Personal Variables, Comprehension of the Four Bioethics Principles, and Convictions towards Bioethical Issues: A Path Analysis

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Abstract

This study aimed to determine the relationship of factors influencing bioethical convictions of B.S. Biology students. It focused on the efficacy of case study discussion in improving comprehension of the four Bioethics principles, the efficiency of a Bioethics course in improving bioethical convictions, the identifying predictors for comprehension of Bioethics principles and bioethical convictions, and the creating of model constructs of predictors which are fit for the data. The convictions test for bioethical issues, Comprehension test for the four bioethics principles, a survey-questionnaire, Otis-Lennon School Ability test and 16PF test were used in gathering data from 116 participants. T-test for dependent samples was used to determine effects of the case study discussion and the bioethics course. To identify predictors for comprehension and convictions among personal and family background factors, global and primary personality factors, and mental ability, step-wise multiple regression was utilized. Path analysis models were then constructed and tested for goodness of fit using Structural Equation Modeling (SEM). Results showed that case study discussion and the Bioethics course were effective in improving comprehension and bioethical convictions, respectively. Predictors for comprehension of Bioethics principles before case study discussion were verbal ability, warmth, and exposure to media. Sex and openness to change were predictors for pre-convictions. Post-conviction predictors were anxiety, self-control, extraversion, liveliness, and perfectionism. Four corrected path models were accepted based on fit indices criteria of SEM. In conclusion, personal factors, much as sex and personality factors are contributors in bioethical convictions, and not cognitive factors like mental ability or comprehension of the four Bioethics principles.

Keywords: Bioethical convictions, path analysis models for bioethical convictions

The West Visayas State University B.S. Biology three-track curriculum is the first Biology curriculum in the country to take measures to offer Bioethics as a free elective since A.Y. 2010-2011. This offering is in compliance to the recommendatory core curriculum drafted by the Division of Science and Technology of UNESCO in 2008 for the teaching of bioethics; which focuses on the introduction of bioethical principles and on universal bioethical issues related to the practice of scientific and medical research for university students.

The course includes the four Bioethics principles as the core topics, as well as in-depth discussion of common and universal bioethical issues which exist in scientific and medical research in the current situations. Among these bioethical issues are abortion, pre-implantation screening, euthanasia, organ donation, human genetic engineering, provision of primary health care, etc. Student opinions towards these issues tend to vary; contradicting the theory of Beauchamp and Childress (2009) that the four principles of Bioethics can be used as action guides in moral decisions regarding convictions towards bioethical issues.

This study was, therefore, based on the premise that areas of the cognitive domain such as comprehension; - the comprehension of the four bioethics principles of the students - is influenced by personal factors such as sex (Gilligan, 1977; Thoma, 1986), religious affiliation (McCarthy & Horn, 1996), family background (McCarthy & Horn, 1996), aspects of personality (Stojiljkovic,1998), mental ability (Sadler, Chambers, & Ziedler, 2003), experiences in relation to the issues, and exposure to media regarding the issues involved. Most of the personal factors are known to be associated with or directly related to cognition. This may help shape the affective domain which, in turn, could influence convictions of the students towards the issues.

On the basis of this premise, this study aimed to determine the relationship of probable factors influencing the convictions of B.S. Biology Bioethics students of a state university towards bioethical issues. Specifically, it focused on determining whether case study discussion is effective as a strategy in improving comprehension of the four Bioethics principles, whether the Bioethics course is effective in improving convictions of the students towards bioethical issues, on the probable predictors for comprehension of Bioethics principles and convictions towards bioethical issues, and in creating and determining path model constructs of the predictors which are fit for the data.

Methodology

Two researcher-made validated instruments (convictions test for Bioethical issues and comprehension test for the four Bioethics principles), a survey-questionnaire, and two standardized tests (Otis-Lennon School Ability test and the 16PF) were used to gather data from the 116 participants who were B.S. Biology students taking up Bioethics during the second semester of AY 2013-2014. The two researcher-made instruments were validated by six experts: two experts in psychology, one expert in bioethics, and four experts in the biological sciences. Validity testing for these tests was done by conducting a pilot test of the two questionnaires to 120 participants. Results were then tested for internal consistency reliability using SPSS 21. Cronbach's alpha obtained for the comprehension test was 0.71; while that of the conviction test was 0.712 thus, based on the widely accepted social science cut off for Cronbach's alpha, which is 0.70 or higher, the two instruments were considered as reliable.

The t-test for dependent samples was used to determine the effects of the case study discussion and the bioethics course. Step-wise multiple regression was used to determine predictors for comprehension and convictions among personal background factors, family background factors, global and primary personality factors based on 16PF, and mental ability. Path analysis models were then devised based on the step-wise regression results, and these were tested for goodness of fit using Structural Equation Modeling (SEM) through SPSS AMOS 21 software.

Results and Discussion

Results of the pre-test and post-test scores of the comprehension test show that there is a statistically significant increase in the test scores from the pre-test ($M = 12.50$; $SD = 3.60$) to the post-test ($M = 15.93$; $SD = 2.24$), $t = 10.24$; $p = 0.00$. The eta squared statistic (0.48) shows a large effect size, thereby indicating that the increase in the test scores may be greatly attributed to the intervention. These are shown in Figure 1 and Table 1.
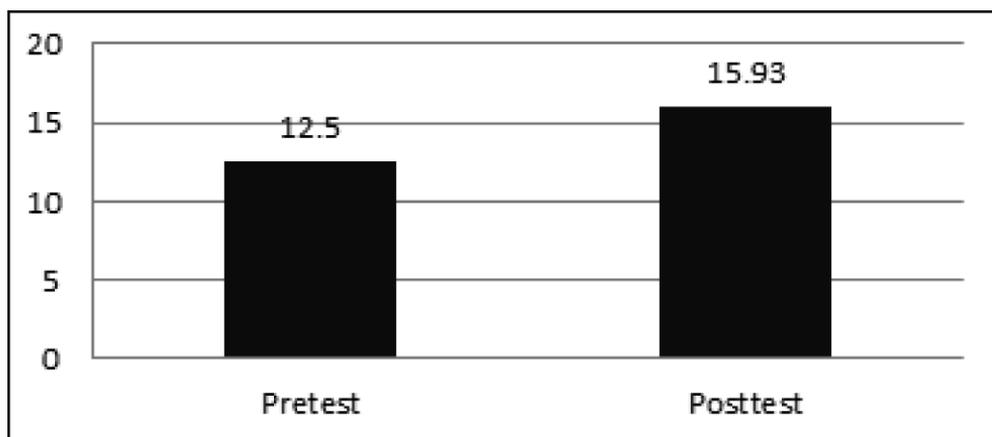
Figure 1. Descriptive Comparison of the Pre-test and Post-test results of the Comprehension Test for Bioethics Principles.

Table 1

Paired Samples t-test of the Pre-test and Post-test for Comprehension of the Four Bioethics Principles

	Mean	SD	t	df	Sig 2-tailed	Partial Eta Squared
Pre-test	12.50	3.60				
Post-test	15.93	2.24	10.24*	115	0.00	0.48
Total	3.93	3.61				

*Note: *p≤.01.*

      These results indicate that the intervention (case study discussion) was effective in improving the comprehension levels of the respondents towards the four bioethics principles. Similarly, in a recent action research (Figueras, 2013) on the effects of case study discussion on comprehension of bioethics principles by the researcher, results imply that an inquiry-based strategy, i.e., a case study discussion, can enhance students' comprehension of the four Bioethics principles. This action research also reported that in addition to the positive results, students' reflections stated that aside from enhanced learning case study discussions and preceptorial session were described by the students

as an enjoyable and interesting learning experience. This result was likewise observed in interviews with the students during preceptorial sessions in this research. Some of the excerpts from the interviews are as follows:

> Stephen: "I enjoyed the case study discussion very much. It was a bit scary at first, but then it was good to hear what my other classmates had to say about the situations given, since some of their perspectives, I could not have thought of them by myself."

> Trina: "I liked listening to the opinions of my classmates. What may be unethical in my opinion may seem acceptable to others, but then when I listened to their points of view, I understood their perspective."

> Yedda: "It was a very enriching and enlightening experience. Discussion of the cases with my classmates helped me understand that sometimes, I tend to be close-minded about some issues."

Moreover, a study by Murphy, Soter, Wilkinson, Hennessey, and Alexander (2009) reported that several discussion approaches in teaching concepts can manifest substantial improvements in comprehension of topics. This can also be further supported by documented information that students can learn more effectively when actively involved in the learning process (i.e., through case study discussions) by Bonwell and Eison (1991) and by Sivan et al. (2001). Venglar and Theall (2007) also report that using case studies in teaching ethics in physical therapy students resulted to greater perceived value of ethics content and had greatly improved critical thinking in clinical practice situations. Moreover, Mustoe and Croft (1999) claim that case studies have also been linked with increased student motivation and interest in a subject, thereby, increasing the ability to learn, especially that comprehension is one of the important cognitive domains.

Results of the pre-test and post-test scores of the convictions test showed that there was a statistically significant increase in the test scores from the pre-test ($M = 23.146$; $SD = 3.40$) to the post-test $(M = 25.948$; $SD = 3.10)$, $t = $ -9.87; $p = 0.00$. The eta squared statistic (0.46) indicated a large effect size; implying that the increase in the test scores could be greatly attributed to the intervention. These are shown in Figure 2 and Table 2.
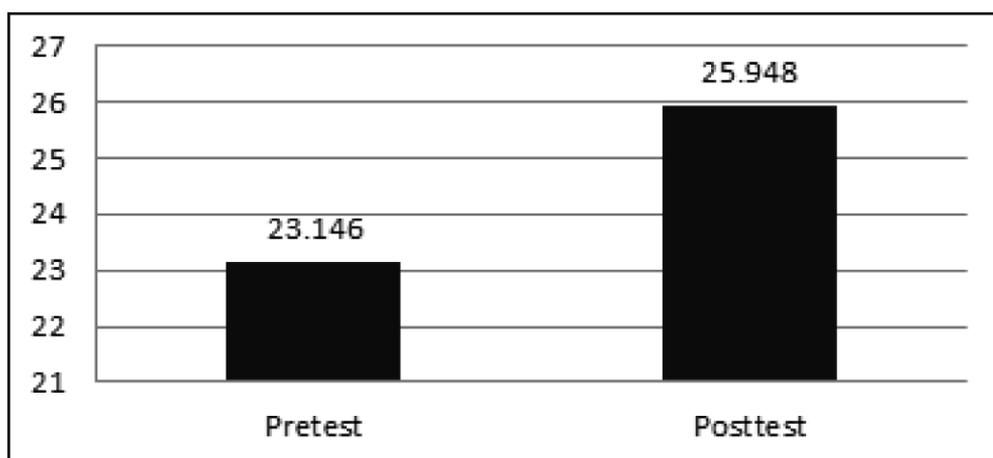
Figure 2. Descriptive Comparison of the Pre-test and Post-test results of the Convictions Test for Bioethical Issues.

Table 2

Paired Samples t-test of the Pre-test and Post-test for Convictions towards Bioethical Issues

	Mean	SD	t	df	Sig 2-tailed	Partial Eta Squared
Pre-test	23.146	3.40				
Post-test	25.948	3.10	9.87*	115	0.000	0.46
Total	2.80	3.06				

*Note: *p≤.001.*

     These results indicate that the intervention (the Bioethics course) was effective in increasing the schema levels of the participants. This may support the premise of several researchers (Bebeau, 2002; Gibbs, Basinger, Grime, & Snarey, 2007; King & Mayhew, 2002) that moral atmosphere in an institution can affect individuals' moral reasoning. Moreover, Schlaefli, Rest and Thoma (1985) also reported that dilemma discussion and psychological development programs with 3 to 12 weeks duration can modestly improve moral judgment.

The multiple regression test showed that verbal ability and exposure to media are predictors for comprehension of the four Bioethics principles before exposure to case study discussion, when only global factors of personality were considered. In the overall model which indicates both verbal ability and exposure to media as predictors, verbal ability explains 7.5 % of the variance ($R^2 = 0.075$; $F_{(2,112)} = 7.248$; $p = 0.007$) and exposure to media explains 11.5% of the variance ($R^2 = 0.115$; $F_{(2,112)} = 7.248$; $p = 0.007$). Verbal ability ($\beta = 0.25$; $t = 2.74$; $p = 0.007$) had greater contribution as a predictor than exposure to media ($\beta = 0.20$; $t = 2.23$; $p = 0.028$). These are shown in Table 3.

Table 3

Model Summary of Multiple Regression Analysis of Predictors of Comprehension of the Four Bioethics Principles Before Intervention (Global Factors of 16PF)

	Coefficients[a]				
Model	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
	B	*Std. Error*	*Beta*		
(Constant)	4.95	2.29		1.79	0.08
Verbal Ability	0.16	0.06	0.25	2.74**	0.007
Exposure to media	0.581	0.26	0.20	2.23*	0.028

Note: a. Dependent Variable: pre-comprehension
Prediction Model: y = 4.095 + 0.16 verbal ability ($R^2 = 7.5\%$, $F_{(2,112)} = 7.248$, p-value = 0.007),
y = 4.095 + 0.581 exposure to media ($R^2 = 11.5\%$, $F_{(2,112)} = 7.248$, p-value = 0.028)
*$p<.05$. **$p<.01$.

These results are expected since it has been an accepted premise that in normal case-scenarios, individuals with high mental ability, particularly in the verbal aspect, can easily comprehend and analyze problem-based situations. Moreover, if a person is constantly exposed to media about certain issues, it can be expected that he can easily comprehend facts and concepts about the issue since he has read or heard about it in various media materials. This may be referred to as cognitive media effect, which occurs when media exposure influences a person's mental processes of the product of these mental processes. The human mind eventually absorbs information from different forms of media it has been exposed to and turns or processes these information in different ways to create new meanings. The individual may develop and establish principles about real life based on generalizations. This premise may be derived from Bandura's social cognition theories on observational learning and cognitive skill learning (Zimmerman & Schunk, 2003).

When only primary factors of personality were considered, verbal ability, warmth, and exposure to media are predictors for comprehension of the four Bioethics principles before intervention. In the overall model which indicates verbal ability, exposure to media, and warmth as predictors, verbal ability explains 7.50 % of the variance ($R^2 = 0.075$; $F_{(2,112)} = 7.248$; $p = 0.001$) warmth explains 11.8% of the variance ($R^2 = 0.118$; $F_{(2,112)} = 7.248$; $p = 0.012$) and exposure to media explains 16.4% of the variance ($R^2 = 0.164$; $F_{(2,112)} = 7.248$; $p = 0.015$).

Verbal ability ($\beta = 0.30$; $t = 3.35$; $p = 0.001$) has the greatest contribution as a predictor followed by exposure to media ($\beta = 0.23$; $t = 2.57$; $p = 0.012$), and lastly, warmth ($\beta = 0.21$; $t = 2.47$; $p = 0.015$). These are shown in Table 4.

Table 4

Model Summary of Multiple Regression Analysis of Predictors of Comprehension of the Four Bioethics Principles before Intervention (Primary Factors of 16 PF)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.013	2.54		0.40	0.690
Verbal ability	0.203	0.06	0.30	3.35**	0.001
Warmth	0.404	0.15	0.23	2.57*	0.012
Exposure to media	0.630	0.26	0.21	2.47*	0.015

Note: a. Dependent Variable: pre-comprehension
Prediction Model: y = 1.013+0.203 verbal ability *(R^2 = 7.5%, $F_{(2,112)}$ = 7.248, p-value = 0.001),*
y = 1.013+0.404 warmth *(R^2 = 11.8%, $F_{(2,112)}$ = 7.248, p-value = 0.012),*
y = 1.013+0.630 exposure to media *(R^2 = 16.4%, $F_{(2,112)}$ = 7.248, p-value = 0.015)*
*$p<.05$. **$p \leq .001$.

It was mentioned in the first set of predictors considering global factors that verbal ability and exposure to media can be expected as predictors because both are directly related to or may influence cognitive processes. The additional predictor, warmth, may be considered a predictor since according to recent theory and research in social cognition, the warmth dimension captures traits that are related to perceived intent, including friendliness, helpfulness, sincerity, trustworthiness, and morality (Fiske, Cuddy, & Glick, 2006). These traits may influence consideration for understanding the four Bioethics Principles since these principles are focused on what should be considered as the common good

based on universal standards; i.e., a "win-win" situation for both parties. Taking into consideration the fact that at this time, the participants were not yet exposed to the intervention, it maybe safe to infer that individuals who lean towards the "warmth" personality trait may be expected to have better understanding or comprehension of the concepts brought about by the 4 principles of Bioethics since the "warmth" traits they possess are by nature, more affiliated to reaching out to other people, thus, making them more receptive of and sensitive to the feelings and welfare of others.

As far as convictions before exposure to the bioethics course is concerned, when only global factors of personality were considered, sex is the only predictor. The model indicates sex as the only predictor, the overall model explains 4.8 % of the variance ($R^2 = 0.048$; $F_{(2,113)} = 5.74$; $p = 0.018$). Sex contributes as predictor at $\beta = 0.220$; $t = 2.396$; $p = 0.018$. These are shown in Table 5.

Table 5

Model Summary of Multiple Regression Analysis of Predictors of Convictions Towards Bioethical Issues Before Intervention (Global Factors of 16PF)

		Coefficients[a]				
	Model	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
		B	*Std. Error*	*Beta*		
1	(Constant)	21.778	0.64		33.96	0.000
	sex	1.756	0.73	0.22	2.40*	0.018

Note: a. Dependent Variable: pre-convictions
Prediction Model: y = 21.778+1.756 sex *(R^2 = 5.0%, $F_{(2,113)}$ = 5.74, p-value = 0.018)*
*$p<.05$.

Sex may be an expected predictor for convictions towards bioethical issues since several studies have observed that since females had higher empathy levels than males, they have higher scores in moral development (Hoffman, 2000; Eagly, 1987; Thoma, 1986).

When only primary factors were considered in determining predictors of convictions before intervention, sex and the primary personality trait, openness to change were found to be predictors. In the overall model which indicates sex and openness to change as predictors, sex explains 5.0 % of the variance ($R^2 = 0.05$; $F_{(2,113)} = 5.74$; $p = 0.014$) and openness to change explains

9.0% of the variance ($R^2 = 0.09$; $F_{(2,113)} = 5.74$; $p = 0.035$). Sex ($\beta = 0.23$; $t = 2.49$; $p = 0.014$) had a higher contribution as a predictor than openness to change ($\beta = 0.193$; $t = 2.136$; $p = 0.035$).   These are shown in Table 6.

Table 6

Model Summary of Multiple Regression Analysis of Predictors of Convictions Towards Bioethics Issues Principles Before Intervention (Primary Factors)

Model	Coefficients[a]				
	Unstandardized Coefficients		Standardized Coefficients	*t*	*Sig.*
	B	*Std. Error*	*Beta*		
(Constant)	19.650	1.179		16.663	.000
sex	1.80	0.72	.226	2.486*	.014
Openness to change	0.37	0.17	.193	2.136*	.035

Note: a. Dependent Variable: pre-convictions
Prediction Model: y = 19.650+1.795 sex ($R^2 = 5.0\%$, $F_{(2,113)} = 5.74$, p-value = 0.014),
y = 19.650+0.371 openness to change ($R^2 = 9.0\%$, $F_{(2,113)} = 5.74$, p-value = 0.035)
*$p<.05$.

        As mentioned in the former section, sex is a considerable predictor for convictions towards bioethical issues because of the tendency of females to have higher empathy than males. Openness to change may be another considerable predictor since individuals who are open to change are more likely open-minded; and therefore, tend to "think outside the box", and may most likely consider alternative options, and unconventional ideas, and have the tendency to be more flexible than individuals who are strictly traditional. In a paper by Johnston (2009) about rule following, standards of practice, and open-mindedness, it is mentioned that the open-mindedness trait is a requirement in the appeal to higher principles or rules when typical standards or guidelines are inappropriate, or violate one's ethical sense. In creating bioethical decisions considering the universal principles, it does not immediately follow that if a certain decision is against or may slightly bend the traditional laws and norms of society, it is automatically wrong in terms of bioethics. There are situations in which one should take into consideration what would be morally right for both parties, even if the decision may be unconventional. Johnston (2009) further discusses that open-minded individuals usually allow themselves to recognize that there are other better standards and higher ideals or principles than those specific to professional practices. Moreover, open-mindedness also allow using further rules to navigate or negotiate action when other rules fail or do not produce the intended result.

The global personality traits, anxiety, self-control, and extraversion were found to be predictors for convictions towards bioethical issues after exposure to the Bioethics course. In the overall model which indicates anxiety, self-control, and extraversion as predictors, anxiety explains 3.0 % of the variance $(R^2 = 0.03; F_{(2,113)} = 4.99; p = 0.007)$; self-control explains 5.0% of the variance $(R^2 = 0.07; F_{(2,113)} = 4.99; p = 0.015)$ and extraversion explains 12.0% of the variance $(R^2 = 0.12; F_{(2,113)} = 4.99; p = 0.017)$. Anxiety $(\beta = 0.25; t = 2.74; p = 0.007)$ had the highest contribution as a predictor; followed by self-control $(\beta = 0.22; t = 2.48; p = 0.015)$ and extraversion $(\beta = 0.22; t = 2.42; p = 0.017)$. These are shown in Table 7.

Table 7

Model Summary of Multiple Regression Analysis of Predictors of Convictions Towards Bioethics Issues Principles After Intervention (Global Factors of 16PF)

Coefficients[a]					
Model	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
	B	*Std. Error*	*Beta*		
(Constant)	18.713	1.893		9.885	.000
Anxiety	0.455	0.17	0.25	2.74**	.007
Self-control	0.464	0.19	0.22	2.48*	.015
Extraversion	0.386	0.16	0.22	2.42*	.017

Note: a. Dependent Variable: post-convictions
Prediction Model: y = 18.713+0.455 anxiety *(R^2 = 3.0%, $F_{(2,113)}$ = 4.99, p-value = 0.007)*,
y = 18.713+0.464 self-control *(R^2 = 7.0%, $F_{(2,113)}$ = 4.99, p-value = 0.015)*
y = 18.713+0.386 extraversion *(R^2 = 12.0%, $F_{(2,113)}$ = 4.99, p-value = 0.017)*
*$p<.05$. **$p<.01$.

Anxiety may be considered as a predictor for convictions before exposure to the bioethics course, since individuals who are anxious have greater sensitivity to fairness and equity/proportionality (Koleva, Selterman, Iyer, Ditto, & Graham, 2014). While these authors have concluded that the aforementioned qualities of anxious individuals may lead them to become overzealous in their moral judgments and would therefore be less willing to give people "the benefit of the doubt" in morally ambiguous situations, it may be theorized that their tendency to be sensitive towards fairness and

being particular about equity/proportionality may allow them to focus on considering the principle of justice in creating bioethical decisions. This aspect is an integral part in bioethical decision-making since it is one of the four bioethics principles, which are supposed to be moral guides in bioethics decision making. Self-control and extraversion are also considerable predictors for convictions, particularly in participants who have not yet been exposed to the Bioethics course. In a study about personality characteristics by Stojiljković (1998), extroversion and emotional stability (which may be associated with self-control) to have some effect on moral reasoning (which may be used in determining convictions towards bioethical issue dilemmas). Stojiljković (1998) explains that the acceptance of another person's point of view and his or her interests, as well as the system-defined norms and rules, are essential characteristics of conventional morality. Thus, the ability of empathically putting oneself in another person's shoes can help one easily recognize another's expectations and requirements and accept the "member of society" perspective; i.e., not just focusing on social norms but also on higher perspective of considering what is morally right and just for all. The author further theorized that this characteristic and perspective can be easily achieved by extroverts, who more frequently turn to others, and who, therefore, more readily accept society's norms. More so with individuals who have well-developed self-control traits allow them to be able to control selfish motives and to put the welfare and perspective of others above their own desires.

When only primary personality traits were considered in determining predictors for convictions after intervention, primary personality traits, liveliness and perfectionism were found to be predictors. In the overall model which indicates liveliness and perfectionism as predictors, liveliness explains 4.0 % of the variance $(R^2 = 0.04;\ F_{2,112} = 5.39;\ p = 0.006)$. Perfectionism explains 5.0% of the variance $(R^2 = 0.09;\ F_{2,112} = 5.39;\ p = 0.015)$. Liveliness $(\beta = 0.27;\ t = 2.818;\ p = 0.006)$ had higher contribution as a predictor than perfectionism $(\beta = 0.23;\ t = 2.469;\ p = 0.015)$. These are shown in Table 8.

Table 8

Model Summary of Multiple Regression Analysis of Predictors of Convictions towards Bioethics Issues Principles After Intervention (Primary Factors of 16PF)

	Coefficients[a]				
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	21.005	1.534		13.696	.000
Liveliness	.494	.175	.267	2.818**	.006
Perfectionism	.377	.153	.234	2.469*	.015

Note: a. Dependent Variable: post-convictions
Prediction Model: y = 21.005 + 0.494 liveliness $(R^2 = 4.0\%, F_{(2,112)} = 5.39, p\text{-}value = 0.006)$,
y = 21.005 + 0.377 perfectionism $(R^2 = 9.0\%, F_{(2,112)} = 5.39, p\text{-}value = 0.015)$

*p<.05. **p<.01.

Liveliness may be a considerable predictor for convictions since lively individuals are usually spontaneous and animated, and may therefore be associated with open-mindedness. Individuals who are open-minded, as mentioned earlier in the paper, have greater tendency to accept unconventional situations and thus, "think outside the box". This allows them to consider options which are more appropriate for the given situation rather than what is usually expected- which is the main aim in giving moral decisions considering the 4 bioethics principles. Perfectionism is a personality disposition characterized by striving for flawlessness and setting exceedingly high standards of performance accompanied by overly critical evaluations of one's behavior (Frost, Marten, Lahart, & Rosenblate, 1990; Hewit & Flett, 1991). An individual with perfectionism traits tends to analyze situations thoroughly before making decisions, and has more chances of taking into consideration what would be for the common good. Perfectionism is the usual choice of individuals with well-developed moral judgments also is referred to in this study as Post-conventional Schema.

Perfectionism may be further supported by two studies. Mu (2011) reported that perfectionism had significant positive correlations with four of the five virtues captured by the Virtue Adjectives Rating Scale(the Chinese equivalent for moral judgment scale); namely, diligence, resourcefulness, self-reliance, and serenity. This study also utilized the 16 PF to measure

perfectionism. The second study, by Yang, Stober, and Wang (2015) postulated that there is a positive correlation between moral values, virtues, reciprocal helping, forgiveness, and condemnation of wrong behaviors and perfectionism traits.

In the Structural Equation Modeling (SEM) analysis, of the five path models constructed, only four were accepted on the basis of criteria set by model fit indices considered in this study since one of the models (model 4) did not reach 3 of the fit indices criteria. The model constructs which fit the criteria are shown in Figures 3 and 4.
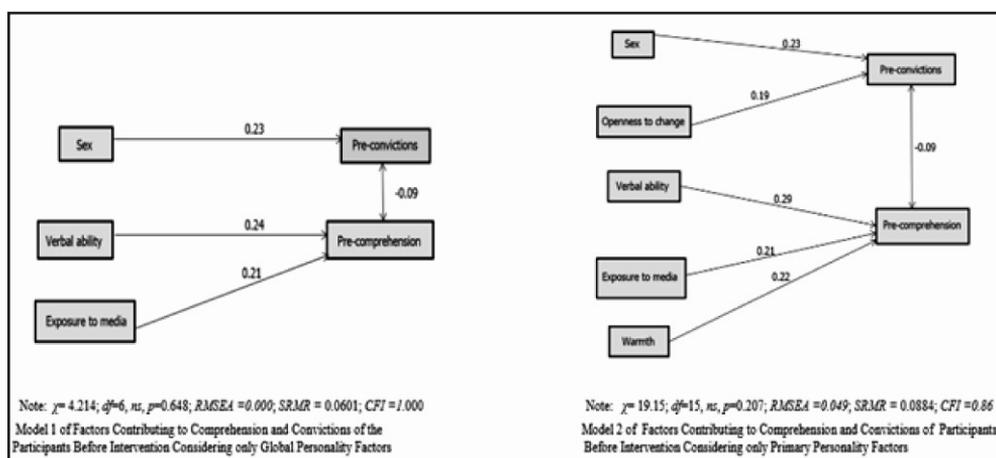

Figure 3. Corrected Path Models (Models 1 and 2) Which Fit the Fit Indices Criteria of the Structural Equation Modeling (SEM)
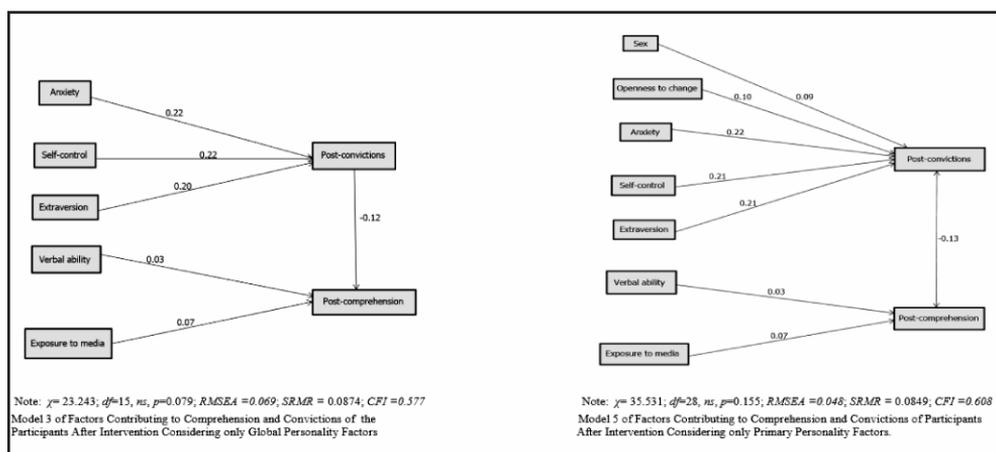

Figure 4. Corrected Path Models (Models 3 and5) Which Fit the Fit Indices Criteria of the Structural Equation Modeling (SEM)

Conclusions, Implications, and Recommendations

The following conclusions are formulated: (a) case study discussion is an effective tool in enhancing comprehension of the four Bioethics principles; (b) the Bioethics course is effective in improving convictions of the students towards Bioethical issues; (c) before exposure to case study discussion, verbal ability, warmth, and exposure to media are predictors for comprehension of the four Bioethics principles; (d) predictors for convictions before intervention were identified as sex and openness to change; (e) for post-convictions, predictors identified were anxiety, self-control, extraversion, liveliness, and perfectionism; (f) comprehension of the four Bioethics principles has a negative contribution to convictions towards bioethical issues; therefore, it may be inferred that the four Bioethics principles are not considered or not prioritized in making bioethical decisions; (g) personal factors such as sex and some personality factors (openness to change, extraversion, anxiety, self-control, liveliness, and perfectionism) are contributors in making moral decisions, not cognitive factors such as mental ability or comprehension of the four Bioethics principles; and (h) the identified predictor-personality factors, particularly those in relation to convictions, are empathy-based personality factors and are commonly associated with one's ability to be flexible, readily accepting society's norms, and putting the welfare and perspective of others over one's own.

Since results of this study showed that predictors and contributors to convictions of students towards bioethical issues are mostly personal factors, it is imperative that educators of Bioethics be aware of the nature of such personal factors. This would give them better understanding on how to "reach" their students. Concrete understanding of personality factors and other personal factors, such as the personal background of the students may also help in identifying strategies which would give optimum results. Results of the study also showed that the Bioethics course is effective in enhancing the convictions of the participants towards bioethical issues. This implies that moral education indeed enhances moral judgment; and, therefore, with the advent of technology nowadays, it is important to give attention to moral education in science curricula. It is important for educators of Bioethics to know that individuals always have pre-convictions towards bioethical issues, and this is usually based on personal factors. Since case study discussion is an effective strategy in teaching the Bioethics principles, this strategy may be considered as an effective tool in teaching similar topics, particularly in moral education. Since the results also showed that education (i.e., moral education in the form of the Bioethics course) has a significant effect on convictions; and the personality factors which affect post-convictions are mostly based on empathy, application or more case study discussions related to the issues taken

up in the course, exposure to movies related to the topics, or close encounters with persons who have experienced the issues (e.g., interviews or community immersions) may be the ideal strategies in increasing empathy among the students. Preceptorial sessions wherein a more personal aspect of the students could be reached would also be an ideal strategy in teaching Bioethics. It is also imperative to consider the inclusion of the Bioethics course in science curricula. Results of this study have proven that the course enhances one's convictions towards bioethical issues; therefore, it is important to consider that convictions or moral judgments can be improved through moral education.

The following recommendations are raised. Since convictions of the participants were proven to have increased upon exposure to the Bioethics course, it is, therefore, safe to recommend to developers of science curricula or science related curricula and to policy makers in education to give attention and importance to moral education especially with the fast advances of science and technology. It is imperative that Bioethics be included as part of B.S. Biology curricula; as well as other medically-related courses. Comprehension of the four Bioethics principles were proven to be enhanced upon exposure to case study discussions; thus, this strategy of teaching is recommended in introducing and inculcating such topics to the students not just in the Bioethics course, but also in topics leaning towards the affective domains in other subjects. Predictors towards convictions were mostly personal factors; majority of which were personality factors. Thus, it is imperative that medical and scientific personnel be aware of this information. It may help them understand the source of their moral decisions and eventually may help them in making morally sound bioethical decisions. For bioethicists and researchers, it is recommended that a similar study be conducted on different institutions offering B.S. Biology or medical-related courses for comparison and for confirmation of findings. Similar studies on high school students may also be conducted so as to determine if the moral schemas in this region (or even country) are developed as early as high school. Additional factors, such as age, empathy and sympathy levels or a different personality test with lesser factors can be used for measurement of personality. A test of measurement of I.Q. is also recommended. More representatives for the different religious affiliations may also be considered, and another test for moral judgment; the DIT or the DIT-2, may also be added as an instrument, to compare the results of the convictions test. It is also recommended that this study be replicated with a higher sampling size; perhaps with several batches of students taking Bioethics. The use of SEM as a statistical tool for similar studies is also recommended. Moral disengagement factors should also be considered, especially to explain low schemas in convictions. An instrument to measure moral disengagement should also be devised in order to attain this objective.

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