

A Comparative Study in the Delivery of Ethics for Engineering Undergraduates

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ABSTRACT

Ethics has resulted from the human faculty of thinking and differs from *akhlak*, which is faith in action. Humility can be used as an indicator of good *akhlak* and is worthy of being used for defining the moral competence of engineers. *Akhlak*, after all, signifies morality and mannerism. This affective trait is to be converged with mastery, representing the cognitive domain. The two modes of delivery of ethics, humility, were then assessed through a mixed-method sequential exploratory research. Two groups of students were subjected to formal and informal teaching programs. Humility is used as the moderating effect of Structural Equation Modelling (SEM) of the Mastery-Humility model. It was found that the group comprising of 163 students (Group P) that underwent an informal delivery of ethics (humility) met the fit indices of the model. This is further confirmed by the Independent t-test. The other group comprising a similar number of students (Q), however, failed to do so despite having more ethics-related taught subjects. Several likely reasons for the teaching modules' ineffectiveness are the necessity of passing ethics as an examination subject, perceived as a lesser value for students to become industry ready, and it being treated as a stand-alone subject.

Keywords: Cognitive, Humility, Model, Formal, Akhlak

INTRODUCTION

Course outcome is developed using Bloom's Taxonomy [1] that involves three learning domains: psychomotor, cognitive and affective. Firstly, the psychomotor, which is the coordination, physical movement, and motor-skill areas. Development of these skills requires exposure and practice and is measured in precision, speed, techniques or procedures.

Secondly, cognitive which include knowledge and intellectual development skills. These domains comprise six major categories, from the most specific behaviour to the most complex. The various levels of difficulties are set up in these categories. The categories are recognised as degrees of difficulty. The category of knowledge: to bring to mind a framework of ideas that will form the basis for further and higher levels of intellect. Comprehension: Finding meaning from the data and facts. Application: using the finding in other settings but with attributes of the same kind. Analysis: breaking into bits and pieces to observe the interconnectedness of things. Synthesis: from the observation, assemble all to fit into a well-defined structure of ideas. Evaluation: Assessing with evidence-based pertinent data for error-free decision-making.

Thirdly, the affective includes how the study deals with things emotionally. Bloom's Taxonomy can be applied to this domain. Mainly it has to do with matters of the heart, which can be summarised as social-emotional skills. At the very basic is the ability to be on the other side of the conversation, that is, the listener. This skill includes putting the speaker at ease and effortlessly hearing out every word. Information gleaned can be put to good use at any possible chance and setting. This receiving stance skill can be combined with a responding skill whereby appropriate questions can be posed, generating and opening up routes for intelligent discussion. From then on, interpersonal connection and expression can be established. Once this is achieved and internalised, the values learnt and grasped will direct the logic and reason in their thinking. This valuing skill will be acted upon in interpersonal matters and settings like appreciation and justification.

There is a need to have the organisational skill of handling differing points of view based on certain beliefs and values. One will use such skill to compare and contrast with one's value system and background, As such conclusion drawn is based on an individual's unique experience. Finally, an action, if any, can be pursued once characterisation is done based on certain value systems. Hence, achieving justice and fairness governed by their respective systems. Accordingly, ethics, with its value systems, will be dealt with herein.

Ethics

Ethics for engineers aims to comprehend the engineering practice's moral values. To practice ethically, one has to accept moral responsibility and faithfully comply with moral obligations. Without this, the easy way out is to choose what is convenient rather than what is right (relativism) [2].

Ethics and Akhlaq

The word "ethics" originates from the Greek word "ethos", meaning "habit" or "custom". A similar word *khuluq* (character) came before the term ethos in the Islamic world. It can be defined as rules of conduct in accordance with value systems. Ethics begins and completes based on man's thought process; meanwhile, *akhlaq* is guided by the Divine rules as practised by Rasulullah *pbuh*.

Rasulullah himself is the 'Qur'an in action. As such, all Muslims will need to abide by all his actions or *akhlaq* (ethics) accordingly to Syariah (Islamic law) [3]. In other words, for a Muslim, good conduct is a sign of truly comprehending his position as 'Abd before his/her Creator. One's behaviour is acceptable when in conformity with His words and guidance.

Humility

It is also called in Arabic as Tawadhuk, defined as one with moral competence standing up against societal injustice when warranted. This dispels the notion that one who has shown humility is docile and unassuming. His humility is towards his Creator. He is always searching for the truth in the pattern of His creation, always respects the work of others, and does not highlight his own, although no less significant [4].

An engineer with such values will always remember that however good his works are, he will always have his feet on the ground. He recognises the worthiness of others "They do not think less of themselves but think of themselves less" [5].

Presently there is no agreed method to assess humility characteristics, Efforts to create inventories describing its relation with humility are inaccurate [4, 6]. In this paper, humility means one who is physically in a prostration (*Sujud*) position and submitting to Him in totality.

COGNITIVE-AFFECTIVE DOMAINS

An engineer is a professional when he/she is both competent and ethical. That means one with both cognitive and affective skills. The latter is not easily measured, and evaluating the outcomes of any engineering programme has been challenging. A convergent model comprising the two domains was developed, with mastery representing the cognitive and humility representing the affective domains. This can be achieved by subjecting them to the concept of Bil-Mizan based on the Tawhidic principle [7].

Mastery Assessment

Mastery is designated as beyond competency in engineering training, and during their undergraduate studies, it is assessed by the Integrated Design Project (IDP) course. The achievements in the course indicate their potential to become master craftsmen later in their careers. In addition, sustainability design is given priority in treating the course, enabling them to use the resources for the good of mankind sustainably and ethically.

A commonly held course in accredited engineering programmes, IDP is chosen as the mark of 'mastery' in undergraduate training [7]. Integrated Design Project Course/Capstone Design Project indicates the disciplines'

competency. It is the very essence of enabling and culminating courses: (a) Enabling Courses (EC) are the courses that form the foundation and principles of engineering that underpin and govern the application, and (b) Culminating Courses (CC) are outcomes-driven from the proper choices and combination of the applied components for making up the complete whole.

Humility Assessment

Spiritual Well-Being assessments can be done by Counsellors in a Holistic Soft-Skill Management (HSM) programme, which identifies and rectifies the spiritual and mental characteristics of students. The other is a Coping Resources Inventory (CIR), used by the Counsellor to assess the student's capability when challenged spiritually and physically, especially those that affect their academic performance [8]. The findings show that having good spiritual values equates to better grades.

This paper discusses the students with different humility traits resulting from the delivery modes. As explained above, the measurement of ethics (humility) is done through its significant role in moderating the convergence of mastery and humility. It is a wholesome measurement but, at the same time, can delineate the effect of one parameter over the other.

METHOD OF STUDY

The humility obtained from the effects of teaching ethics-related subjects at two institutions of higher learning (IHLs) forms the sub-scale of the two variables in the model construction. The purpose was to examine: (a) the moderating effect and (b) the effects of the modes of delivery of ethics. The study used the mixed-method exploratory sequential design and involved two IHLs (P and Q). They are populated with Malay-Muslim students. Those who participated in the study numbered 507 answered the main questionnaire survey.

Structural Equation Modelling (SEM) was used to measure humility as the sub-scale with an equal number of respondents of 163 (within the range of 100-200 for SEM) from each group). A pooled Confirmatory Factor analysis was obtained for calibration. The Confirmatory Factor Analysis (CFA) meets the goodness of fit, and the construct validity has the following fit indices:

Table 1. Fit Indices

Test	X ² /df	RMSEA	CFI	IFI	TLI	PNFI	Helter's Critical N
Value	<4	≤.08	≥.95	≥.90	≥.90	≤1	≥75
Pooled Model	3.924	.076	.952	.952	.944	.804	159(01)

Notes:

α : 0.72 to 0.9, C.R.; 0.73 to 0.95, AVE: 0.5 to 0.8, HTMT: 0.85.

RESULTS

The following results showed the mastery-humility model and the fit indices with humility as a sub-scale moderating the convergence of mastery and humility.

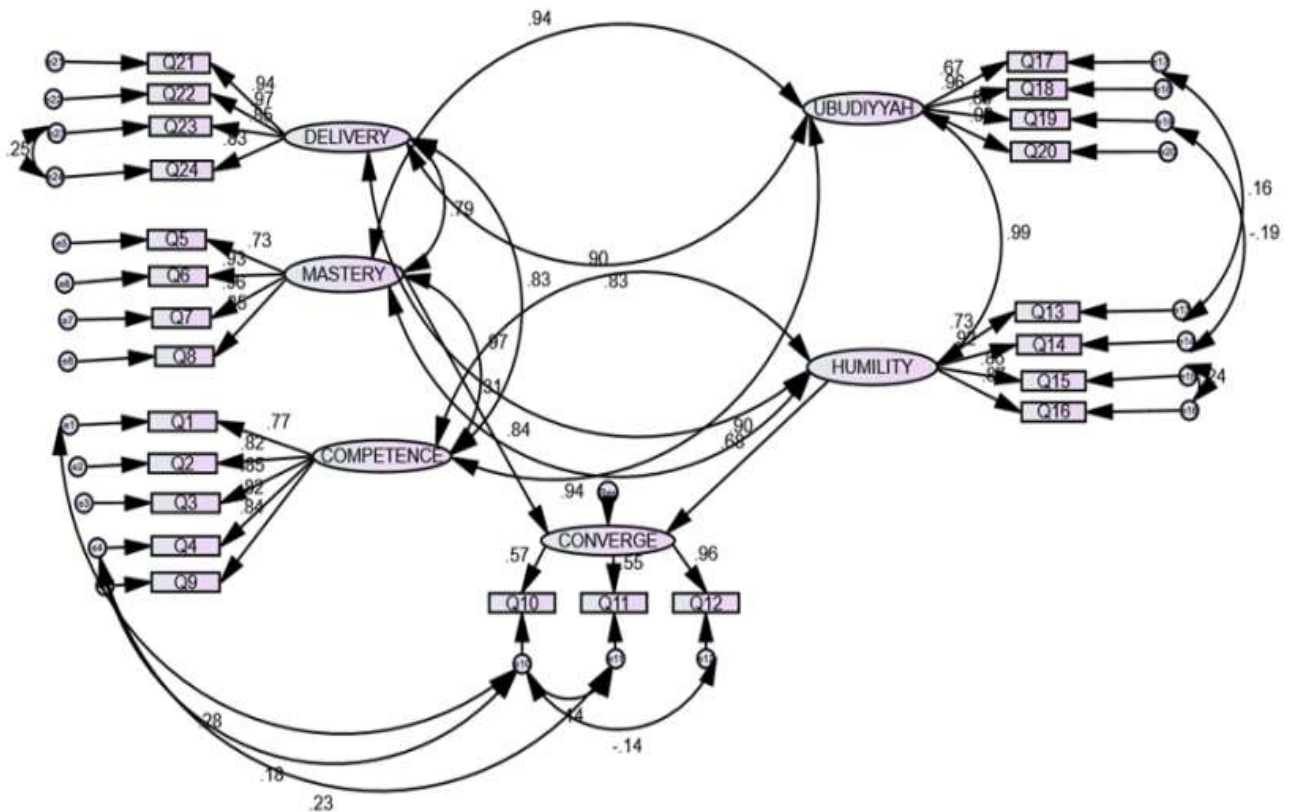


Figure 1. Mastery-Humility Model

Table 2. Fit Indices (MH Model)

Test	X ² /df		RMSEA	CFI	IFI	TLI	PNFI
Value	<4		≤.08	≥.95	≥.90	≥.90	≥.05
Final CMH Model	3.31		.068	.963	.963	.956	.793

Table 3. Effect of Teaching Modules on Humility subscale (HH)

Test	Loading		Loading	Direct Effect	Direct Effect	Remark
Value	Mastery → Convergence		Humility → Convergence	Mastery → Convergence	Humility → Convergence	Respondents
HH (a)	.282		.734	.382	1.423	Q (N= 163)
HH (b)	.244		.857	.310	1.211	P (N= 163)
Test	Chi-square	X ² /df	RMSEA	CFI	TLI	Remark
Value		<4	≤.08	≥.95	≥.90	Respondents
HH (a)	514.38	2.227.	.087	.935	.916	Q (N= 163)
HH (b)	446.82	1.934	.076	.955	.942	P (N= 163)

Note: Group P satisfies the indices of fitness.

On comparing further between the two groups, further observations are made. From the independent samples t-test (Table 4), there was a significant difference in the scores for Group P ($M = 10.01$, $SD = 5.21$) and Group Q ($M = 8.74$, $SD = 4.75$) conditions; $t(324) = 2.46$, $p = 0.015$.

Table 4. Independent t-test

	GRPS	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
HUMILITY	GP:Q	163	8.74	4.746	0.372
	GP:P	163	10.1	5.211	0.408

Levene's Test for Equality of Variances		t-test for Equality of Means							
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
							Lower	Upper	
Equal Variances Assumed	6.325	0.12	-2.456 > 1.967 (C.V.)	324	.015 < 0.05	-1.356	0.552	-2.442	-.270

ANALYSIS AND DISCUSSION

The study's results on the two delivery modes show markedly different outcomes. In terms of humility, traits that can be converged with mastery form a blended individual to be moulded into a master craftsman. Students from University P seem to have the upper hand in handling ethical decision-making and have the potential to be the desired professionals ($CFI = .955$, $RMSEA = 0.076$, $X^2/df = 1.934$). In contrast, students from University Q failed to obtain the necessary levels of fit indices. In addition, the results of the independent sample t-test indicated that students from University P obtained a higher mean (10.01) than students from University Q, which is 8.74.

Some pitfalls may have led to this outcome.

Firstly, the necessity of passing the examination subject, which may lead to their CGPA being affected by any failure, puts the students at greater stress than those from University P. The push for better grades may have been the pressure to study by memorisation without internalising the values of genuine humility. Unethical behaviour was observed in some cases while sitting for the ethics paper examination.

Secondly, the push to finish the syllabus put the lecturers and the students in a bind. Doing the extra mile on non-technical subjects, either trying to enhance ethics-related subjects or reading a hadith or verses from the Qur'an, will be frowned upon. It was done better, the students said by the others rather than the subject lecturers themselves. The students may not have enough time if the lectures are less focused. They are more keen to be industry ready.

Thirdly, the coordinator is not equipped sufficiently to pursue the drive to inculcate the values of ethics within the revealed and/or acquired knowledge. Ethics, therefore, stands on its own without interactions with other subjects, which can be greatly facilitated by the coordinator.

These three reasons may lead to the teaching modules' ineffectiveness: the examinable forms of instruction, resistance by students and the seemingly inadequate role of the Islamisation Coordinator.

In the case of University P, there is only one subject on Islamic and Asian civilization dealing in matters that touch on some form of morality. This differs greatly from University Q, with six ethics subjects and examinations. University P pushes aggressively through non-examination informal means such as living up to their motto of Effort, Taqwa and Virtue in all activities.

The following may be their efforts which proved fruitful:

Firstly, though not to the extent of performing salat before learning mathematics, as practised during the Golden era of Islam, they have the habit of reading verses of the Qur'an or Hadith, and at the end of the classes, all shake hands thanks to the One who is guiding them. It is built upon them the humility to be grateful to the lecturers. They aimed to be the industry's preferred but simultaneously feared Allah and had high morality. This is also the guiding principle of the Students Affairs Department's activity in the Faculty.

Secondly, A large number (300/year) of the activities organised by the Faculty are based on this principle. Many staff members are formally accredited to develop social, moral, and communication soft skills. At the end of each semester, there will usually be a get-together to have food together anywhere convenient to celebrate, even to the extent of having cooked food in classrooms. The human values and rapport thus develop is all-embracing.

Thirdly, under-performance students are mentored through special uplifting programs designed to improve their academic achievements through Spiritual-Well Being workshops. Using the Coping Resources Inventory (CIR) tool the inner strength of the problematic students is identified. Those identified need several sessions to strengthen their duties and roles as Muslims. They became much better academically after those sessions.

CONCLUSION

For far too long, ethical decision-making in engineering has been left to the human faculty of thinking that when the right is confronted with convenience, the latter wins (relativism). 'Akhlaq' is, however, 'faith in action which is divinely guided; thus, an enduring positive course of action will result. Humility is the best form of *akhlaq*, being steadfast as an 'Abd, physically and whole-heartedly but not physically measurable. The outcome of undergraduate training in this affective domain aspect is best delivered by informal means with a mix of good rapport in the class and outside, availability of qualified academics and counsellors and subject experts ingrained with soft skills.

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