facilitators of student learning and creators of classroom environmental productivity so students can develop the skills they need (Yuen Fook & Nazamud-Din, 2017). Biology pre-service teachers with bioethics, so that to become a professional teacher in the 21st century have to able to shape the personality of his students to behave or behave ethically. It is based on the idea that the future of man is determined by the ethics he formed (Mautner, 2009) because in everyday life all humans face a moral dilemma (Macer, 2008), even ethical issues synergize with human capacity-building (Miah, 2011).

Moral dilemmas can be solved through bioethics learning, because bioethics learning can enhance moral development, including moral development in students (Mascarenhas & Rosa, 2010). The study of bioethics also enhances bioethics knowledge and ethical decision making (Casini et al., 2014; Drumwright, Prentice, & Biasucci, 2015; Klungland, 2002; Macer, 2008), as well as improving ethical attitudes (Macer, 2008), and creating an ethical climate in students (Drumwright et al., 2015). The study of bioethics should be given by different methods according to the level of education (Helland, 2002). Therefore, bioethics learning is very appropriate given to biology pre-service teachers by using OIIDE learning model. The OIIDE learning model is a decent learning model for values learning because the learning model is oriented to learning to solve ethical bioethics dilemmas (Hudha, Amin, Sumitro, & Akbar, 2016a, 2016b). Thus, the implementation of the OIIDE learning model is important to know its effectiveness in improving bioethical knowledge, ethical decision-making and ethical attitudes of biology pre-service teachers.

OIIDE learning model was a learning model that is implemented for learning process that aims to bring out values and ethics according to the learning material, so that students are able to behave ethically (Hudha et al., 2016b). The OIIDE learning model as an acronym of *Orientation, Identify, Discussion, Decision, and Engage in Behavior* has five syntaxes as in Table 1.



Table 1. Syntaxes of OIIDE learning model.

OIIDE Learning Model Syntax	Teacher Activity	Student Activity
Phase 1: <i>Orientation</i>	<ul style="list-style-type: none"> a. Preparing and directing the students to study. b. Deliver the learning material by providing material reinforcement through ethical dilemma stories, or historical narratives of ethical problems, or showing documentary films on ethical problems related to the learning material. 	<ul style="list-style-type: none"> a. Preparing and directing them selves to learn, according to the learning material. b. Observing and paying attention to the presentation of learning material, as well as focusing on the material of strengthening ethical dilemma issues which presented by the lecturer
Phase 2: <i>Identify</i>	<ul style="list-style-type: none"> a. Assigning each student to identify the findings of ethical dilemmas of ethical problems from the material presented. b. Appointing students randomly to explain the findings of ethical dilemmas of ethical problems that have been identified. c. Informing that the result of the identification of ethical dilemmas is the topic of group discussion. 	<ul style="list-style-type: none"> a. Identifying ethical dilemmas for the problems presented by lecturers with: <ol style="list-style-type: none"> 1) Find the values and conflict values in ethical dilemmas. 2) Examine the facts of ethical dilemmas faced (reviewed); 3) Make a synthesis between facts and dilemmas; 4) Choose the issue of priority ethical dilemma as a material for discussion; 5) Identify. b. Explain the chosen priority ethical dilemma for the identified ethical problems.
Phase 3: <i>Discussion</i>	<ul style="list-style-type: none"> a. Divide the students into small heterogeneously groups (4-5 people for each group) to discuss. b. Become a facilitator and mediator of group discussions. c. Become the moderator of the presentation and moderator of question and answer session of the discussion results. 	<ul style="list-style-type: none"> a. Form a heterogeneous discussion group between 4-5 people per group. b. Consult to determine the topic of discussion based on the identification of the ethical dilemma of each student. c. Manage democratic discussions on the topic of discussion through determining the role of each group member. d. Presenting the results of group discussions in front of the class and conducting question and answer session. e. Arrange the results of the discussion to be used as a basis for decision making. Ethics.
Phase 4: <i>Decision</i>	<ul style="list-style-type: none"> a. Requesting each discussion group to determine ethical decision making on ethical problems in the discussion topic b. Requesting each discussion group to convey their ethical decisions results from the group discussion. 	<ul style="list-style-type: none"> a. Establish the ethical decisions on ethical dilemmas of ethical problems that are the topic of discussion. b. Conveying the ethical decisions of ethical problems discussed.
Phase 5: <i>Engage in behavior</i>	<ul style="list-style-type: none"> a. Directing the students to make ethical or written ethical statements that illustrate the involvement of ethical behavior on the ethical decisions of the group discussions. b. Summing up the results of the learning process with students 	<ul style="list-style-type: none"> a. Write an ethical statement that describes the involvement of ethical behavior on ethical decisions according to the topic of group discussion in an honest and transparent manner. b. Make conclusions on the material that has been studied with the lecturer.

Research Focus

This research focused on the purpose of examining the effectiveness of the implementation of the OIIDE learning model, namely: (1) Whether it is effective in improving bioethics knowledge; 2) Whether it is effective in enhancing ethical decision-making skills; (3) whether it is effective to improve ethical attitudes, for the biology pre-service teachers.

Methodology of Research

General Background

This research was a quasi-experimental research with the pre-test post-test non-equivalent control group design. OIIDE learning model is an experimental group and conventional learning model is a control group.



Table 2. The table of research design.

Group	Pre-test	Treatment	Post-test
E	O ₁	X ₁	O ₂
C	O ₃	X ₀	O ₄

Note: X₁: OI DDE learning model; X₀: Without OI DDE learning model (Conventional); E: Experiment; C: Control

This research was conducted for three months from February to April 2017 on Zoology lectures that integrate bioethics. The materials that students studied during the research were nine topics, namely moral and ethics, ethical theories, rules of bioethics, ethical decisions, class Chondrichthyes, class Osteichthyes, class Amphibia, and class Reptilia. Class meetings are held once a week with the duration of 100 minutes per meeting.

Implementation of OI DDE learning model is done at each meeting with syntax according to (Hudha et al., 2016b), namely: *Orientation, Identify, Discussion, Decision, and Engage in Behavior*. The conventional learning model is an implementation of the learning model that has been commonly applied so far in lectures and courses. Thus, learning model innovations are needed. The results show that the innovation learning model given to the experimental group further improves the understanding of concepts rather than conventional learning in the control group (Artayasa, Susilo, Lestari, & Indriwati, 2017).

The implementation of the learning syntax of the OI DDE learning model starts from stage 1: *Orientation*. At this stage the lecturer presents learning that is supported by strengthening the material of the factual bioethics, ethical dilemma in the field or the screening of documentary films relating to human behavior that is unethical towards animal classes. For example, a fish exploitation documentary with Cyanide poison or with a bomb, exploitation of shark fins and letting the fish die in the event that the wound loses its fin, and exploiting *Rana cates-biana* and being cooked alive. Stage 2: *Identify*. Each student has to identify ethical dilemmas found from material and documentary films to be used as discussion material. Stage 3: *Discussion*. Each student discussing in a small group (4-5 people) which begins with deliberation determines the topic of discussion for his group based on the results of the identification of each student's ethical bioethical dilemma. At the discussion there was a presentation of the results of the discussion of each group in front of the class by all members of the discussion group Stage 4: *Decision*. The results of the discussion for each group are ethical decisions based on each discussion topic of each group. Stage 5: *Engage in behavior*. The ethical decision results of each discussion group are manifested in the form of an ethical attitude in the form of the ethical behavior of each student who is written in writing honestly. This written statement of ethical behavior describes the actual behavior of each student in responding to ethical dilemmas of bioethical problems discussed based on learning material.

Sample of Research

The research population was the second-semester biology pre-service teachers on department of biology education of the Faculty of Teacher Training and Education Muhammadiyah University of Malang, East Java, Indonesia which consists of 123 students. The sample of the research were 76 students who were taken at simple random technique, divided into experimental groups as many as 37 students, as well as a control group of 39 students.

Instrument and Procedures

Research data for bioethics knowledge and ethical decision making were obtained from the results of the description test. Data from the improvement of ethical attitudes were obtained from the questionnaire instrument scoring with five-level Likert items: 1) strongly disagree, 2) disagree, 3) neither agree nor disagree, 4) agree, and 5) strongly agree (Azwar, 2012, 2013). The test is given to both classes twice, i.e., pre-test and post-test. The pre-test is given at the first meeting in the third week of February 2017 and the post-test is given the last meeting, i.e., in the first week of April 2017. The test consists of 15 items of description with item 0-6 scores. All test items are valid ($p < .05$). The Cronbach Alpha score tests the bioethics knowledge and ethical decisions of 0.889 indicating that the tests are reliable (Arikunto, 2006; Siegar, 2015; Sudjana, 2008).



Data Analysis

Test the differences in the effectiveness of the OIDDE learning model and conventional learning models on improving bioethical knowledge and ethical decisions was made with Analysis of Covariance (ANCOVA). The score obtained in the pre-test was a covariate to determine whether the post-test is significantly different, and before the application of ANCOVA, the Kolmogorov-Smirnov normality test is performed first, and the Levene homogeneity test.

Test the difference in the effectiveness of the OIDDE learning model and conventional learning models for improving ethical attitudes was done with an unpaired T test. The ethical attitude score, derived from the questionnaire examination given on the basis of five-level Likert item, could be: 1) strongly disagree, 2) disagree, 3) neither agree nor disagree, 4) agree, and 5) strongly agree. The results of Likert scale scores were further processed with an unpaired T test. All data analyzes were performed through Statistical Package for Social SPSS for Windows version 22.

The end of this research was by tracing the response of learning model implementation of OIDDE to all biology pre-service teachers in the experimental group through a questionnaire to get an overview of the implementation of OIDDE learning model. The response result serves to complete the data related to the practicality of the OIDDE learning model as well as to contribute to the discussion of the research.

Results of Research

The results of data analysis that have been done to know the achievement of the increase of knowledge of bioethics in experimental group and control group are presented in Table 3. The result of ANCOVA analysis in Table 3 shows the difference of effectiveness of OIDDE learning model to the achievement of bioethics knowledge improvement.

Table 3. The test result of ANCOVA learning model effectiveness against the knowledge of biology pre-service teachers' bioethics.

Source	df	F	P
XKnowledge	1	192.350	< .0001
Class	1	205.020	< .0001
Error	73		

Based on the results of ANCOVA test in Table 3 can be known, F arithmetic difference learning model (class) was 205.020 with p -value < .0001. Thus, the H_0 that reads no difference in the achievement of bioethics knowledge between the experimental group and the control group is rejected. Therefore, the research hypothesis which reads that there is a difference in the achievement of bioethics knowledge between the experimental group and the control group is accepted. Therefore, there is the influence of OIDDE learning model on the achievement of bioethics knowledge in biology pre-service teachers.

The analysis of the corrected average of each group that is the experimental group and control group is presented in Table 4.

Table 4. The corrected mean of bioethics knowledge of biology pre-service teachers.

Group	Pre-test	Pos-test	Difference	Enhancement	Corrected Mean
Experimental	67.865	79.162	11.297	16.65%	72.095
Control	45.077	48.615	3.539	7.85%	55.32

Based on Table 4 it can be seen that the achievement of increasing the bioethics knowledge of biology pre-service teachers who receive the OIDDE learning model in the experimental group is significantly higher than that of the biology pre-service teachers who receive conventional learning in the control group. Increased knowledge bioethics of biology pre-service teachers in the experimental group was 16.65% and the bioethics knowledge improvement of biology pre-service teachers in the control group was 7.85%. This showed that the OIDDE learning model influences the achievement of increasing the bioethics knowledge of biology pre-service teachers.



The next analysis is to examine the effect of the OIDDE model on the achievement of biology pre-service teachers, as shown in Table 5.

Table 5. The test result of ANCOVA learning model effectiveness against ethical decisions of biology pre-service teachers.

Source	df	F	p
Class	1	41.582	< .0001
Error	73		
Total	76		

Based on the results of the ANCOVA test in Table 5, it can be seen that F calculated the different treatment of OIDDE learning model is 41,585 with p -value < .0001. Thus, the H_0 that reads no difference in the achievement of ethical decisions between the experimental group and the control group is rejected. Thus, the research hypothesis which reads that there is a difference in the achievement of ethical decisions between the experimental group and the control is accepted. That is, there is the influence of learning model OIDDE achievement of ethical decisions of biology pre-service teachers. In this research, LSD (*Least Significance Different*) test is not necessary because the study only consists of two treatments.

As for the corrected average analysis of each class, the experimental group and the control group is presented in Table 6.

Table 6. The corrected mean of the ethical decision of the biology pre-service teachers.

Group	Pre-test	Pos-test	Difference	Enhancement	Corrected Mean
Experimental	78.892	90.243	11.351	14.39%	81.634
Control	54.205	60.205	6.000	11.07%	68.373

Based on Table 6 it is known that the achievement of ethical decisions of biology pre-service teachers who receive the OIDDE learning model in the experimental group is significantly higher than that of the biology pre-service teachers who receive conventional learning in the control group. The achievement of ethical decision making in the experimental group is 14.39% and the achievement of the ethics decision making of the students in the control group is 11.07%. This shows that the OIDDE learning model has an effect on improving the ethical decision-making ability of the biology pre-service teachers.

The ethical attitudes in this research were analyzed by unpaired T-tests, and summaries to determine whether there were differences in ethical attitudes of biology pre-service teachers in the experimental and control groups, are shown in Table 7.

Table 7. The summary of the t-test results is not a pair of ethical attitudes.

		t-test for Equality of Means		
		t	df	p (2-tailed)
Ethical behaviour	Equal variances assumed	18.886	74	< .0001
	Equal variances not assumed	18.604	53.998	< .0001

Based on Table 7 it is known that the value of T arithmetic obtained is 18.604 with p -value < .0001. Thus, H_0 which reads no difference in achievement improvement of the ethical attitude of biology pre-service teachers who accept the OIDDE learning model in the experimental group with biology pre-service teachers receiving conventional learning in control group. Thus, the research hypothesis that there is the difference of attainment of ethical attitude among experiment groups with control is accepted. Therefore, there is the influence of the OIDDE learning model to the improvement of ethical attitudes of biology pre-service teachers.



The end of the research is traced to the response of the learning model implementation of OIIDE to all biology pre-service teachers in the experimental group. The result is that the biology pre-services teachers in the experimental group like and are very happy to learn zoology with the OIIDE learning model because during the learning process, the biology pre-service teachers feel that their self, has the flexibility to criticize, the potential of ethical thinking to solve the ethical dilemma of bioethics. The biology pre-serve teachers feel the atmosphere of life in learning in the classroom, so suggest adding hours of class in the classroom because the learning time is felt quickly.

Meanwhile, biology pre-service teachers in the conventional group do not respond to the implementation of learning. Biology pre-service teacher in the conventional group feels happy with the learning of bioethics which is integrated in the course of zoology and see, that important bioethic is given in order to increase knowledge wider.

Biology pre-service teachers in the experimental group argue that the OIIDE learning model should not only be implemented in zoology courses, but also in other courses in biology. Biology pre-service teachers like learning with the OIIDE learning model, because the learning process is fun, not focusing on lectures, even discussions are well executed and live, no more self-assertive students because all are given the opportunity to play a role, and each student is critical and creative.

The matter that becomes a complaint of students in the experimental group is the time spent for learning with OIIDE learning model on 100 minutes is not enough, so the learning hours need to be added. Responding to student complaints about less learning time for the learning process with OIIDE learning model indicates that student response to the implementation of OIIDE learning model is very positive so that the OIIDE learning model is feasible to be implemented in various learning areas. The research findings show that the OIIDE learning model produces interesting and fun learning.

Discussion

The result shows that the average score of bioethics knowledge and ethical decisions, as well as the unrelated T-test results from the experimental group, were higher and significantly different than the control group. This means that the implementation of the learning model OIIDE is more effective in improving bioethics knowledge, ethical decisions and ethical attitudes of biology pre-service teachers than conventional models. The findings of Klungland (2002); Helland, (2002); Lindqvist (2002); Árnason (2004); Macer (2008); and Casini et al. (2014) also show that bioethics learning has an influence on bioethics knowledge and ethical decisions. Also findings of Hudha, Amin, Husamah, Indradi, and Wardojo (2016), show that the implementation of the OIIDE learning model optimizes ethical decisions and students' ethical attitudes toward ethical dilemmas of reproductive behavior.

Various factors that affect the results, such as the implementation of the syntax of OIIDE learning model encourages students to take better responsibility for learning and completing each task more effectively. It is seen in every implementation of the syntax of learning. In the first syntax, the orientation, students receive learning materials concept -the concept of bioethics and ethical decision-making integrated into zoology courses through lectures, questions and answers, and power points, also presented documentary films of ethical bioethics dilemmas relating to learning materials. Joyce, Weil, and Calhoun (2009) state that orientation can be given through the giving of stories, historical narratives, or documentaries, making learning interesting; Anthony, Aryani, and Wrastari (2014), also state that giving orientation in learning affects cognitive and affective learning outcomes.

Therefore, the implementation of the OIIDE learning model in studying zoology that integrates bioethics through the ethical orientation of bioethics dilemma encourages the increase of bioethics knowledge and ethical decision making of biology pre-services teacher. Hudha (2015) asserts that bioethics knowledge and ethical decision-making ability cannot be separated from the ability of logic and moral development that exists in each individual. Wisesa (2011) states that ethical decision-making involves an ethical reasoning process which inside it collaborates with one's moral awareness and cognitive moral ability.

The integration of bioethics in zoology lectures is very precise, because the results of this research indicate an increase in the achievement of bioethics knowledge that is very significant in biology pre-service teachers in the experimental group, as well as provide significant instructional impact and significant impact. The positive impact is shown by the increasing care of biology pre-services teachers toward various issues of bioethics problematics and the growing awareness of ethics in using experimental animals in the implementation of laboratory experiments with animals.

In the second syntax implementation, the biology pre-service teachers are known that they are able to identify the ethical dilemma of bioethics, indicated by the focus in mapping the ethical problems of ethical bioethics.



Thus, by illustrating the concept of bioethics under their control, they became sensitive to the ethical dilemma of bioethics. As Sinaga and Suhandi (2015) state that the identified concept can be mapped in accordance with hierarchy and poured in the form of concept maps. The concept of bioethics understood in the orientation stage and manifested in identification indicates the mastery of the concept of bioethics, so that the identification implementation improves students' bioethics knowledge.

The third syntax, discussion, is a collaborative activity in deciding on a group problem, and according to Paramita and Kristiana (2013) through a group discussion qualitative data is collected and decisions are made. Group discussion activities were conducted by referring to the Arends (2012), which was conducted in small groups (4-5 people) heterogeneously. A large group in the discussion should be avoided, as it can create uncomfortable conditions in sharing thoughts, opinions, beliefs, and experiences of the discussion participants (Onwuegbuzie, Dickinson, Leech, & Zoran, 2009). Thus, through small group discussion activities in a heterogeneous process, mutually reinforced knowledge of bioethics was resulting in a pattern of democratic discussion.

The process of discussing ethical bioethics dilemmas in a heterogeneous and ethnic group in the OIIDE learning model turns out not to increase knowledge of bioethics, but also to improve ethical decision-making. This is supported by the findings that discussions are more effective than lectures, so the discussion has an effect on the improvement of knowledge (Sakiyah, Jaji, & Muharyani, 2015). This is indicated by the findings of research, that the thinking patterns of prospective teachers are always based on bioethics in discussion, namely: (1) always raise the concept of bioethics in every conversation related to the ethical dilemmas of life ethics problematics, (2) always associate the discussion argument with the rules or principles of bioethics expressed Beauchamp and Childress (2001); Dunsford (2015); Ebbesen, Andersen, and Pedersen (2012), and Minarno (2012); i.e autonomy, beneficence, non-maleficence, and justice. This means that the syntax of the OIIDE learning model supports the increased bioethics knowledge and students' ethical decision-making abilities.

Other new findings are the presentation of the results of group discussions presented by all group members in front of the class, and not the representative of the group raises the positives: first, the emergence of the pattern of cooperation and the growth of mutual respect to the members of the discussion group; second, the strength of the learning process centered in the students, because no students are more prominent than the other students in the discussion and presentation of the results of the discussion, this is due to the mutual empathy among fellow members of the third discussion group, the growth of mutual cooperation and collaboration among members of the group discussion, the fourth increasing knowledge of bioethics and decision making ethical in biology pre-service teachers, due to the complex assignment given by the lecturer.

Implementation of the fourth syntax, decision, is supporting to improve the ability of biology pre-service teachers in making ethical decisions. Research findings indicate that the ability of ethical decision-making of biology pre-service teachers in the experimental group is higher than the control group; this is a significant influence of the implementation of learning model OIIDE. According to the opinion of Drumwright, Prentice, and Biasucci (2015), through the study of ethics one can improve ethical decision-making and ethical climate in the students. The ethical decision-making is determined by the nature of ethical dilemmas solved (Sweeny & Costello, 2009). Good ethical decision-making besides encouraging the growth of instructional effects in the form of mastery of learning materials, also encourages the growth of good impacts in the form of ownership skills, attitudes and habits both in studying and utilizing science and technology, critical thinking, discipline, responsibility, cooperation, tolerance and the like (Rahmat, 2008).

Increasing the ability of biology pre-service teachers in making ethical decisions is a reflection of the concept of good bioethics, as well as a good ability to solve problems. Through solving the problem students are able to acquire several skills such as observation, discovery, and scientific thinking (Maulida, Juanengsih, & Mardiaty, 2017). Triyuni (2016) states that problem-solving implementation is a model that can be used to encourage students to improve their ability in a concept, to think reflectively in teaching and learning process, to solve the problem of their lives skillfully and rationally according to the stages of the logical process.

Achievement of increased bioethics knowledge and higher ethical decision-making skills of biology pre-service teachers in experimental groups than biology pre-service teachers in control groups is the evidence that collaborative OIIDE learning models can improve learning outcomes and have high levels of effectiveness. Therefore, a more comprehensive and competitive quality and learning process can be done through the updating of learning models that place students as subjects (student centered learning) and not as objects (Mursid, Nugrahadi, & Siagian, 2014). Therefore, it can be stated that the OIIDE model of learning is effective for learning values, including life or bioethics values. Considering that bioethics is an interdisciplinary and complex study of



science, appropriate learning models for moral and ethical learning should be considered. Corner (2008) states that students can understand the problem, critically evaluate and take action based on knowledge; it must consider what knowledge is developed.

The next syntax stage is engaged in behavior, which is shown by the biology pre-service teachers with the determination of ethical behavior involvement on the ethical dilemma of bioethics that they learn. The form of behavioral involvement that leads the biology pre-service teachers in the experimental group through the implementation of this OIIDE learning model is the expression of ethical behavior which is expressed verbally and honestly against the ethical decision has been set. The establishment of ethical attitudes that reflect ethical behavior that describes attitudes can be verbally poured (Azwar, 2012), as the theory of tripartite attitude (Ajzen, 2005; Azwar, 2012).

The findings of this study which indicate the improvement of ethical attitude of biology pre-service teachers in the experimental group is better than the improvement of ethical attitude of biology pre-service teachers in the control group. It indicates that the OIIDE learning model is more effective than the conventional learning. The existence of the syntax engaged in behavior support is increasing the ethical attitude of biology pre-service teachers in the experimental group, because with the growth of involvement behaviors form self-concept in the form of ethical attitude.

Establishing an ethical attitude is not an easy thing due to the widespread contradiction between the facts in society and the implementation of classroom learning. Solomon's (2001) findings suggest that ethical attitudes require specific responsibility for achieving their development. In educational institutions, ethical attitudes are well established, but in a community environment the formation of ethical attitudes is hard to find. Such a situation is also expressed by Tanyid (2014), that there is currently a gap in the right values, if in school the values of good and right are well planted, but in society it can happen not to give good ethical values and be correct.

Attempts to shape ethical values and attitudes have been done through school culture, living, ethics, honesty, compassion, love to learn, being responsible, respecting laws and regulations, respecting others, loving jobs, saving, hardworking, on time (Maryamah, 2016). As for the stages undertaken according to Maryamah (2016) include: value, technical level development, social level development, school culture development among students, and evaluation of school culture.

Based on the results of this research one can indicate that the ethical attitude of biology pre-service teachers increased significantly after given learning with OIIDE model of learning compared to biology pre-service teachers in the control group. Thus, the formation of ethical attitude through learning on the students should begin by providing knowledge about ethics with learning model that is, in line with the findings of Sari (2016) which shows that students who are equipped with knowledge of ethics and able to apply it, in the future no longer commit violations of the code of ethics, so that after graduation they can improve the image of their profession.

It is important to emphasize that learning values should be developed in the 21st century, because Scott (2015) mentions that global development requires a learning model capable of transforming the need to address global challenges through formal education. Through education that is expected to produce students who have the quality to live as creative individuals, innovative, intelligent, and competent globally (Usmeldi, Amini, and Trisna, 2017). Therefore, OIIDE learning model is one of the learning models that is able to form 21st century human resources that are creative, innovative, intelligent, competent, and even able to behave ethically. This is based on the evidence that the OIIDE learning model in addition to improving bioethics knowledge also enhances ethical decision-making ability and ethical attitude of students. According to Fesol, Salam, Osman, Bakar, and Salim (2016), the most effective teaching methods and different learning styles will help educators maximize their learning materials.

The study of bioethics, which contains moral and ethical aspects, becomes important to be integrated in various fields of learning, including various fields of biology. As stated by Kuhse and Singer (2009), bioethics is a substitute for the term "Science of survival" which should be taught at all levels of education. Integrating bioethics materials to biology learning through existing courses and taught by OIIDE learning model is an improvement in biology learning, as it can improve bioethics knowledge, ethical decision-making, and student ethical attitudes. The instructional impact and accompanying effects of such bioethics learning certainly fosters ethical behavior. Ethical behavior is a core competency needed by 21st century human resources (Maftuh, 2016).

The learning of moral and ethical values through bioethics is important given to biology pre-service teachers, as so far the study of values, morals and ethics is only through subjects of civics, basic social sciences, religious sciences, and campus culture. Helland, (2002) states that bioethics learning needs to be taught at different levels of education by different methods.



Developing bioethics knowledge through integrated bioethics learning into learning through OIIDE learning model is a learning that is known to improve bioethics knowledge, ethical decisions, and ethical attitude of biology pre-service teachers. Collaboration of bioethics knowledge and good ethical decisions turns out to produce good ethical behavior, although verbally demonstrated, and certainly good ethical behavior can uphold good moral and ethical values. That is why, moral and ethical learning is needed to shape ethical behavior in college students (Hudha, 2015).

The OIIDE learning model has been proven to be effective in improving bioethics knowledge, ethical decisions, and ethical attitudes, as students learn as motivated learners and engage actively during learning so that they can create a positive learning climate according to the syntax. As the findings of Fiksl, Flogie, and Aberšek (2017), the success of the teaching and learning process is determined by increased student motivation, the creation of a positive learning climate, and the active involvement of students during the learning process.

Conclusions

The effectiveness of OIIDE learning model is higher than conventional learning, especially in improving bioethics knowledge, ethical decision-making abilities, and ethical attitudes of biology pre-service teachers. The effectiveness of OIIDE learning model in this research was shown by the positive response of all biology pre-service teacher experimental groups to the OIIDE learning model, which gave their response as a very interesting, fun, and innovative learning model. Therefore, the OIIDE learning model is very appropriate to be implemented in learning in the 21st century and the industrial revolution era 4.0 at the primary, secondary and tertiary education levels, especially learning that aims to shape students' ethical behavior. Therefore, learning that is related to solving the ethical dilemma of bioethical problems in various disciplines is highly recommended to implement the OIIDE learning model in the implementation of its learning.

Acknowledgements

The researcher would like to thank Dr. Yuni Pantiwati, MM. M.Pd., Dr. Eko Budi Minarno, M.Pd.; Dr. Abdul Kadir Rahardjanto, M.Si.; Husamah, S.Pd. M.Pd.; Dwi Setyawan, S.Pd. M.Pd.; and Dr. Yudi Suharsono, M.Si., for the willingness to validate the learning model of OIIDE and learning materials, as well as the test instruments used in this research.

References

- Ajzen, I. (2005). *Attitudes, personality, and behavior* (Second). England: Open University Press-MacGraw-Hill Education.
- Anthony, R., Aryani, F., & Wrastari, T. (2014). Pengaruh penggunaan film sebagai media belajar terhadap pencapaian Higher Order Thinking Skill pada mahasiswa Fakultas Psikologi UNAIR [The influence of the use of film as a learning media on the achievement of higher order thinking skills in Students of t. *Jurnal Psikologi Klinis Dan Kesehatan Mental*, 03 (1), 40–47.
- Arends, R. I. (2012). *Learning to teach* (Ninth). New York, USA: McGraw-Hill.
- Arikunto, S. (2006). *Prosedur Penelitian Suatu Pendekatan Produk* [Research Procedure of a Product Approach]. Jakarta: Rineksa Cipta.
- Árnason, E. (2004). Mitochondrial cytochrome b DNA variation in the high-fecundity atlantic cod: Trans-Atlantic clines and shallow gene genealogy. *Genetics*, 166 (4), 1871–1885. <https://doi.org/10.1534/genetics.166.4.1871>.
- Artayasa, I. P., Susilo, H., Lestari, U., & Indriwati, S. E. (2017). The effectiveness of the three levels of inquiry in improving teacher training students' science process. *Journal of Baltic Science Education*, 16 (6), 908–918. Retrieved from <http://oaji.net/articles/2017/987-1513971002.pdf>.
- Azwar, S. (2012). *Penyusunan Skala Psikologi* [Psychological scale-up]. Yogyakarta: Pustaka Belajar.
- Beauchamp, T. L., & Childress, J. F. (2001). *Principles of biomedical ethics*. New York, USA: Oxford University Press.
- Berger, J. (2005). Current ethical problems in cell biology. *Journal of Applied Biomedicine*, 3, 109–113.
- Casini, M., Meaney, J., Midolo, E., Cartolovni, A., Sacchini, D., & Spagnolo, A. G. (2014). Why teach 'Bioethics and Human Rights' to healthcare professions undergraduates? *JAHHR*, 5/2 (10), 349–368. <https://doi.org/10.1371/journal.pone.0004916>.
- Chowdhury, M. (2016). Emphasizing morals, values, ethics, and character education in science education and science teaching. *The Malaysian Online Journal of Educational Science*, 4 (2), 1–16.
- Corner, L. (2008). Asia-Pacific perspectives on bioethics education. In D. Calderbank & D. R. J. Macer (Eds.), *Asia Pacific perspectives on bioethics education* (pp. 1–8). Bangkok: UNESCO Asia and Pacific Regional Bureau for Education.
- Drumwright, M., Prentice, R., & Biasucci, C. (2015). Behavioral ethics and teaching ethical decision making. *Decision Sciences Journal of Innovative Education*, 13 (3), 431–458. <https://doi.org/10.1111/dsji.12071>.
- Dunsford, J. (2015). *Ethical decision-making framework evidence informed practice tool*. WRHA Ethics Services.



- Ebbesen, M., Andersen, S., & Pedersen, B. D. (2012). Further development of Beauchamp and Childress' theory based on empirical ethics. *Journal of Clinical Research and Bioethics*, (25), 1–7. <https://doi.org/10.4172/2155-9627.S6-e001>.
- Fesol, S. F. A., Salam, S., Osman, M., Bakar, N., & Salim. (2016). Learning style approaches for Gen Y: an assessment conducted in a Malaysian Technical University. *Pertanika Journal of Social Sciences & Humanities*, 24 (4), 1335–1347.
- Fiksl, M., Flogie, A., & Aberšek, B. (2017). Innovative teaching/ learning methods to improve science, technology and engineering classroom climate and interest. *Journal of Baltic Science Education*, 16 (6), 1009–1020.
- Forté, B. (2012). Ethics and clinical bioethics before diversity and pluralism in the contemporary world. *BIOETHIKOS*, 6 (1), 7–10.
- Helland, D. E. (2002). Teaching bioethics in Norway. In *Teaching Bioethics* (pp. 61–64). Copenhagen: Nordic Council of Ministers.
- Hudha, A. M. (2015). Kajian pengetahuan bioetika dan kemampuan pengambilan keputusan etis mahasiswa calon guru biologi [The assessment of bioethics knowledge and ethical decision-making skills of biology teacher candidate students]. In *Prosiding Seminar Nasional Pendidikan Biologi 2015* (pp. 530–538). Malang: UMM Press.
- Hudha, A. M., Amin, M., Husamah, H., Indradi, R., & Wardoyo, S. S. I. (2016). Efektivitas model pembelajaran OIIDE sebagai langkah promotif dan preventif terhadap seks pranikah melalui PIK remaja di Kota Malang [The effectiveness of the OIIDE learning model as promotive and preventive steps toward premarital sex through PIK Health]. Malang.
- Hudha, A. M., Amin, M., Sumitro, B. S., & Akbar, S. (2016a). *Improving OIIDE learning model for ethics and value learning*. Surabaya.
- Hudha, A. M., Amin, M., Sumitro, S. B., & Akbar, S. (2016b). Telaah model-model pembelajaran dan sintaksnya sebagai upaya pengembangan model pembelajaran 'OIIDE'. *Jurnal Pendidikan Biologi Indonesia*, 2 (2), 109–124.
- Hudha, A. M., Amin, M., Sumitro, S. B., & Akbar, S. (2017). A study on the knowledge of bioethics among prospective biology teachers. *Eubios Journal of Asian and International Bioethics*, 27 (November 2017), 183–186.
- Iancu, M., & Anitei, M. (2014). Bioethical education in teaching Biology. *Procedia - Social and Behavioral Sciences*, 127, 73–77. <https://doi.org/10.1016/j.sbspro.2014.03.215>
- Janarto, D. K. (2010). Pembelajaran interdisipliner: upaya mengapresiasi sastra secara holistik. *HUMANIORA*, 1 (2), 522–535.
- Joyce, B. R., Weil, M., & Calhoun, E. (2009). *Models of Teaching: Model-Model Pengajaran* (8th ed.). Yogyakarta: Pustaka Pelajar.
- Klungland, H. (2002). Teaching bioethics group report and final discussions. In *Teaching Bioethics* (p. 135). Copenhagen: Nordic Council of Ministers.
- Kuhse, H., & Singer, P. (2009). *A Companion to Bioethics (2nd Edition)*. United Kingdom: Blackwell Publishing Ltd.
- Kusmaryanto, C. B. (2015). *Teaching bioethics group report and final discussions*. Jakarta: Penerbit Buku Kompas.
- Lindqvist, M. (2002). *Teaching bioethics*. Copenhagen.
- Macer, D. R. J. (2008). *Moral games for teaching bioethics*. Bangkok, Thailand.
- Maftuh, B. (2016). Innovative teaching and learning in elementary school. In Muhammad Husni, Yuyun Febrina, Bq. Shofa Ilhami, Yul Alfian Hadi, & Nurul Mu'aminin MZ (Eds.), *Proceeding ICETE 2016 International Conference* (pp. 1–11). Lombok, Indonesia: Universitas Hamzanwadi.
- Maftukhin, M. (2015). Ilmuan, etika dan strategi pengembangan ilmu pengetahuan di Indonesia [Scientists, ethics and science development strategy in Indonesia]. *Episteme Jurnal Pengembangan Ilmu Keislaman*, 10 (1), 200–226. <https://doi.org/10.21274/epis.2015.10.1.199-226>.
- Mahmudi, A., & Pd, M. (2006). *Pembelajaran Kolaboratif* [Collaborative learning]. Yogyakarta.
- Maryamah, E. (2016). Pengembangan budaya sekolah [Development of school culture]. *Tarbawi*, 2 (2), 86–96.
- Mascarenhas, N. B., & Rosa, D. de O. S. R. (2010). The teaching of Bioethics in the education of nurses: interface with the adopted literature. *Acta Paul Enferm*, 23 (3), 392–400.
- Maulida, R., Juanengsih, N., & Mardiyati, Y. (2017). The effect of problem solving learning model based just in time teaching (JiTT) on science process skills (SPS) on structure and function of plant tissue concept. *Jurnal Pendidikan Biologi Indonesia*, 3 (3), 248–253.
- Mautner, M. N. (2009). Life-centered ethics, and the human future in space. *Bioethics*, 23 (8), 433–440. <https://doi.org/10.1111/j.1467-8519.2008.00688.x>.
- Miah, A. (2011). *Ethical issues raised by human enhancement. Values and Ethics for the 21st Century*. Scotland.
- Mihaela, E. (2009). The knowledge – As production factor. *Studies and Scientific Research-Economic Edition*, 14, 39–43.
- Minarno, E. B. (2010). *Pengantar Bioetika: Dalam Perspektif Sains dan Islam* [Introduction to bioethics: In the perspective of science and Islam]. Malang: UIN Maliki Press.
- Minarno, E. B. (2012). Pembelajaran bioetika sebagai pengawal perkembangan biologi modern dan penyelamatan lingkungan hidup [The study of bioethics as a supporting guide for the development of modern biology and saving the environment]. *El-Hayah*, 3 (1), 35–40.
- Mursid, R., Nugrahadi, W., & Siagian, S. (2014). Model-based learning entrepreneurship development efforts in the formation of character. *International Journal of Education and Research*, 2 (11), 189–204. Retrieved from <http://www.ijern.com/journal/2014/November-2014/16.pdf>.
- Nora, C. R. D., Deodato, S., Vieira, M. M. da S., & Zoboli, E. L. C. P. (2016). Elements and Strategies for Ethical Decision-Making in Nursing. *Texto & Contexto - Enfermagem*, 25 (2), 1–9. <https://doi.org/10.1590/0104-07072016004500014>.
- Onwuegbuzie, A. J., Dickinson, W. B., Leech, N. L., & Zoran, A. G. (2009). A qualitative framework for collecting and analyzing data in focus group research. *IJOm International Journal of Qualitative Method*, 8 (3), 1–21.
- Paramita, A., & Kristiana, D. L. (2013). Teknik focus group discussion dalam penelitian kualitatif. *Buletin Penelitian Sistem Kesehatan*, 16 (2), 117–127.
- Pollard, C. L. (2015). What is the right thing to do: Use of a relational ethic framework to guide clinical decision-making. *International Journal of Caring Sciences*, 8 (2), 362–368.



- Sakiyah, M., Jaji, J., & Muharyani, P. W. (2015). Perbedaan efektivitas metode diskusi dan ceramah terhadap pengetahuan pekerja tentang alat pelindung diri (APD) di bengkel las Kelurahan Bukit Lama Palembang [The differences in the effectiveness of discussion and lectures methods on worker knowledge about personal protective equipment]. *Jurnal Keperawatan Sriwijaya*, 2 (2), 115–123.
- Sari, G. A. (2016). *Pengaruh kecerdasan spiritual, kecerdasan emosional, dan locus of control terhadap perilaku etis mahasiswa akuntansi (Studi empiris mahasiswa perguruan tinggi negeri kota Padang)* [The influence of spiritual intelligence, emotional intelligence, and locus of control on the ethical behavior of accounting students]. Universitas Negeri Padang.
- Scott, C. L. (2015). *The Futures of Learning 2: What Kind of Learning for the 21st Century?* (No. 14). Ireland.
- Siegar, S. (2015). *Statistik Parametrik untuk Penelitian Kuantitatif* [Parametric statistics for quantitative research]. Jakarta: PT. Bumi Aksara.
- Sihkabuden, S. (2004). Pengembangan Bahan Pembelajaran Pendidikan Moral dengan Metode Diskusi Dilema Moral pada Siswa SMU/SMK [Learning materials development of moral education with discussion method of moral dilemmas on high school/vocational high school students]. *Jurnal Ilmu Pendidikan*, 11 (2), 130–140.
- Sinaga, P., & Suhandi, A. (2015). The effectiveness of scaffolding design in training writing skills Physics teaching materials. *International Journal*, 8 (1), 19–34.
- Solomon, H. M. (2001). Origins of the ethical attitude. *Journal of Analytical Psychology*, 46 (3), 443–454. <https://doi.org/10.1111/1465-5922.00256>.
- Sudjana, N. (2008). *Penilaian Hasil Proses Belajar Mengajar* [The assessment of teaching and learning process results]. Bandung: PT Remaja.
- Tanyid, M. (2014). Etika dalam pendidikan: Kajian tentang krisis moral berdampak pada pendidikan. *Jurnal Jaffray*, 12 (2), 235–250. <https://doi.org/10.25278/jj71.v12i2.13>.
- Thieman, W. J., & Palladino, M. A. (2013). *Introduction to biotechnology (3rd Edition)*. Boston: Pearson Education.
- Triyuni, T. (2016). The influence of science learning set using scientific approach and problem solving model on learning outcomes of junior high school students in the subject of heat and temperature. *Jurnal Pendidikan IPA Indonesia*, 5 (2), 177–185. <https://doi.org/10.15294/jpii.v5i2.7679>.
- Urbancová, H., & Urbanec, J. (2012). Internal factors influencing the knowledge continuity ensuring. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 40 (4), 387–395.
- Usmeldi, U., Amini, R., & Trisna, S. (2017). The development of research-based learning model with science, environment, technology, and society approaches to improve critical thinking of students. *Jurnal Pendidikan IPA Indonesia*, 6 (2), 318–325. <https://doi.org/10.15294/jpii.v6i2.10680>.
- Wisasa, A. (2011). Integritas moral dalam konteks pengambilan keputusan etis [Moral integrity in the context of ethical decision making]. *Jurnal Management Teknologi*, 10 (1), 82–92.
- Yuen Fook, C., & Nazamud-Din, A. (2017). Strategies to enhance assignment and feedback practices in the 21st century classroom: a case study. *Pertanika Journal of Social Sciences & Humanities*, 25, 155–166. Retrieved from [http://www.pertanika.upm.edu.my/Pertanika PAPERS/JSSH Vol. 25 \(S\) Jan. 2017/15 JSSH\(S\)-0316-2016-4thProof.pdf](http://www.pertanika.upm.edu.my/Pertanika PAPERS/JSSH Vol. 25 (S) Jan. 2017/15 JSSH(S)-0316-2016-4thProof.pdf).

Received: July 05, 2018

Accepted: October 30, 2018

Atok Miftachul Hudha	PhD Student of State University of Malang, Lecturer of Biology Education Department, Teacher Training and Education Faculty, Muhammadiyah University of Malang, Jl. Raya Tlogomas No. 246 Malang 65144, Indonesia. E-mail: atok1964@gmail.com
Mohamad Amin	PhD, Professor, Biology Education, Faculty of Mathematic and Science, State University of Malang, Jl. Semarang No. 5 Malang 65145, Indonesia. E-mail: mohamad.amin.fmipa@um.ac.id
Sutiman Bambang Sumitro	M.Sc., D.Sc, Professor, Departement of Biology, Faculty of Mathematic and Natural Sciences, Brawijaya University of Malang. Jl. Veteran, Malang 65145, Indonesia. E-mail: sutiman@brawijaya.ac.id
Sa'dun Akbar	PhD, Professor, Elementary and Preschool Education, Faculty of Education, State University of Malang. Jl. Semarang No. 5 Malang 65145, Indonesia. E-mail: sadun.akbar.fip@um.ac.id

