Educating the Ethical Dimension of Engineering to a Muslim Engineer

B. KARAGÖZOĞLU

Department of Electrical and Computer Engineering, Faculty of Engineering, King Abdulaziz University, Jeddah, Saudi Arabia
bkaragoz@kau.edu.sa

Abstract. Education is the way of bringing up a person so that he will keep up with the truth, the good and the beautiful in his deeds and the deeds of others. It is a lifelong phenomenon that requires teaching, training, preaching and exemplifying. Islam is a way of life that covers all aspects of life in all walks. The Muslim gains high moral values through education and sustains them through continuous supports via his prayers. He abstains from all ill-behaviors and holds on the truth even if it is against his personal benefit. Eventually he becomes a pious citizen who drives the society forward in civilization. Ethics is a simplified presentation of the Muslim worldview; yet, lifelong education of engineering ethics is essential to settle in a continuously changing state of worldly affairs. If a Muslim is brought up in an environment where there is harmony between school, society and his beliefs, then he can't do anything else but organize his acts ethically. Upbringing of an engineer must be planned with great care during his formal education so that he will have the correct state of mind at graduation and he must be continuously updated on correct practices afterwards.

Keywords: etiquette, ethics, morals, Muslim attitude, education

1. Introduction

We must live in this universe and carry out many activities to support our lives. Wisdom is granted to mankind to seek knowledge. Knowledge is the aggregate facts, truths or principles acquired and retained by the mind. Human mind collects information about the environment in which he is living using his natural senses. The information collected is assessed with wisdom and it becomes knowledge. Prophet Muhammad (peace be upon him) says[1 – 3]:

"*wisdom is the lost property of a Muslim; he takes it wherever he finds it*".

Science gives us knowledge about facts of nature. Science and technology tell us how to do things without differentiating between right and wrong. Accepted standards of right and wrong are the morals. A code or system of rules defining moral behavior for a particular society is called the ethics. Hence, ethics is what we ought to maintain in our profession[4].

Guidelines for ethical decisions are important indeed in determining the truth and falsehood. However, an engineer in real life faces a lot of challenges where the situation is blurred and the case falls into a gray area. The decision may be critical for other people although the engineer may not be sued for his verdict. The upbringing of the person and his character play an important role in reaching a healthy conclusion. In Muslim countries, we used to have large families where the elderly and mothers have been responsible for the rearing of children. Technological advancements reduced the dependence on the land. Pension systems, economical harassments and overpopulated cities downsized families considerably. Especially with the mother going out to work, the children's welfare is mostly left at the custody of nurseries, streets and schools. We can't establish truthfulness in the society unless we prevent the corruption, and prepare well-educated honest citizens. The paper deals with the educational aspect and it discusses the importance of teaching ethical codes and training ethical behavior for engineers as a life-long phenomena. It indicates that ethical codes developed by several engineering organizations are in a close harmony with the Muslim worldview. It asserts that ethical trainings will be superficial unless supported by a full-fledged educational approach to prepare a Muslim engineer.

2. Domain of Ethics

Professions are based on large knowledge foundations requiring extensive teaching, training, preaching and exemplifying. Professional skills are important to the well-being of a society. Training changes how we perform. Teaching changes the way we think. Naturally, teaching and training are not mutually exclusive. In fact, training and teaching occur simultaneously in many instances, although some fields require more training than others. Professions are usually self-regulating, in that they control the training and evaluation processes. They use ethical standards in their regulation processes. Professionals may have autonomy in workplaces; hence, they are expected to utilize their independent judgment in carrying out their professional responsibilities[4].

Engineering is a learned profession that deals with designing, developing and applying technology into all aspects of human life to improve public welfare. Hence, engineering is one of those fields where teaching plays a larger role

than training[5]. Engineers take an idea and make it real. To serve humanity effectively, engineers must maintain a high level of technical competence. However, such a high level of technical expertise without adherence to moral (ethical) guidelines is as much a threat to public welfare as is professional incompetence. Therefore, engineers must be guided by ethical principles governing the engineering profession as embodied in codes of ethics.

Engineering ethics specify rights and responsibilities and bring a fair standard across institutions/societies. Such codes have been adopted by several authorities such as state boards of registration, professional engineering societies, and even by some private industries[4, 6, 7]. Study of engineering ethics can guide us in resolving moral dilemmas that we might encounter. In an engineering work, design decisions and ethical decisions are not two different kinds of decisions; rather they are two different aspects of the same decisions. Many universities have integrated courses, lectures and seminars on engineering ethics as a part of their curricula[7 – 12]. This is especially imposed by ABET[(1)] in the new engineering criteria together with many other soft skills[13 – 15].

3. Muslim Worldview

Muslims believe in that creatures can be divided into two gross categories as the dense and the transparent. The transparent ones include jinns, angels and souls. The human is from the dense side and jinns are different from all others; they are created for a purpose as stated in the Holy Qur'an:

"I have only created Jinns and men, that They may serve Me". (51:56)[(2)]

Creation is for servitude that can be defined as submission to the orders and prohibitions of Allah and His Apostle for the reason that Allah and His Apostle order or prohibit them, in the way Allah and His Apostle order and prohibit them; without any objection, dispute or retaliation. In short, servitude is a submission. Submission is to accept and adopt a principle, an order or a rule with a definite belief that the ultimate result is secure, safe and to our benefit.

The servitude is carried out in the heart and it appears in the deeds of men. The deed is an application in accordance with orders of Allah and His Apostle. Religion is the collection of rules that govern the faith, behaviors, intellectual, morals and social relations. If these rules are set by the Creator and passed to the servants through an apostle, then it is called the authentic religion. Men are not authorized to determine the rules to govern their deeds; if they do so, then

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(1) The Accreditation Board for Engineering and Technology (ABET), Inc. 111 Market Place, Suite 1050, Baltimore, Maryland 21202-4012, USA. Web Site: http://www.abet.org
(2) Translations of Qur'anic verses are from *The Holy Qur'an: Text, Translation & Commentary* by A. Yusuf Ali, Islamic Propagation Center International, South Africa, 1946.

this becomes the false religion. Faith is to believe in Allah and all that He asks us to believe, in the way He wants us to believe. The scientific knowledge is gained by a mature wisdom, true revelations and correct observations. True revelations are the ones that reach the humanity from the Almighty through His prophets. The intellectual rules of the religion administer the way we obtain the wisdom[1, 16].

3.1 *Satisfaction of Human Senses*

The deeds of men are fixed by sensations that can be sorted into two groups as material senses and spiritual senses. The material senses have special organs for their satisfactions (5 senses such as seeing, hearing, etc). Spiritual senses such as love, hatred, sorrow etc. have no specific organs to satisfy them. All sensations need to be satisfied; otherwise they cause discomfort and illness to their owners. Muslim canonical laws (*Sharia*) describe the way of satisfying all senses without interfering and disturbing other senses of the person and senses of the others. For example, seeing is a sense that needs to be satisfied; however, we shouldn't damage our own sense of family and chastity of others. Implementations of *Sharia* in human beings are called the Morals. The Creator knows the best to satisfy the material and spiritual senses.

Our obligation is to be the vicegerent or deputy (*khalifah*) of the Creator, Allah Almighty on earth as assigned by Himself [the Holy Qur'an 8;2:30-31]. This is reflected as the servitude. The Muslim, within the limited sphere of his existence, is absolute master of his conduct. In a collaborative work, a team leader is appointed first and he distributes duties to other members. There is no collective obligation in Islam and each individual is responsible for his own deeds. Yet, all members are also required to help each other in fulfilling their duties. Hence, the obligation is personal even though carried out in a society. We must live in harmony with all His creatures and we need laws, orders and regulations to maintain this harmony. It is a responsibility of everyone to learn the rules and directives governing his obligations, practice and steadfast with them. The person must learn his duty and make sure that he carries them out according to scientific principles for the duty, its application and consequences. Learning comes before action. He can't destruct and waste or misuse any material of his employer. We will not reach the stage of Islamic consciousness unless we are absolutely sure that the work is a responsibility assigned to us and satisfying its obligations at the best of our capacity is a part of our servitude to Allah Almighty.

The satisfaction of the individual's responsibilities occurs in two directions: Beliefs (foundations) and applications (*Sharia*). Sciences covering the beliefs are divided into three branches: The faith, the knowledge of organizing thoughts

and the knowledge of conducts. Sciences governing the applications are divided into two main groups: Sciences of social behaviors and sciences of worshiping (catechism). There are connections between sciences related to foundations and applications; they support each other for the welfare of mankind.

3.2 *Divinely Assigned Responsibilities of Men*

All events that surround the life of an individual take place in three phases as illustrated in Fig. 1: inspiration, thinking and deciding, and accomplishment.
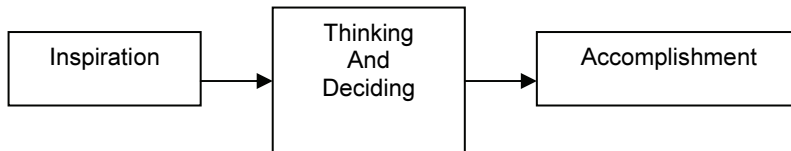

Fig. 1. Three phases of occurence of events.

We are not responsible for the inspiration phase. Good or evil may come to the mind. A well-trained individual with fear of Allah will refrain from the evil and he will pursue to do the good. Then, he strives to fulfill the desires inspired by using legitimate or illegitimate means. This is the intention phase that involves thinking, judging and taking all necessary measures to accomplish the antici-pated action. It can be realized in several stages starting from situation descrip-tion and problem definition up to fulfillment with feedback between stages. Good intentions are not enough; ethical behavior requires actually doing the right thing and working hard to achieve the result without wasting even a min-ute.

The ultimate result may be either fortune or disaster and it will be in accor-dance with Allah's will. Thus, the accomplishment of the desire will occur if it is predestined for us and at the predetermined time. We have no control, hence no accountability for the accomplishment phase. Eventually, we work for good but we neither cheer up the success excessively nor become too depressed for catastrophes. Figure 2 illustrates the human nature and modified Muslim re-sponses for gains and losses. The perfection state in attitudes will be reached when the pleasure from an exceptionally high gain and sorrow from a huge loss due to a catastrophe have the same effect in the mind. This is not an apathetic attitude since the Muslim intellect always plans for the best and he does his best to achieve it. He immediately moves into the next duty without wasting any minute with cheers for the success and sorrows for the failure.

B. Karagözoğlu

No doubt, the human mind is capable, within certain limits, of distinguishing right from wrong, and every individual has been endowed with it in some degree. Similarly, the knowledge of good and evil is, to some extent, intuitive because human conscience intrinsically feels uneasy in the presence of evil. Islam provides us with the commonly agreed and objectively accepted standards, which have been eluding us.
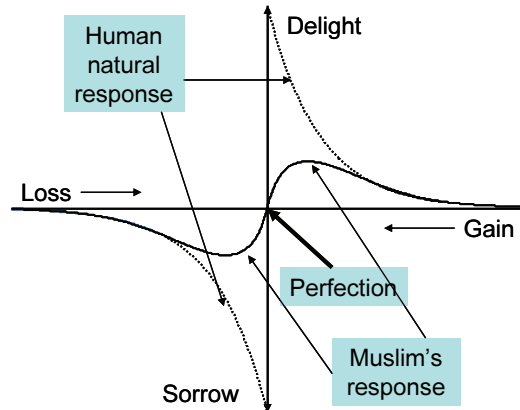
Fig. 2. Effects of gains and losses.

The fact that Allah taught man shows that he has the Divine gift of learning and thinking. Man employs these qualities to enable him to carry out his duties and responsibilities in a manner that suits his status in the universe. He was given the power of choice between good and evil, through his will. His actions on earth will not go unaccounted. Rather, two responsible angels continuously register all good and bad deeds and the record book will be given to the person on the day of resurrection. Content of the book will be judged and even parts of the body will bear witness to the actions. Eventually, either he will be granted a way to paradise or he will be thrown into the hellfire.

3.3 *Worships and Abstentions*

Attitudes, dispositions, or character traits that enable us to be and to act in ways that develop this potential are called virtues. They enable us to pursue the ideals we have adopted. Honesty, courage, compassion, generosity, fidelity, integrity, fairness, self-control, and prudence are all examples of virtues. They are developed through learning and through practice. As the ancient philosopher Aristotle suggested, a person can improve his or her character by practicing self-discipline, while a good character can be corrupted by repeated self-indulgence. Virtues are habits. That is, once they are acquired, they become characteristic of a person. Moreover, a person who has developed virtues will be naturally disposed to act in ways that are consistent with moral principles. The virtuous person is the ethical person[17].

Worshipping is compulsory in Islam, and it has been included in the basic pillars of faith. But the Islamic forms of worship are not some sort of mystic exercises that link men with some unknown, mysterious being, and which subject men to perform useless acts and meaningless movements. All the Islamic com-

pulsory forms of worships are designed as exercises and training to enable people to acquire correct morals and habits and to live righteously, and to adhere to these virtues till the end, whatever are the changes in their circumstances. Worshipping improves the Muslim spiritually so that his actions, motives and conscience could reach a stage of development in which feeling of remorse overtakes him in the doing of unrighteous deeds and he becomes keen on performing good deeds.

A person can implement a deed in one of the four ways: by heart, by words, by physical acts and by abstaining from the act. The last one appears in certain worships like fasting in the Holy month of Ramadan. All prohibitions are also considered among the last one. Worships are obligations we are relieved by performing them. Otherwise, they will remain as debts on us. Worships are timed acts while prohibitions are continuous. Once we offer the Morning Prayer, there is no other obligatory prayer till the noon time. Acts like stealing, cheating, and lying are prohibited all the time. We acquire merits rewarded by Allah Almighty as we keep away from prohibitions. Complying with the prohibitions is so important that if order and prohibition conflict on an act, we abandon the order and organize our deed according to the prohibition.

3.4 *Etiquette and Morality*

Rules of interaction can be listed as: the etiquette (good manner), the law, morals and ethics. The etiquette contains codes of acceptable personal behavior and courtesy. The law is a system of rules established by authority. Morals are accepted standards of right and wrong. And ethics is a code or system of rules defining moral behavior for a particular society. Obeying the law is also a good manner and breaking the law calls for punishment. Ethics is considered within the general framework of morals[9].

Every deed has two faces as the etiquette and the morals as illustrated in Fig. 3. The etiquette is the visible (material) side and the morals is the invisible (spiritual) side. They are like two faces of a coin. If one of the faces is ruined then the coin can be sold only at the value of its nickel! The morals side is the sincerity and devotion of the person in his deed and it affects the fidelity of the act. Eventually he will be rewarded for his deed according to its fidelity.

Fig. 3. Etiquette and morals.

4. Stages of Education

The very first verse revealed to Prophet Muhammad (peace be upon him) is

"*Read*" (the Holy Qur'an 96:1).

The Prophet himself said

"*Seek knowledge from cradle to death.*"[18]
"*Seek knowledge even if it were in China.*"[19]

There are so many verses in the Qur'an and traditions emphasizing the importance of gaining knowledge. The above traditions also indicate that education is a lifelong phenomenon and it is not bound to a specific location.

Science is the name given to the knowledge that illuminates the way, guides to the correct path and relieves the stress of worldly duties from the person who owns it. Sciences are divided into two distinct categories as the definitive (explicit) and probabilistic (implicit) sciences. In definitive sciences, the truth is given by Allah, the Almighty in the form of Qur'anic verses and traditions of His Prophet Muhammad (peace be upon him). Mankind uses the bestowed wisdom to understand them and adapt them to life. In probabilistic sciences however, the fact is not given to mankind, but he seeks to find it using the wisdom and guidance of definitive sciences. Both have several branches and each branch has its own method of study.

In the Holy Qur'an (2:31) reads

"*And He taught Adam the nature of all things…*"

In the interpretation of this verse, the scholars say that all the knowledge the person needs on the earth is given to him at birth. However, there are covers over the knowledge and education is the systematic way of lifting up these covers gradually. Therefore, there is no creation of a new idea, rather there is discovery. The education is not filling up the mind with information. Rather, it is the way of bringing up of a person so that he will keep up with the truth, the good and the beautiful in his deeds and deeds of the others. Ordering the good and prohibition from the evil (which involve learning and teaching) are among the fundamental canons of Islam. The truth is the thing that agrees with the fact rather than stating the truth in every occasion. The good is using the truth in a beneficial way. The beautiful is utilization of the good in a way to delight the good-natured human senses.

Education takes place in four distinct stages. Stage one is the childhood that is usually extended from birth up to about six years. The place of education is father's home and mother's lap. The child gains information through mere observation and play. The personality develops in this period. Hence, the family must demonstrate good examples in personal and social conduct. The second

stage is the basic education that starts from six years and continues until the age of puberty (around 14 years). The person is not responsible for his deeds in front of Allah Almighty before the age of puberty. In this stage he is going to gain all virtues and attributes he needs for carrying out his responsibility at later stages. He is taught and trained to be a good citizen and live in accord with himself, his family, social environment and nature at large. He will be given an education at cultural level in explicit and implicit sciences. There is a need for harmony between school, home and society. The kids may be sent off as apprentices to people with high morals especially during the summer holidays. At schools, the kids may have counselors to guide them in their studies and to the professional life that would follow.

The third stage is the professional education that covers teaching and training for a specific profession. The youngsters are formally educated in one of the application areas in a university/college in classrooms, scientific laboratories and field studies. Training requires a trainer but teaching is expedited by a teacher. Engineering is the profession in which a knowledge of mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. By its very nature, an engineer needs a sound background in explicit and implicit sciences to carry out his profession successfully. This background is achieved in the previous stage and consolidated in this stage. The graduates are armed with sufficient knowledge and skills to practice their professions.

The fourth stage is the life-long learning. The evolutionary progress will start by having up-to-date education and training. Then, hard work and pursuing continuous improvement are other essential gradients. The type of education involves short courses, seminars, research work, workshops and industrial training sessions and preaching by learned people. Each profession will have its professional circles to improve cooperation between members, to further their knowledge and skills, to generate codes of practice and to arbitrate in case of disputes.

We are recommended to respect science (*al-ilm*) and we must always consult people since consultation between those who are entitled to have a voice is strongly recommended by our beloved Prophet (peace be upon him). In a Muslim society, the truth comes from the revelations and their interpretations. It is difficult for every professional to acquire a high level of competence in decision making. Hence, it is highly recommended that the professional organizations have Muslim scholars who are also literate in their fields of specializations. In case of unavailability of such a person, they may direct some high caliber students in that track to eliminate the shortage.

5. Muslim Attitude

Every individual living in the civilized world must shoulder several duties to fulfill his personal interest and to contribute to the well being of his family, his fellow citizens, and humanity at large. The Muslim engineer uses all his resources for the benefit of the people at six levels as illustrated in Fig. 4. He will be like a light source that illuminates its neighborhood. He will benefit himself first. He must do his best to reach and retain the highest possible level of physical and spiritual maturity. Hence, he must develop a strong character.

The levels of responsibility cover, in decreasing order, the family and first-degree relatives, the close and distant neighbors, the fellow citizens, the fellow country, the fellow Muslims and finally the whole humanity. If there is any non-Muslim in the previous levels, he will be treated among the humanity in the last level. In benefiting people, these levels must be observed. In harming people however, all levels are equal and a Muslim can't harm anybody unless there is a legal reason for it[3].
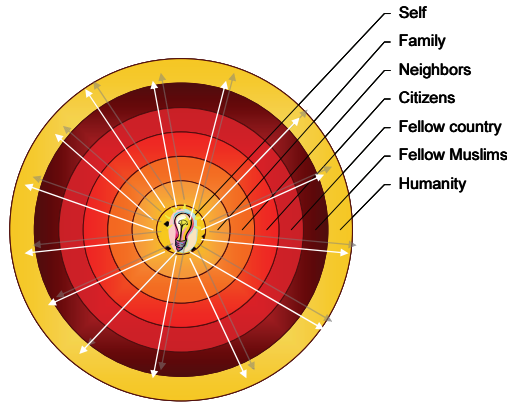
We must live in harmony with all creatures of Allah Almighty and progress toward the ultimate goal of the life: to gain the pleasure of Almighty. In this respect, we must look for continuous improvement

Fig. 4. Levels of responsibility.

while being extremely careful about our personal conducts. We must always remember that we are the followers of a Prophet (peace be upon him) who said,

"He who deceives us is not from us"[20].

We must state the truth even if it is against our personal desires because a Muslim can't tell a lie since lying is stated as a big crime for us. It is crucial to spread the goodness and not to publicize the wickedness. If good and evil meet at an act, we prefer abstention from the evil to fulfilling the good.

6. Concluding Remarks

The Creator of earths and heavens created the human being for a special reason; to be His deputy on the Earth. He furnished the man with material, spiri-

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[3] Many ideas in this paper are taken from Teacher Ibrahim Eken, a Muslim scholar in Kayseri, Turkey.

tual and mental capabilities, and provided him with a clear guidance to carry out his duties through the last authentic religion that is Islam. If we educate the Muslim engineer with the spirit of Islam and train him in practicing his religion correctly, then we don't have to worry about the ethics since his moral values cover them in full. The whole earth is the prayer hall (*masjid*) for a Muslim. Allah Almighty states in Al-Qur'an that nobody but Muslims shall maintain prayer halls for His sake. We don't need to have several levels of watchdog organizations to monitor him because he is absolutely sure that all his actions are very carefully recorded by angels into his book. However, to understand Islam, one must have uncorrupt and unbiased mind. It is also difficult to sustain these high levels of spiritual and intellectual abilities. At the same time, the life is dynamic and the world-affairs change continuously. Hence, continuous education and training are essential to improve him materially, mentally and spiritually so that he can keeps up and cope with the continually changing state of affairs.

In a classical engineering education, we used to concentrate on the cognitive domain of the education that mainly deals with recall of knowledge and development of intellectual abilities and skills. Therefore a scientific paper should be based on facts and there was no place for beliefs. Affective domain that deals with interests, attitudes, appreciations, values, emotional sets and biases has been almost neglected. Yet, beliefs and opinions play an important role in engineering decisions. This trend generated atheist engineers and scientists who lost their identities as humans and could not communicate and cooperate well with the society. We had people with high intelligence quality but low in intellectual quality. Educational authorities and engineering institutions felt the need for supplementing the engineering education with soft skills that lead into a paradigm shift in engineering education[21]. In this respect, engineering codes of ethics have been developed and instigated into the engineering curricula[22]. However, codes of ethics cannot be treated as if they were recipes for action. They are not self-interpreting and are not entirely free from potential conflicts. So, at best, they provide a framework for judgment, certainly not a substitute for it[7, 23].

The paper introduced and discussed many terminologies pertinent to Muslim beliefs. There are many examples of morals in books of Muslim scholars and they are regularly preached to believers in Friday sermons and in many other occasions. We can count numerous examples of ethical behaviors prescribed in the Qur'an and Sunnah such as practicing fairness in trading, avoiding all forms of cheating and stealing, observing the common good, abstaining from waste, being responsible in harvesting natural resources, minimizing pollution, and eliminating any threats to public health. There is no doubt that continuous education in the form of teaching, training and preaching is essential. However, it has very little or no use if the person switches off his perceptions and he doesn't believe in divine responsibilities. Hence, the paper concludes

that upbringing of an engineer during his formal education must be planned with a great care so that he will have the correct state of mind at graduation and he must be continuously updated on correct practices afterwards.

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تدريس البعد الأخلاقي في الهندسة للمهندس المسلم

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قسم الهندسة الكهربائية وهندسة الحاسبات،

جامعة الملك عبدالعزيز، جدة، المملكة العربية السعودية

المستخلص. يمثل التعليم طريقة تربية وإعداد الفرد، بحيث يفي بمتطلبات الصدق والحسن والجمال في أفعاله وأفعال الآخرين. ويمثل التعلم نشاطا مستغرقا لحياة الفرد بأكملها، مشتملا على الدراسة، والتمرين، وقبول الوعظ، والاقتداء بالأسوة الحسنة. إن الإسلام هو طريقة حياة تشمل جميع مناحي الحياة في كافة المجالات. ويكتسب المسلم قيما أخلاقية عليا من خلال التعليم، ويوفر من خلال صلاته دعما مستداما لهذه القيم. ويتجنب المسلم كل مظاهر السلوك السيئ، ويلتزم الصدق والحق حتى لو كانا مضادين لمصلحته الشخصية. ومن ثم ينتهي الأمر به إلى أن يصبح مواطنا صالحا ورعا يقود المجتمع حضاريا للأمام. وتمثل الأخلاقيات عرضا مبسطا لنظرة المسلم للعالم، ولكن المهندس المسلم يحتاج (إضافة إلى رصيده الأخلاقي) لتعلم الأخلاقيات الهندسية طيلة حياته، حتى يستطيع التعامل مع أحوال الدنيا المتغيرة باستمرار. وعندما تتم تنشئة المسلم في بيئة تتمتع بالتوافق بين المدرسة والمجتمع ومنظومة معتقداته، فإنه لا يسعه إلا أن يأتي بأفعال أخلاقية. إن إعداد المهندس هو مهمة يجب التخطيط لها بعناية فائقة خلال فترة تعليمه النظامي حتى يكتسب العقلية الصحيحة عند تخرجه، وبعد ذلك يحتاج المهندس إلى تجديد معلوماته عن الممارسات الصحيحة بصورة مستمرة.