Biology students’ convictions and moral disengagement toward bioethical issues: a path analysis

Van Helen S. Cuaderes1 · Jeannemar Genevive Yap-Figueras2

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Abstract
Advances in science and technology has led to the rise of different issues in relation to human life and security as well as the environment. These issues also paved the way for the field of Bioethics with its principles aiming to uphold moral standards on these issues. This study aimed to test and modify the theoretical models of the factors influencing the conviction schemas of BS Biology Bioethics students of a state university toward bioethical issues. One hundred ten (110) undergraduate students were pre-tested and post-tested for comprehension of Bioethics principles, moral disengagement, and convictions toward bioethical issues. Identified personal factors were also retrieved for testing. Results showed that the Bioethics course has increased the participants’ comprehension of Bioethics principles, moral disengagement, and convictions toward bioethical issues. Stepwise multiple regression results revealed that anxiety, extraversion, exposure to media, and moral disengagement can predict pre-convictions. On the other hand, only moral disengagement was found to predict post-convictions. Furthermore, moral disengagement can be predicted by convictions before the course while anxiety, openness to change, and convictions were the predictors after the course. The proposed theoretical model was for tested goodness of fit using Structural Equation Modeling (SEM) and acceptance was based on the model fit criteria. Since the proposed model was not found to fit the data, this was revised based on the results of multiple regression and correlation among exogenous variables. Three models were constructed and found to fit the data adequately. These models show the direct and indirect effects of personal factors and moral disengagement on convictions. The mediating effects of moral disengagement and convictions to each other were also shown. Findings further imply that the ability to understand the principles does not influence convictions, but rather moral disengagement has a greater influence on the said factor. Improving moral education by integrating Bioethics to the curriculum is recommended to further strengthen the moral judgement and reasoning of students.

Keywords Ethics education · Bioethics · Moral disengagement · Bioethical convictions · Theoretical models

Extended author information available on the last page of the article
Introduction

The rise of modern technology, specifically in biotechnology and biomedicine, has led to advancements on how people deal with organisms, the environment, and human life. The benefits that humankind reaped from these technologies are coupled with ethical issues. In addition to these, history taught us lessons from horrors of the Nazi war experiments to Tuskegee Syphilis Study, and other historical events (Schüklken 2005). All of these paved the way for the discipline of bioethics or biomedical ethics. This was established in 1970 with various professions are involved to come with the principles (Ebbesen 2011). One of the foundations of the discipline is the principles of American ethicists Beauchamp and Childress. There are four moral principles included: beneficence, nonmaleficence, respect for autonomy, and justice which function as an analytical framework of general norms that form a suitable starting point for reflection on moral problems in biomedical ethics. (Beauchamp and Childress 2001, p. 13). Despite of the emergence of the field, there is a constant battle between what is legal and moral in procedures such as abortion, euthanasia, allocation of resources to HIV/AIDS patients and many others.

As a Christian nation, the Philippines is not exempted with dilemma regarding bioethical issues as the culture is deeply rooted on religious beliefs which can be traced from Spanish colonization era. Moreover, only a few higher education institutions in the country offer Bioethics as a separate course, while others introduce the bioethical issues as part of the general education or specialization courses while others offer it as an elective course (Yap-Figueras 2019). In the study, the target tertiary institution is offering Bioethics as a required course in the curriculum for B.S. Biology program. This course has been offered since 2010 which focuses on the discussion of the basic principles and bioethical issues arising from medical procedures and practice, research, and other related fields. Bioethical issues discussed in the course are abortion, euthanasia, organ donation and transplantation, in vitro fertilization, human genetic engineering, disposal of biohazardous wastes, primary health care services, and handling of human subjects.

In addition to the current status of Bioethics education in the country, Chan et al. (2020) assert that there is a need for learning bioethics and law for biology students for the reason that upholding the discipline’s standards is assigned or entrusted to biology educators. As they evaluate the top 20 biology programs, they found out that most have lack connections and interaction between the discipline and ethics/law. Also, an enthusiasm to investigate the current global pandemic brought by COVID-19 is evident, however a need for teachers’ bioethics training is important to teach students on how to deal with the different aspects of research related to the infectious agent. Furthermore, universities should also strengthen their education and advisory efforts by developing and facilitating courses in Bioethics and Biosafety as legislators are expediting some legislations on biosecurity.

Despite the principles laid by Beauchamp and Childress, as observed, students have varied opinions and perspectives regarding the different bioethical issues.
When faced with issues, people are in moral dilemma – “circumstances in which moral obligations demand or appear to demand that a person adopt each of two (or more) alternative but incompatible actions, such that the person cannot perform all the required actions” (Beauchamp and Childress 2019). In most cases, though guided by moral principles for decision-making, people tend to ignore it to accommodate what one prefers, with justifications at the back of their minds or moral justification. They are able to ignore these moral principles through moral disengagement (MD) which is defined by Bandura (1999) that, though aware that their actions and decisions are wrong, people justify their actions and commit immoral behaviors in order for these acts to be acceptable.

This study was anchored on the following theories: Kohlberg’s Theory of Moral Development as basis for the formation of convictions, Albert Bandura’s Theory of Moral Disengagement, and Bloom’s Cognitive and Affective Domains of Learning.

Kohlberg (1969), as cited in Yilmaz et al. (2019), identified six developmental constructive (knowledge and meaning constructed from experience) stages and with each stage an individual becomes progressively better at responding to moral dilemmas than the last. Convictions are developed in the stages of moral development, specifically in the postconventional level where an individual judgment is based on self-chosen principles, and moral reasoning is based on individual rights and justice. Moreover, these stages built the convictions of students in judging the different issues to be wrong or right.

Bandura (1986) defined moral disengagement as a set of cognitive mechanisms that deactivate moral self-regulatory processes and thereby help to explain why individuals often make unethical decisions without apparent guilt or self-censure. Cantu-Pawlik (2019) added that it is the process by which an individual convinces him/herself that ethical standards do not apply to him/herself within a particular situation or context. They do these by: sanctifying their harmful behavior as serving worthy causes, absolving themselves of blame for the harm they cause by displacement and diffusion of responsibility, minimizing or denying the harmful effects of their actions, or dehumanizing those they maltreat and blame them for bringing the suffering on themselves. In the case of bioethical issues, people set aside their moral principles and engage decisions which they think are justified by the benefits they can get from such decisions.

On Bloom’s cognitive and affective domains, knowledge on the bioethical principles and different bioethical issues are directly associated with cognition while personal variables, particularly on the learner’s ability for valuing and internalizing values (affective domain) affects the convictions of students.

Another framework in which this study is grounded is based on the accepted predictive path models for comprehension of the bioethics principles and convictions toward bioethical issues by Yap-Figueras (2019). Considering only global personality factors, a model showed that participants’ sex had direct contribution to pre-convictions while verbal ability and exposure to media directly contribute to pre-comprehension. On the other hand, if primary personality factors were only considered, sex and openness to change had direct contributions to pre-convictions whereas, verbal ability, exposure to media, and warmth had direct contributions to pre-comprehension. After the intervention, a model showed that anxiety, self-control, and
extraversion contribute to post-convictions, that is, when only global personality factors are considered. Lastly, when primary personality factors were only considered after the intervention, the model showed that sex, openness to change, anxiety, self-control, and extraversion contribute to post-convictions. Verbal ability and exposure to media had direct contributions to post-comprehension for both models. In all models, comprehension of the bioethics principles had negative contributions to convictions.

Based on the aforementioned frameworks, this study focused on the convictions of students toward bioethical issues as influenced by personal variables such as sex, verbal ability, personality, and exposure to media (Yap-Figueras 2019), moral disengagement (Detert, Treviño and Sweitzer, 2008), and comprehension of the four bioethics principle. The proposed theoretical path model is shown in Fig. 1.

The first objective of the study was to determine the levels of comprehension of students on Bioethical principles, moral disengagement, and convictions toward bioethical issues; the second objective was to determine the predictors of the aforementioned variables; and third objective was to test and revise the proposed model constructs based on the predictors and relationships fit for the data.

**Methods**

**Participants**

The study was conducted in a state university in a region in the country which offers Bioethics course. The participants of the study were 110 4th year Filipino B.S. Biology students taking up the Bioethics course during the 1st semester of A.Y. 2021-2022. Out of the total 122 students taking up the course, 110 gave their voluntary consent to participate in the entire duration of the study. The participants who gave their consent to participate in the study fully completed the course with all the requirements was well as their responses to the research instruments. There were no dropouts among the study participants.

**Fig. 1** The theoretical path model representing the relationships among the personal variables, comprehension, moral disengagement, and convictions toward bioethical issues



Ethical considerations

The conduct of this investigation absolutely observed and subscribed to the ethical standards and guidelines of the Publication Manual of the American Psychological Association 7th Edition (2020) as well as the university. Two (2) of the members of the research committee of this research are members of the university medical ethics committee and have reviewed the informed consent form, research process, and research instruments. All the necessary permits were secured and granted by the respective parties prior to the start of the study. The protocol of the study assured the participants that their psychological, physical, and health will not be harmed in their participation in the study; that all data will be safeguarded and kept confidential.

An online orientation program was held to explain to the participants the purpose, methods, and possible benefits from participation in the study. They were also made to understand that participation or non-participation in the study will in no way affect their grade in the Bioethics subject. They were then asked to voluntary sign an online informed consent form due to limitations of in-person engagement brought by the COVID-19 pandemic. The participation of the students in this study was voluntary, thus participants were not coerced, harassed or bribed in order to join the study.

Instruments

One (1) researcher-made validated instrument (bioethical issues moral disengagement instrument), two (2) adopted instruments (bioethics principles comprehension test and bioethical issues convictions test) and one (1) inventory instrument (exposure to media inventory) from Yap-Figueras (2019), and results from two standardized tests (Otis-Lennon School Ability Test and Cattel’s 16 Personality Factors Test) were utilized as data.

The researcher-made instrument underwent face and content validation by five experts; i.e., two experts in psychology; two experts in biological sciences and science education; and a medical doctor. Furthermore, reliability testing was conducted to a parallel group consisting of 77 participants to establish the internal consistency of the instrument. Results yielded a Cronbach’s alpha value of .850 which considered to be “good” internal consistency according to George and Mallery (2018).

Bioethical issues moral disengagement instrument This was a 40-item test which determined the level of moral disengagement toward bioethical issues. The items were based on Bandura et al.’s (1996) Mechanisms of Moral Disengagement. Each of eight (8) mechanisms of moral disengagement were represented by a subset of five (5) items. Each item tapped participants’ readiness to resort to the mechanisms of moral disengagement in terms of the different bioethical issues. For each of the items, participants rated a 5-point Likert-type scale their degree of acceptance of moral exemptions for such conduct on an agree-disagree continuum. The following scores were assigned for the response for each item: 1 – strongly disagree, 2
– disagree, 3 – neither agree nor disagree, 4 – agree, and 5 – strongly disagree (full questionnaire in Appendix A).

Results of the instrument were summarized and categorized through a devised scale. Results were interpreted as follows:

| Score Range | Interpretation |
|-------------|----------------|
| 3.67 – 5.00 | High           |
| 2.34 – 3.66 | Moderate       |
| 1.00 – 2.33 | Low            |

**Exposure to media inventory** It is comprised of eight (8) items which includes the bioethical issues discussed in the course with corresponding semantic differential scale with 1 as “Not Knowledgeable” and 5 as “Knowledgeable”. The rating of the participants was on their personal judgement of their exposure to different forms of media with regard to the issues presented in each item (full inventory in Appendix B).

The results were then interpreted using the following scale of interpretation.

| Score Range | Interpretation |
|-------------|----------------|
| 3.67 – 5.00 | High           |
| 2.34 – 3.66 | Moderate       |
| 1.00 – 2.33 | Low            |

**Bioethics principles comprehension test** This is comprised of 20-item situational questions pertaining to the students’ understanding of the four bioethics principles. Five (5) situational questions were allotted to represent each principle being violated. Specifically, the each test item elicits the student’s ability to determine in which of the four bioethics principles by Beauchamp and Childress is violated. These four principles include: Beneficence, Nonmaleficence, Respect for Autonomy, and Justice. Each item was given one (1) point for every correct answer while no point was given for wrong responses (full questionnaire and answer key in Appendices C and D).

The mean score was interpreted using the following scale of interpretation.

| Score Range | Interpretation               |
|-------------|------------------------------|
| 16.00 - 20.00 | Excellent Comprehension |
| 10.00 - 15.99  | Average Comprehension      |
| 5.00 - 9.99    | Below Average Comprehension|
| 0 - 4.99       | Poor Comprehension          |

**Bioethical issues convictions test** This instrument is comprised of 10 items. Each of the item presents bioethical issues scenarios or dilemma wherein four choices based on Rest’s three schemas of moral reasoning are provided. These schemas are the following with its corresponding points: Post Conventional Schema (3), Maintaining Norms Schema (2), and Personal Interests Schema (1). The minimum points was
10 and the maximum points for the instrument was thirty (30) (full instrument and point assignment for the choices in Appendices E and F).

The results of the test were then summarized, categorized, and interpreted using the following scale of interpretation.

| Score Range     | Interpretation               |
|-----------------|------------------------------|
| 23.34 – 30.00   | Post-conventional Schema     |
| 16.67 – 23.33   | Maintaining Norms Schema     |
| 10.00 – 16.66   | Personal Interests Schema    |

**Data gathering procedure**

All necessary permission to conduct the study was sought from the participants and the university administration. An informed consent form clearly stating the intent of the study, the intervention, and the necessary data to be gathered such as personal information, personality test scores from the university testing center, and the pretest and posttest scores from the instruments were given to the participants of the study. They were then asked to voluntarily sign the consent form through Google Form whenever they freely want to participate and provide the needed information as data.

Due to the limitations brought by COVID-19 pandemic and limited in-person engagement policy by the university, research activities were done online. Specifically, online classes were held via Google Meet while gathering of responses was done via Google Form.

The pre-test for Bioethical Issues Moral Disengagement Instrument, Bioethics Principles Comprehension Test, and the Bioethical Issues Convictions Test was administered towards the end of the second semester of the A.Y. 2020-2021. Personal information and personality test results were also gathered in the same semester in order to start the preliminary data analysis procedures. OLSAT and 16PF results were obtained from the University Testing Center as part of the student services of the university.

During the first semester of the A.Y. 2021-2022, the participants were oriented of the Bioethics class, as well as the timeline of activities for the course. After the issues were discussed, the post-test for the different instruments was administered.

All the necessary data gathered were tallied, categorized, and analyzed using appropriate statistical tools and procedures.

**Analysis of data**

Mean and standard deviation were utilized to describe the levels of the endogenous variables specifically, comprehension, moral disengagement, and convictions of students before and after the Bioethics class. Stepwise multiple regression was utilized to determine the predictors of the endogenous variables. Moreover, Pearson’s $r$ was utilized to determine significant correlations among personal variables considered.
as exogenous variables. Testing of the model was carried out employing Structural Equation Modelling (SEM) through SPSS AMOS 21 software. Acceptance or rejection of the model was based on at least 3 model fit indices as suggested by Hooper, Coughlan and Mullen (2008). Path analysis models were constructed to modify the proposed model and were tested using the same technique.

Results

Pretest and posttest results of the comprehension test  Bioethics Principles Comprehension Test revealed that before taking up the Bioethics course, students have “Average” ($M=10.97$, $SD=2.90$) comprehension on the four Bioethics principles: Respect for Autonomy, Beneficence, Nonmaleficence, and Justice. During the course, class activities included case study discussions, film analysis, and preceptorial sessions. Lecture-discussion was utilized as well. After the Bioethics course, students showed the same level comprehension which is “Average” ($M=13.23$, $SD=2.55$) on the same principles. There was an increase in the mean score but the comprehension remained in the same level.

Pretest and posttest results of students’ moral disengagement  Results revealed that the level of moral disengagement of students toward bioethical issues was “Moderate” ($M=2.97$, $SD=0.48$) before the Bioethics course. After the course, the moral disengagement remained “moderate” ($M=3.03$, $SD=0.43$). Though on the same level, it can be noted that there was a slight increase in the mean.

Pretest and posttest results of the convictions test  The results of the students’ convictions toward bioethical issues revealed that the students were at the “Maintaining Norms Schema” ($M=21.49$, $SD=3.67$) before they took the Bioethics course. This means that the students relied their convictions in maintaining the established social order as a definition of morality. Posttest on their convictions also revealed that students remain in the same schema, the “Maintaining Norms Schema” ($M=22.76$, $SD=3.33$), with a slight increase in the mean.

Identified predictors for convictions toward bioethical issues before and after the bioethics course  Personal variables such as sex, verbal ability, personality factors (anxiety, extraversion, self-control, openness to change, and warmth), and exposure to media were considered as factors that may predict convictions in the proposed model. Comprehension of four Bioethics principles and level of moral disengagement were identified to as predictors as well.

Before the Bioethics course, regression results indicated that the overall model significantly predicts students’ convictions toward bioethical issues [$R^2 = .452$, $R^2_{adj} = .431$, $F(4, 105) = 21.638$, $P < .001$]. This model accounts for 45.2% of the variance in students’ convictions. An inspection of the individual predictors revealed that moral disengagement ($\beta = -.61$, $t(105) = 8.41$, $P < .001$) had the highest contribution; exposure to media ($\beta = -.16$, $t(105) = 2.14$, $P = .04$); anxiety ($\beta = -.21$, $t(105) = 2.07$) and...
\( t(105) = 2.74, P = .008 \); and extraversion \((\beta = -.16, t(105) = 2.05, P = .04)\) also significantly contributed to the model.

After the course, the same factors were tested to determine the significant predictors of convictions. Results indicated that the overall model significantly predicts students’ convictions toward bioethical issues \([R^2 = .513, R^2_{\text{adj}} = .508, F(1, 108) = 113.65, P < .001]\) accounting for 51.3% of the variance in students’ convictions. The model, however, revealed that only moral disengagement \((\beta = -.716, t(108) = 10.66, P < .001)\), among other variables, significantly contributed to the model.

**Identified predictors for moral disengagement toward bioethical issues before and after the bioethics course**

Predictors for the other endogenous variables, the comprehension of four bioethics principles and moral disengagement, were also carried out. Regression analysis revealed that there was no significant predictor of the students’ comprehension before and after the course.

Before the course, an overall model significantly predicts students’ moral disengagement toward bioethical issues \([R^2 = .378, R^2_{\text{adj}} = .372, F(1, 108) = 65.703, P < .001]\). This model accounts for 37.8% of the variance in students’ moral disengagement. Convictions toward bioethical issues \((\beta = -.615, t(108) = 8.106, P < .001)\) was found to be the only significant predictor of moral disengagement.

On the other hand, after the course, the overall model significantly predicts students’ moral disengagement on bioethical issues \([R^2 = .549, R^2_{\text{adj}} = .536, F(3, 106) = 43.04, P < .001]\) accounting for 54.9% of the variance in students’ moral disengagement. Individual predictors revealed that convictions \((\beta = -.704, t(106) = 10.77, P < .001)\); anxiety \((\beta = .159), t(106) = 2.398, P = .02)\); and openness to change \((\beta = .139, t(106) = 2.085, P = .04)\) significantly contributed to the model predicting the moral disengagement of the students toward bioethical issues.

**Accepted predictive path models for students’ moral disengagement and convictions toward bioethical issues**

The results of regression on the predictors of moral disengagement and convictions were utilized to construct predictive path models for the aforementioned endogenous variables. Three models were proposed and tested using Structural Equation Modelling (SEM). These models were all accepted based on the criteria set by model fit indices considered in the study. These three models represent the predictive path models of students’ moral disengagement and convictions before and after the course as well as the overall model.

Figure 2 presents the accepted model before the Bioethics course highlighting factors influencing students’ convictions and moral disengagement. Extraversion \((\beta = -.16), anxiety (\beta = -.21), exposure to media (\beta = -.16), and moral disengagement (\beta = -.58)\) had direct negative contributions to convictions implying that an increase in these factors lead to decreased in convictions. Basing on Keith (2019) magnitude of effects \((\text{path values below 0.05 = “too small influence”; 0.05-0.10 = “small influence”; 0.11-0.25 = “moderate influence”; and above 0.25 = “large influence”})\), extraversion, anxiety, and exposure to media have negative “moderate influence” to convictions. Additionally, it is notable that moral
disengagement has a negative “large influence” on convictions. Moreover, correlations among exogenous variables revealed a significant and negative relationship between extraversion and anxiety ($r = -0.37$, $P < 0.001$).

Also shown in the model are the direct effect of convictions ($\beta = -0.05$) of convictions on moral disengagement which is considered to be a “small influence”. Likewise, extraversion, anxiety, and exposure to media have indirect effects on moral disengagement through convictions.

The accepted model fits the data adequately based on the different fit indices (see note under the accepted models). Notably, the Root Mean Square Error of Approximation ($RMSEA$) value of the revised model was found to have an “excellent” fit with the data. The threshold values for fit indices were based on the guidelines set by Hooper et al. (2008).

Figure 3 highlights factors influencing students’ convictions and moral disengagement after the Bioethics course as shown in the accepted path model. In this model, only moral disengagement ($\beta = -0.28$) had direct contribution to convictions which is considered to have a “large influence”. Furthermore, anxiety and openness to change had indirect contributions to convictions through moral disengagement.

Also shown the model, anxiety ($\beta = 0.15$) and openness to change ($\beta = 0.15$) had direct positive “moderate influence” on moral disengagement. On the other hand, convictions ($\beta = -0.55$) had negative direct contribution to the same factor which is considered to have a “large influence”.

The different indices of the model fit most of the thresholds. The indices which fit the thresholds were Model Chi-Square ($\chi^2$), Standardized Root Mean Square Residual ($SRMR$), Comparative Fit Index ($CFI$) and the Parsimony Normed Fit Index ($PNFI$). Though two (2) of the fit indices, $RMSEA$ and Akaike Information Criterion ($AIC$) did not conform with the acceptable threshold, the model is still accepted as Hooper et al. (2008) argue that there are no “golden rule” for assessment.

![Fig. 2](image-url)
of model fit, but reporting variety of indices is necessary to reflect different aspect of the model fit (Crowley and Fan 1997).

**Overall model showing the paths for students’ moral disengagement and convictions toward bioethical issues** Figure 4 presents the overall model considering all the significant predictors of moral disengagement and convictions before and after the course. Path of anxiety ($\beta = .06$) has positive “small influence” on convictions while exposure to media has a negative “small influence” on the same endogenous variable. Extraversion ($\beta = .04$), on the other hand, has positive “too small influence” on convictions. Notably, moral disengagement ($\beta = -.45$) exerts a negative “large influence” on students’ convictions. The paths of anxiety and extraversion imply that an increase on these factors also causes an increase in the convictions, while an increase in the exposure to media among the students causes a decrease in the

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**Fig. 3** Model 2 of factors influencing convictions and moral disengagement of students toward bioethical issues after the Bioethics course. Note: $\chi^2 = 4.167; df = 2; P = .13; RMSEA = 0.07; SRMR = 0.064; CFI = 0.976; AIC (default model) = 20.167; PNFI = 0.319

**Fig. 4** The overall model considering all the factors influencing convictions and moral disengagement. Note: $\chi^2 = 8.99; df = 7; P = .25; RMSEA = 0.051; SRMR = 0.071; CFI = 0.980; AIC (default model) = 36.99; PNFI = 0.430

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convictions. As a major predictor, an increase in the moral disengagement decreases the convictions. Anxiety and openness to change can also indirectly contribute to convictions through moral disengagement.

Examining the direct paths of the factors on moral disengagement, it can be noticed that anxiety, openness to change, and convictions have direct causal effects on moral disengagement. Anxiety (\(\beta = .15\)) and openness to change (\(\beta = .17\)) have positive “moderate influence” on moral disengagement which implies that an increase on these factors means also an increase in the moral disengagement. Conversely, convictions (\(\beta = -.42\)) have a negative “large influence” on moral disengagement. This means that an increase on this factor causes a great decrease in the moral disengagement of the students. Anxiety, extraversion, and exposure to media indirectly contribute to moral disengagement through convictions.

All the fit indices of the model conform with the index fit threshold values. This means that the model fits the data adequately.

Discussion

Pretest and posttest scores of the comprehension test The comprehension test results indicate that the Bioethics course was able to increase the mean score of the students from the pretest to the posttest. Similar results were revealed by the study of Yap-Figueras (2013), with case study discussion as the major strategy in discussing the different bioethical issues, that comprehension levels were improved after the bioethics course showing significant increase in test scores from the pretest to the posttest. This is supported by Herreid (2005) that case studies, mostly through problem-based learning (PBL), have improved knowledge retention of the learners compared to standard lecture. Moreover, the same method also has major positive impact on the skills development of the students. A more recent study revealed that case study analysis, in terms of knowledge development, has helped contribute toward deeper understanding of the course content, thus bridging the gap between theory and practice (Seshan et al. 2021). Additional small group discussion method also improved cognitive achievement and retention of basic principles of bioethics among medical students (Afandi et al. 2009). In addition, case studies were found to be more effective than other methods of content delivery at increasing performance on examination questions in some of biology concepts (Bonney 2015).

Inspection of individual items revealed that commonly missed items in the pretest included those eliciting the principle of justice, a principle which allows fairness in the distribution of benefits and risks (Beauchamp and Childress 2019). Specifically, the item, “A comatose patient who was totally against organ donation is subjected by his family members for “organ harvesting” because of monetary compensation” got the lowest number of students who correctly responded. Only 15% of the students correctly answered the item in the pretest and it further decreased to only 6% in the posttest. The item might have been confused with the principle of respect for autonomy since the patient is comatose, but it is a violation of human rights to
use a person’s disadvantaged financial situation to obtain organs. In addition, only 30% of the students responded correctly to the item, “A cadaver of a patient whose relatives cannot pay for the hospital bills is not released and is used without permission for human dissection in medical school” during the pretest. The percentage of students who got the correct answer decreased to 15% in the posttest, thus reduced number of students who got the item correctly. This item was also mistaken for respect for autonomy. The correct answer for the item should be justice since respect and dignity should be given to cadavers. The inability to pay the hospital bills should not be a ground for releasing the cadaver to be used for dissection in order to compensate for the bills. This is clearly a degradation of human dignity, thus violating the principle of justice. Other item for the principle of justice missed by the respondents include: “A doctor refuses to sign a seaman’s medical clearance unless he submits to a diagnostic test which is a new procedure in the Seaman’s Hospital. (Patient’s laboratory tests are all clear.)”. This item was answered correctly by 29% of the students in the pretest. However, during the posttest, the percentage of students who correctly answered the item was improved to 36%. The condition that the seaman should undertake in order to release his results is a form of coercion. Hospital may take advantage of the situation that the person needs to claim his results in order to comply for his job requirements. However, he is entitled to claim his laboratory results even without the imposed diagnostic test. This item shows violation of human rights, which, therefore, is against the principle of justice.

The results have shown that the Bioethics course have increased the level of comprehension of the four Bioethics principles of the students. However, they have to be reminded to critically analyze the items or scenarios in order not to confuse one principle to another. Other factor that may have affected the results in terms of comprehension is the learning delivery mode during the conduct of the study which in through online modality. As online course-taking reduces student learning compared to conventional in-person classes and student performance is more variable online than in traditional classrooms (Bettinger et al. 2015). Reduced learning and performance may be to the issues raised by higher education students such as lack of face-to-face interaction with the instructor, response time and absence of traditional classroom socialization (Adnan 2020).

**Pretest and posttest scores of the convictions test**. The results of the convictions test revealed an increase in the mean, however the interpretation of the mean showed that the students were on the same schema, the “Maintaining Norms Schema”, both in the pretest and in the posttest. Due to various backgrounds of the students, there were different views on the bioethical issues discussed. Specifically in the case of abortion, there was a decrease in the number of students who belong in the post-conventional schema from the pretest to the posttest, from 28%, it decreased to 18%. Thus, some students have moved from the post-conventional schema to maintaining norms schema. This implies that in the case of abortion, the bioethics course has influenced the way students feel about the issue for some students have moved from a higher schema to a lower one.

The maintaining norms schema where the students belong clearly represents where they should belong at their age. Since the students are already considered
as young adults, they are expected to understand the situations in a sociocentric perspective in which they are able to identify the established practice that leads to social order (Rest et al. 2000). The increase in the mean of convictions from pretest to posttest is supported by Serodio et al. (2016) in which Konstanz Method of Dilemma Discussion (KMDD), a strategy similar to case discussion, has positive effect on medical students’ moral competence in their Bioethics course, though the results showed no statistical significance. Moreover, a significant increase on the test scores of the convictions test was reported by Yap-Figueras (2019) which utilized case study discussion in the same course. A slight increase in the mean is supported by Martins et al. (2020) where nursing students showed moral competence stagnation even after Bioethics. This affirms the idea that many people never reach the Kohlberg’s highest level of moral reasoning with only a very small percentage of adults rising above the next level (Moshman 2011).

**Pretest and posttest scores of the moral disengagement instrument** The respondents were given theoretical situations in which they will have to decide, in terms of their agreement to the statement, on the different bioethical issues with items representing each mechanism. The results have shown that there was a slight increase in the mean of moral disengagement among the students after the course. Most of the items in the issue of abortion showed an increase in agreement with the justifications which leads to higher levels of moral disengagement among the students. Majority believe that *abortion is a part of a woman’s right to make reproductive choices; giving birth to a child in which the mother cannot give a decent life is just as “slowly killing” the child”; and “in case of pregnancy caused by rape and the women decides for an abortion, the blame is all attributed to the rapist”*. In the issue of assistive reproductive technology, most students believe that “*Undergoing In vitro fertilization (IVF) to bear children is giving couples their right for procreation and performing their “sacred obligation” as couples*”. The item, “*Euthanasia is showing compassion for it frees a person from all the suffering and pain*” was also agreed by the majority of the students. Lastly, almost all students are in agreement with the item, “*A medical research done without informed consent of the human subjects is justified because it is a stringent moral demand to alleviate or eradicate human suffering*”.

As reviewed by Keefer (2003), during case-based approaches in instructions, more complex and more contextually sensitive ethical strategies have been employed by more experienced thinkers and some students. Some cases show that in order for students to protect their threatened values and fulfill obligations, they appeal to hypothetical situations and/or generate midway solutions. This was evident in the results of the study that the different cases are being dealt by the students differently in terms of their moral disengagement. The same author also believes that “*ethical instruction is most successful when it is introduced and integrated into authentic contexts, those same contexts within which it will subsequently need to be practiced and understood*”. Thus, the Bioethics course, using the same strategy, is seen to deliver similar results. The differences in the perception of the students on the various bioethical issues may be attributed to their individual differences which predispose them to see the situations differently and make moral disengagement
more or less likely (Detert et al. 2008). The authors hypothesized that empathy, trait cynicism, locus of control, and moral identity influence moral disengagement that leads to unethical decision-making among students. (Bandura 2016) further added that moral disengagement can be activated differently across various situations due to different social cues or conditions. Also, as revealed by the study of Kish-Gephart et al. (2014) situations concerning self-interest affect how an individual decide. Specifically, situational harm to others and dispositional conscientiousness would act as restraining forces that weaken the effects of personal gain situations on morally disengaged reasoning. Furthermore, moral disengagement is less likely when personal gain incentives are relatively moderate.

**Identified predictors and model for convictions and moral disengagement toward bioethical issues prior to bioethics course** All of the factors have negative Beta ($\beta$) values which means that an increase in the identified predictors causes a decrease in the convictions. Tillman, Gonzalez, Whitman, Crawford and Hood (2018) assert that a series of cost-benefit analysis is being undergone by individuals during ethical decision-making. Moreover, in the case of moral dilemma, individuals compare the cost of violating moral standards, which they are fully aware, and the perceived benefits of adhering to these standards. Yet, often times the costs associated with the decision’s negative return for perpetrators and those affected by their actions are not fully considered. This leads to moral disengagement. With this premise, the students’ decisions with the different bioethical issues are largely influenced by their cost-benefit analysis, which often lead to picking out the choice that doesn’t go with the moral standards.

Exposure to media also had a negative contribution to pre-convictions of the students. This means that the more exposed they are to media, with social media as the main source of information, there is a decrease in their convictions toward bioethical issues. This is supported by the results of the study of Chauhan, Connelly, Howe, Soderberg and Crisostomo (2021) which revealed that perceptions on social consensus, problem recognition, and ethical sensemaking are affected by social media use. Specifically, when used as information dissemination tool, it inhibits ethical decision making among undergraduate students. Additionally, problematic media content has been shown to have a negative influence on several moral domains, most notably harm/care as well as fairness/cheating (Krcmar and Locke 2020).

Regression results also revealed that anxiety negatively predicts the convictions of the students. Polat, Kutlu, Ay, Purlsa and Erkan (2019) affirms the results as their study revealed that anxiety negatively affects independent decision-making of nurses. However, the results seem to contradict the premise that anxious individuals have greater concerns about fairness Koleva, Selterman, Iyer, Ditto and Graham (2014). This suggests that increased anxiety would lead to increased convictions since the students are concerned with equity or proportionality. Lastly, extraversion is one of the predictors of convictions having a negative value. Results of the study of Tao, Cai, Rana and Zhong (2020) revealed that when faced with personal dilemmas, introverted participants make decisions which are utilitarian in nature while extroverted participants make more deontological decisions. In other words, introverts make decisions based on the consequences, while extroverts base their
decisions on the moral code. This supports the results of the study that the higher level of extraversion, the lower will be the convictions on the different bioethical issues. Likewise, Franken and Muris (2005) contends that impulsive personality traits, which is similar to extrovert participants, could not predict utilitarian decisions.

The results showed that only convictions can predict moral disengagement before the Bioethics course. Since moral disengagement is a cognitive process, it denotes reasoning, thus when people morally disengage, they are reasoning (Schaefer and Bouwmeester 2021). Since the emotional aspect is mostly involved in the convictions of individuals, their reasoning is being subdued. With this, a negative effect may be expected on the moral disengagement process. In other words, the greater the conviction of individuals, the less likely they will be morally disengaged.

Identified predictors and model for convictions and moral disengagement toward bioethical issues after bioethics course Though the Bioethics principles have been learned in the course, moral disengagement remained as the only predictor of students’ convictions (post-convictions). As mentioned by Tillman et al. (2018), an unethical act is committed through moral disengagement and after learning consequences, the one who committed it will experience negative emotions and will engage in post-moral disengagement as a coping mechanism. Thus, even if students already learned the principles, moral disengagement still persists as they are able to rationalize their choices using the different mechanisms. With the results, the more they were morally disengaged, the lower was their convictions.

Results demonstrated that convictions remained to be a predictor of moral disengagement with negative influence to the dependent variable. On the other hand, anxiety and openness to change have positive contribution to moral disengagement after the Bioethics course.

As emphasized earlier, moral disengagement involves reasoning using the different mechanisms described by Bandura (1999). It can also be noted that comprehension of the four Bioethics principles, though it was improved after the Bioethics course, it cannot predict the students’ convictions nor moral disengagement. Though contrary to the results of Yap-Figueras (2019) that comprehension and convictions have negative associations with each other after the Bioethics class, moral disengagement may have played a role in mediating the personal factors and convictions as individuals may justify that their decision of doing damaging conduct is made personally and socially acceptable by portraying it as serving socially worthy or moral purposes (Bandura 1999). Since bioethical issues require decisions to be made with some extent of negative effect, students may justify these actions with moral justifications even if they have learned the principles.

Negative emotions, as well as positive emotions, usually affect decision-making process of individuals. With the present study, anxiety positively predicted moral disengagement of students. Consistent with the findings of Petitta, Probst, Ghezzi and Barbaranelli (2021) that negative emotion, specifically anger, through emotional contagion positively predicts moral disengagement. Results also confirmed that susceptibility to moral disengagement is affected by personal antecedents as lack
of empathy, rigid and authoritarian beliefs, low self-esteem, and fear and anxiety (Johnson 2014).

Also, openness to change had positively predicted moral disengagement. This conforms with the findings of Sverdlik and Rechter (2020) that openness-to-change values positively associated with moral disengagement. Furthermore, it is affirmed by Rengifo and Laham (2022) that moral disengagement significantly accounted for the effects of the domains of agreeableness and openness/intellect and aspects of politeness, compassion, volatility, enthusiasm, assertiveness, and openness on unethical decision-making.

Generally, the results revealed that moral disengagement, exposure to media, anxiety, and extraversion significantly predicted convictions while convictions significantly predicted moral disengagement before the course. On the other hand, moral disengagement significantly predicted convictions while anxiety, openness to change, and convictions predicted moral disengagement after the course. The result that anxiety predicted convictions after the Bioethics course was consistent with Yap-Figuera (2019). As the previous study revealed, sex and openness to change were predictors of the pre-convictions and self-control and extraversion, in addition to anxiety, were predictors of the post-convictions. The difference in the results may be due to the mediating effect of moral disengagement which is found to be a major predictor of convictions before and after the course.

Overall model of students' moral disengagement and convictions toward bioethical issues When making ethical decisions, Rest (1994) proposed a model with four steps as follows: moral sensitivity/awareness, moral judgment, moral motivation/intention, and moral action/courage. Moral awareness is the recognition of the moral dilemma which can be affected by the knowledge of an individual regarding the issue. As shown in the overall model, exposure to media has a negative contribution to convictions, thus affecting the choices of individuals during ethical decision-making as affirmed by Chauhan et al. (2021) that social media use affects the perceptions on social consensus, problem recognition, and ethical sensemaking of students. Also, moral domains have been negatively affected by problematic media content (Krmar and Locke 2020). In terms of moral judgement, Tillman et al. (2018) emphasized that during decision-making, an individual goes through a series of cost-benefit analysis and in the case moral dilemma, individuals compare the cost of violating the moral standards. Through moral disengagement, though fully aware of the consequences, individuals violate the moral standards by applying the different mechanisms such as moral justification. With this premise, students are able to select choices that do not conform with the moral standards through moral disengagement, thus resulting to a negative contribution.

The model further shows that anxiety and extraversion have positive direct contributions to convictions. Carver et al. (2021) claim that anxiety influences the problems in social and academic functioning of students. As part of the social aspect, decision-making is essential to interact with others. The model affirms Koleva et al. (2014) that increased anxiety among individuals have effects on their concern about fairness, thus positive effects on convictions. However, this is contrary to the findings of Polat et al. (2019) that anxiety has negative effects on
the independent decision-making of nurses. Moreover, anxiety impairs decision-making as revealed by the study of Miu et al. (2008). This disagreement may be explained by the differences in the context of the situations and the issues. Additionally, extraversion directly influences convictions as supported by Tao et al. (2020) that extroverts base their decisions on the moral code. Basing the decisions on moral code means that individuals choose the choice/s in the postconventional morality characterized by preservation of life at all costs, and the importance of human dignity (McLeod 2013).

The model also presented the contributors of moral disengagement: openness to change and anxiety having positive contributions and convictions with negative contribution. Openness to change, as one of the Big Five Personality factors, indicates how open-minded a person is (123test® 2022). With this idea, higher levels of openness to change lead to choices that violate moral standards because they are less conservative of their choices. The model is being supported by the findings of Sverdlik and Rechter (2020) that openness-to-change values and moral disengagement are positively associated. Consequently, Rengifo and Laham (2022) propose that openness to unethical decision-making accounts for moral disengagement. Furthermore, individuals are more susceptible to moral disengagement as affected by personal factors such as anxiety (Johnson 2014) and contagion of negative emotions Petitta et al. (2021). Lastly, moral judgement and reasoning, as reflected in the convictions, negatively contributes to moral disengagement. This implies that the more ethical the judgements is, the less morally disengaged an individual is. With this, if a decision is made within the moral standards, an individual would be less likely to rationalize and justify the decision through the different mechanisms of moral disengagement for this requires reasoning (Bandura 1999).

Conclusions and implications

Based on the results of the study, the following conclusions were formulated: (a) Bioethics course with predominantly case study discussion as the main teaching strategy was able to enhance the comprehension of students on the four Bioethics principles, increased the level of moral disengagement, and students’ convictions toward bioethical issues; (b) predictors of pre-convictions of students were extraversion, anxiety, exposure to media, and moral disengagement while post-convictions were predicted by moral disengagement; (c) the identified predictors have negative contributions to pre and post-convictions; (d) moral disengagement before the course was predicted by convictions while after the course, the predictors were convictions, anxiety, and openness to change; (e) convictions, as a predictor, has a negative contribution to moral disengagement while anxiety and openness to change positively contributed to moral disengagement after the course; (f) there were no identified predictors for the comprehension of four Bioethics principles before and after the course; (g) accepted path model prior to the course showed that pre-convictions mediate the influence of extraversion, anxiety, and exposure to media on moral
disengagement; (h) accepted path model after course showed that effects of anxiety and openness to change on convictions are mediated by moral disengagement.

The aforementioned conclusions paved the way for the following implications: (a) since the Bioethics course was able to increase the comprehension and conviction levels of students, it is imperative that the course be included in the curriculum of medical, research, and other allied fields in order for the students to be guided with the different principles when they are on their workplace in the future; (b) due to the increased moral disengagement after the course and its large negative contribution to convictions, it is necessary for course facilitator to strengthen the moral grounds in terms of the perception on the different issues by relating the principles on the personal experiences of the students; (c) since individual differences exist among the learners, understanding their background in terms of their anxieties, media exposure, extraversion, and openness to change will help educators design instruction and activities that will better enhance moral standards, thus improving their ethical decision-making in the future. This is very important for the reason that these students will soon land on medical or research professions which will require them to make sound decisions; (d) moral education, in this case the course Bioethics, should be strengthened in the country due to the interplay of the various factors affecting the students’ moral judgement. The results of the study have proven that moral judgement is influenced by personal factors and moral disengagement, thus inclusion of the principles and discussion of the issues through case study discussion and other strategies be included on the general education course Science, Technology, and Society, as well as in some elective courses.

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Declarations

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Authors and Affiliations

Van Helen S. Cuaderes¹ · Jeannemar Genevive Yap-Figueras²

Van Helen S. Cuaderes
vanhelen.cuaderes@antiquespride.edu.ph

Jeannemar Genevive Yap-Figueras
jeannemargenevive.figueras@wvsu.edu.ph

¹ College of Teacher Education, University of Antique – Main Campus, Sibalom, Antique, Philippines
² Biological Sciences Department, College of Arts & Sciences, West Visayas State University, RH 101, RH Bldg. Luna St., La Paz, 5000 Iloilo City, Philippines