Measurement of Ethics among Engineering Students

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Abstract: Ethics is an important attribute for any professions like engineering, medicine, legal and so on. Despite its importance, ethics has come down among the engineers in the recent past and the day to day events in the nation witnesses the engineering as collapsible or substandard bridges, development of illegal arms, unworthy clothing for uniformed people, etc,. Engineering Ethics is introduced into curriculum and the students are assessed and evaluated theoretically as per the legal directions. This loses the focus and the purpose of ethics. Engineering ethics is an important outcome specified in the Graduate Attributes of Accreditation at national and international level. Specifically, the code of conduct or the behavior of student could be measured based on the identified and well proven ethical principles. Questionnaire has been prepared against eleven basic principles of ethics. Students' thinking on each of these principles is measured through 1-5 likert scale. Face validity is adopted in this survey. It is an indirect assessment method which enables to achieve the objective of assessing the ethical behavior of engineering students. The results show that the actual thinking on ethical practices and their emotions have been captured and reported among engineering students.

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1. Introduction

Ethics are the rules of behavior based on ideas about what is morally good and bad. It is the study of behavior of individual and their interactions with other kind of known or unknown people. It is a belief that 'ethics' is very important in one's life. Ethics involves systemizing, defending and recommending concepts of right and wrong conduct. Ethics is otherwise known as 'personal values' or 'core principles'. Ethics cannot be taught; it needs to be practiced. Practicing ethics include doing his duties on his own; he should have concerns for other living things; he should understand the impact of his work; he should take the responsibility and have commitment through accountability and ownership.

Ethics can be broadly classified into three types. Metaethics talks about the nature of ethics and moral reasoning. Discussions about whether ethics is relative and whether we always act from self-interest are examples of meta-ethical discussions. Normative ethics is interested in determining the content of our moral behavior. Applied Ethics attempts to deal with specific realms of human action and to craft criteria for discussing issues that might arise within those realms. Applied ethics focuses on domain-specific areas like medicine, business, and engineering [Cavalier, 2002].

Early meaning of the term profession referred to a free act of commitment to a way of life. Professional ethics is the set of standards adopted by professionals. Every profession has its professional ethics. Engineering ethics is that the set of ethical standards that applies to the profession of engineering. The preamble of the code of ethics of the National Society for Professional Engineers (NSPE) states the following:

- Engineers are expected to exhibit the highest standards of integrity and honesty
- Engineers are required to provide services with honesty, impartiality, fairness and equity
- Engineers must be dedicated to the protection of public health, safety and welfare.
- Engineers must adhere to the highest principles of ethical conduct.

Ethical awareness of issues is important for engineers who make decisions that will impact society. All engineering decisions involve ethical considerations. So, it becomes essential to verify the behavior and attitude of engineering students of present generation. Literature says that there are many theories and techniques for the measurement of professional ethics exist in engineering field.

A study on ethics among engineering students has been conducted and measured their perception of ethical beliefs and actions of their peers. They observed that the ethical academic culture brings positive influences like personal ethical development among the students [Brad Stappenbel, 2013]. By creating an environment where students are constantly thinking about ethics, the student tend to realize the importance of ethics in engineering, and this will help them make ethical decisions in their careers. Many educators agree that similar approaches are effective and engaging ways of teaching ethics [Bucciarelli, 2008]. Many universities have attempted to improve ethics education, but a majority of them were unsuccessful. Students lack interest in ethics education and tend to avoid taking ethics based courses (Herkert, 2006).

New technique for measuring ethics among engineering students has been proposed (Jegan Abu Hamad, 2013). They considered attributes of engineers, pedagogical approach for content delivery and assessment techniques for measuring ethics. They concluded that the Defining Issues Test and the Engineering and Science Issues Test are the promising instruments to assess moral development of engineering students. The curriculum can be structured to include professional ethics as the centralized course to all engineering domains (Monzon, 1999).

New approach has been tried among engineering students and their understanding on ethics has been measured using the survey method. This paper proposes a model to measure ethics among engineering students using survey, an indirect assessment tool, considering all the required attributes like integrity, confidentiality, transparency and so on. The paper is organized into the following sections: section 2 describes the methodology, section 3 discusses the results and section 4 gives the conclusion.

2. Methodology

Most engineering educational institutions include orientation, practice and assessment of ethics in their curriculum. Accreditation Board of Engineering and Technology (ABET) and National Board of Accreditation (NBA) have mandated that engineering educational programs include ethics in their undergraduate and postgraduate curriculum. Some institutions have a specific course in engineering ethics while some practice ethics through other courses. Measuring ethics through theoretical examinations may not give accurate expected results whereas the rubrics based assessment on ethical behavior through indirect methods help definitely in giving accurate results.

It is important for engineering students to study and practice engineering ethics so that they will be prepared to make ethical decisions during their professional careers. The objective could be achieved by making the students to practice the ethical standards during their study period. Students can be made learnt core values and code of conduct by fostering an increased awareness of ethical behavior, presenting the accepted codes of ethics for professional engineering societies, and presenting engineering case studies that illustrate ethical (or unethical) decisions. Students have to follow ethics in his day-to-day activities: inside classrooms / laboratory / hostels, assignment submission and examinations, interaction with parents/faculty, seniors/juniors, fellow classmates and so on. All these can be done by giving team assignments, framing laboratory rules, arranging open discussions with faculty, etc. Their presence and their attitude in these

forums can be used for measuring their ethical behavior. A survey questionnaire was constructed and face validation were performed. Face validity is merely a subjective, superficial assessment of whether the measurement procedure used in the study appears to be a valid measure of a given variable. The Questionnaire framed meets SMART (Specific, Measureable, Attainable, Realistic, and Timely) guidelines. Framing survey questions and targeting different groups of students enables better understanding on results. This indirect assessment method can be focused to students of different UG/PG programmes, boys/girls, and day scholar/hosteller.

Questions are framed based on 11 ethical principles: Integrity, Loyalty, Transparency, Confidentiality, Honesty, Accountability, Public interest, Rules and regulations, Impartiality, Exercising authority and Exercising leadership. Questions are framed for each category to measure their personal attitude. Students are asked to rate their personal character and opinion in the 1-5 likert scale. In the likert scale, Scale 1 says 'Never' and Scale 5 says 'Frequently or often or always". Five general questions on ethical beliefs are framed with the likert scale 1-5, Scale 1 says strongly disagree and Scale 5 says strongly disagree. Questions used in the survey are given in Annexure 1.

3. Results and Discussion

Fifteen different questions under 11 ethical principles and five general questions are prepared to measure their personal behavior as well as their

general opinion on ethical beliefs. Survey is conducted to different student groups in which 72% of UG students and 28% PG students participated. Among 55 participants, 63% of students are boys and 37% are girls; 65% day scholars and 35% hostellers.

Students from different domains like Information Technology, Mechanical, Electrical and Civil programmes have been participated in this survey. The survey measures how engineering students perceive their own ethical beliefs and how they practice in their daily routine life. Nearly 88% of participants take 10 minutes to complete the survey and the remaining take 10-20 minutes to complete the survey. Table 1 shows the responses of different tudents for 15 questions.

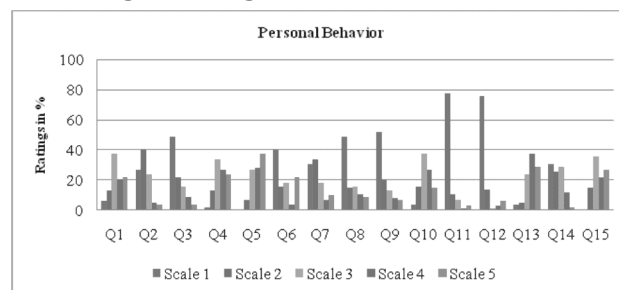**Fig. 1 Rating on Personal behaviour**

Fig. 1 shows ethical behavior of different types of students for different questions. Question 5 (Q5) expresses the transparency and character of a person. Nearly 38% agrees that they appreciate their peer's work frequently and 28% says that they do it now and then. Question 6 (Q6) expresses the confidentiality nature of a person. Nearly 40% agrees that they never share passwords with their peers and friends but 21% says that they always share passwords. As this quality is very much important for his employment, it is desired to create awareness among these students about this unethical behavior. For the question 12, nearly 23% of participants have agreed that they misbehaved during class hours, examination halls, etc and violated the rules and regulations. It needs attention and they need to be monitored. Repeated

Table 1 Number of responses for Personal Behavior

	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Q1	6	13	38	21	22
Q2	27	40	24	5	4
Q3	49	22	16	9	4
Q4	2	13	34	27	24
Q5	0	7	27	28	38
Q6	40	16	18	4	22
Q7	31	34	18	7	10
Q8	49	15	16	11	9
Q9	52	20	13	8	7
Q10	4	16	38	27	15
Q11	78	11	7	1	3
Q12	76	14	1	3	6
Q13	4	5	24	38	29
Q14	31	26	29	12	2
Q15	0	15	36	22	27

Table 2 Number of Responses for Personal Values

	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
GQ1	20	23	35	14	8
GQ2	22	24	27	9	18
GQ3	32	33	16	9	10
GQ4	0	2	18	38	42
GQ5	0	6	12	38	44

education on University rules and regulations would completely remove malpractices from the study environment. Table 2 shows the general opinion on Ethical beliefs by the students.

Figure 2 shows the % responses of general opinion on Ethical beliefs by the students. For the question GQ3, nearly 65% of participants say that the involvement of College is must for the development of ethics. For the question GQ4, 80% of students say that the College is active in shaping the students with good characters like honesty, responsibility, and leadership.
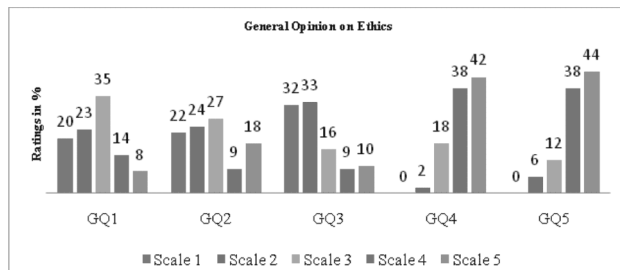
Fig. 2 General opinion on Ethics

From the study, it has been observed that very few students involve in unethical activities like spreading of unwanted messages and the use of mobile phones (Q11 and Q12). Most of them use social networking sites for betterment of their surroundings. The use of mobile phones during the class or exam hours is greatly reduced, and this may be due to the awareness created among the students on its consequences.

4. Conclusion

The paper describes the importance of measurement of ethics among engineering students. Students can learn their good quality and attributes during their school days. But learning professional ethics and practicing them would happen only in institutes and should continue for their entire life. So, it becomes essential to measure the performance of ethical behavior of students. Classroom based teaching for professional ethics may not support for long time. Value added courses like ethics orientation, awareness on code of conduct, motivational talks, healthy senior-junior interaction, team projects, association activities, etc., enable the students to really understand ethical and unethical behavior. These activities help them to practice ethics anywhere anytime and they never give up their core values at any circumstances.

Behavior and attitude are not only assessed through their theoretical examinations. Since professional ethics needs to be practiced in real time, a survey based measurement among students can help in assessing their ethical behavior. Analysis on survey results enables to identify whether the students understand the ethical values and able to differentiate ethical and unethical activities. It helps in taking corrective action for the development of good personal characters among the students.

Acknowledgement

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Annexure 1 – Survey Questionnaire

Name (Optional)   :

Year of study (1st, 2nd, 3rd, 4th)   :

Department   :

Day Scholar/ Hosteller   :

UG/PG student   :

Gender   :

Rate yourself in the 1 – 5 likert scale where 1 corresponds to 'never' and 5 corresponds to 'always'

Personal Behaviour

S. No.	Description	Rating (1 – 5)
Q1	Number of times you have demonstrated your talents and skills on stage	
Q2	Number of times you missed the theory and lab classes	
Q3	Number of times you have hidden, concealed or distorted significant information in communicating to parents, classmates, and friends	
Q4	Number of times you have clarified your doubts with your peers or faculty	
Q5	Number of times you have appreciated or commented your peer's work	
Q6	Number of times you shared your personal account's password with your friends	
Q7	Number of times you have given your assignment and lab observation to your fellow friends and made them to copy (without spending your time for their learning)	
Q8	Number of times you made an unauthorized copy of software, music or video in your personal gadgets like PCs, laptop, mobiles, etc	
Q9	Made an unauthorized copy of assignment and lab experiments from your classmates	
Q10	Number of times you have agreed for the mistakes happened with or without your knowledge	
Q11	Number of times you sent unwanted or unethical messages/images/videos to social networking groups	
Q12	Number of times you used mobile phones or involved in other misbehavior during class hours/examinations	
Q13	Number of times you have yielded timely help to others who are in need?	
Q14	Number of times you have deviated from your values and principles due to your friend's pressure	
Q15	Number of times you are truthful though it costs you personally	

Personal Values

Rate your   values in the 1 – 5 likert scale   where corresponds to ' strongly disagree ' and 5   corresponds to 'strongly agree '

Q No	Description	Rating (1 – 5)
GQ1	One has to lie or cheat at least occasionally in order to succeed and lead life today	
GQ2	The values and behavior of students are about the same when he enters into Corporate / Enterprise for employment	
GQ3.	The development of ethics and character in students is exclusively the responsibility of parents; college should not be involved.	
GQ4.	Colleges should be more active in seeking to inspire core ethical values like honesty, responsibility and respect and developing good character among students	
GQ5	I am satisfied with my own character and values that I possess	