

The Islamic Element of *Al- 'Adl* in Critical Thinking: the Perception of Muslim Engineering Undergraduates in Malaysia

Mohd Nuri Al-Amin Endut, Wan Suhaimi Wan Abdullah, and Zulqarnain Abu Bakar

Abstract—The element of justice or *al-'adl* in the context of Islamic critical thinking deals with the notion of justice in a thinking process which critically rationalizes the truth in a fair and objective manner with no irrelevant interference that can jeopardize a sound judgment. This Islamic axiological element is vital in technological decision making as it addresses the issues of religious values and ethics that are primarily set to fulfill the purpose of human life on earth. The main objective of this study was to examine and analyze the perception of Muslim engineering students in Malaysian higher education institutions towards the concept of *al-'adl* as an essential element of Islamic critical thinking. The study employed mixed methods approach that comprises data collection from the questionnaire survey and the interview responses. A total of 557 Muslim engineering undergraduates from six Malaysian universities participated in the study. The study generally indicated that Muslim engineering undergraduates in the higher institutions have rather good comprehension and consciousness for *al-'adl* with a slight awareness on the importance of objective thinking. Nonetheless there were a few items on the concept that have implied a comparatively low perception on the rational justice in Islam as the means to grasp the ultimate truth.

Keywords—Engineering education, Islamic critical thinking, rational justice, perception, tertiary education.

I. INTRODUCTION

THE role of an engineer should not be regarded as a purely technical or mechanical profession. Engineers, according to Don E. Kash [1], play a role as revolutionaries who help to formulate an ideology for contemporary society which provides an accurate picture of reality, of how society works. Thus, engineers are actually taking on an important societal role in imparting both the positive and negative impact. They have the opportunity to 'design' the society's ways of live, just as much as they have the ability to design their projects, be it bridges or computer programming [2]. More importantly, engineers should also take the responsibility of the implied social impact of their designs, be it in economic, environment, ethics as well as religious issues. Just as an engineer accounts for the different conditions his design must endure, he must account for the different societal

conditions his design will create.

Thus, as potential engineers, it is important for the Muslim engineering students to not only be aware of their social and professional responsibilities but also to be more critical of the religious impact inflicted from their design projects. As such they should be exposed to a holistic engineering education which also emphasizes on religious conceptual thoughts rather than solely focuses on the technical based knowledge. After all it is believed that such action of promoting Islamic critical thinking will definitely contribute to a better human capital development of the nation.

II. *AL-'ADL* IN CRITICAL THINKING: ITS RELATION TO ENGINEERING EDUCATION

In the context of Islamic critical thinking, *al-'adl* or justice implies the notions of right and wrong, as it is often used in a broader dimension that includes moral and religious values in making decisions and weighing judgments. The Arabic term *al-'adl* is derived from the verb *'adala* which literally means; first, to make something straight or to sit straight, to amend or to alter; second, to draw away, depart or deflect from one path to another; third, to be equal or equivalent, or to equalize; and fourth, to balance or counter balance[3][4][5][6]. These literal expressions hold up the terminological definition of *al-'adl* as 'the thing that is established in the mind and soul as being righteous or upright (*mustaqim*)', as opposed to injustice or unfairness (*jawr*) [7]. However, it is important to note that the notion of justice in Islam is also widely perceived as placing things in their rightful place, as against to tyranny (*zulm*) [8]. The Islamic justice just not merely emphasis on the equality but rather on the fairness notion as equality sometime is very relative and there are many examples of justice that is achieved through inequality such as the distribution of Islamic inheritance.[9]

The concept of *'adl* from the perspective of Islamic critical thinking was nicely described in al-Kindi's theory of rational justice [10]. He expressed that rational justice is the sense of quality inherent in man that stimulates him to do the right things, guided and determined by reason. Rational injustice, on the other hand, according to him is accidental and an evil act produced by desires through its senses of wrath or other intemperate impulses that restrain the mind to be in command of reasoning. Justice however, is not merely a counterpart of evil but also a virtue that is to be nurtured and improved by man in the light of his comprehension of the truth [11]. Hence man, according to al-Kindi's philosophical theory of justice, must not only know and comprehend justice but also to act in

Mohd Nuri Al-Amin Endut is attached to Universiti Teknologi PETRONAS, Perak, Malaysia (phone: 605-368-7733; fax: 605-365-6280; e-mail: nuriend@petronas.com.my).

Wan Suhaimi Wan Abdullah is with University of Malaya, Kuala Lumpur (e-mail: wansuhaimi@um.edu.my).

Zulqarnain Abu Bakar is with Universiti Teknologi PETRONAS, Perak, Malaysia (e-mail: zulqab@petronas.com.my).

accordance with it which could only be reached through sound and critical reasoning.

Basically there is an obvious need for critical thinking in the engineering enterprise. The accepted wisdom of professional engineers requires intellectual standard of thinking and reasoning that include clarity, accuracy, relevance and fairness in checking the quality of reasoning about a problem, issue, or situation. To think professionally as an engineer entails having command of these standards or basic elements of critical thinking. As engineers master the rudimentary skills of critical thinking in the context of engineering, they have really appropriated the skills of life-long learning wherever their professional and personal lives lead them. [12]

Current engineering education has exposed various methods and techniques of decision making to facilitate engineers in seeking the best functional balance between cost, reliability and performance of a product or a project. These expositions, however, will basically look into the influential constraints of various contexts, mainly in the business and environmental perspectives [13], which believe that the bigger concern lies in the economic consideration instead of religious values. Such perception obviously does not accord with the Islamic education that witnesses the comprehensiveness of the problem from the religious basic legal maxims encompassing sociological, political, legal, economic, philosophical, practical and other relevant issues.

This is where the element of *al-'adl* can potentially bring a great impact onto Muslim engineering education particularly in its aspect of Islamic critical thinking. This Islamic element is vital in technological decision-making as it addresses the issues of religious values and ethics that are primarily set to fulfill the purpose of human life on earth. The nature of engineering, which basically deals with ways to exploit the human and material resources for the well being of mankind, would certainly expose engineers with dilemmas and arguments that require critical evaluation in making righteous decisions. It is common for today's engineering practices to confront with several conflicting demands particularly with regard to social and environmental issues.

Essentially, the content of the Qur'an includes broad and fundamental principles, and legal value judgments. Even in matters pertaining to the rationally perceptible natural rights of man, or the demand of social justice, justification of it must be weighed from the God-conscious and revealed value system. This justification is indeed vital as an all-alleged 'pure rational' reasoning is easily swayed by unwarranted desires, social distortions, vested interest and the corrupted authorities for natural reason and natural law have been invoked from unholy causes throughout history [14]. Islamic value judgment, therefore, provides guidance for engineering designers to comprehend and devote themselves to the virtuous personal and societal core values and to be cautious with the misleading liberal rationalization of human baser instincts.

Therefore it is critically important for the future engineers to be conscious of the Islamic value systems in handling the multi criteria engineering problems. The permanent

axiological cognition of the certain Qur'anic verses is not only applicable to several situations in diverse frames of references but also capable of multi interpretations as observed in allegorical (*mutashabih*) verses. This profound wisdom renders levels of meaning and generality of the values of the Qur'an that suits its adoption to real time-space situation. It also demands a form of axiological systemization that distinguishes the terminal and intrinsic values from its instrumental values and facilitates the application of strategies in dealing with complex issues and ever-changing circumstances with the best solutions [15]. Such system could be apparently perceived from various Islamic maxims of *maqasid al-syari'ah* (the Objectives of Islamic law), the classifications of values into the necessities (*daruriyyat*), convenience (*hajiyyat*) and embellishments (*tahsiniyyat*), as well as the classifications of knowledge into the personal (*'ayn*) and social (*kifayah*) obligation.

On the whole, *al-'adl* is deemed as the axiological aspect of critical thinking that steers the mind to make righteous and objective decision based on just evaluation. However the necessity of introducing and assimilating the concept into the engineering education must be established from a strong ground. Thus this study would look into the actual perception of the Muslim engineering students towards the thinking in decision-making practices.

III. METHODOLOGY

The study engaged a mixed methods research comprises both the quantitative and qualitative approaches. Both, the survey data collection and the interview session were conducted during lecture sessions at various university campuses. The survey was conducted employing the cluster sampling method involving 557 Muslim engineering students from four public universities (Universiti Teknologi Malaysia, International Islamic University Malaysia, Universiti Sains Malaysia and University of Malaya) and two private universities (Universiti Teknologi PETRONAS and Universiti Tenaga Nasional).

These universities were selected based on several reasons. Firstly, the curriculums adopted at these universities are mostly stressed on the importance of critical thinking in their programs' and faculties' objectives. Secondly, they were among the Malaysian top-ranking universities. Thirdly, the assimilation of Islamic element in the critical thinking courses was implemented in some of these universities. Fourthly, some of these universities were known for their reputable engineering and technology programs. This sample size of 557 respondents was considered more than sufficient for a 95% confidence level and a confidence interval of 5.

To administer the survey, a self-developed research questionnaire was constructed comprises two sections; the first section (Section A) covers the respondent's demographic data and the second section (Section B) consist of 19 statement items, designed to gauge the undergraduates' perception of *al-'adl* through its four constitutional components of Religious Values (4 items), Relevance Factor (4 items), Objective Reasoning (4 items), Truth Oriented (4

items) and Religious Stimulation (3 items). Section B of the questionnaire employed the selected-response items format that dictated the responses on five-point Likert scale ranging from one for “strongly disagree” to five for “strongly agree”.

An expert panel of 10 individuals from the areas of Islamic thoughts and Engineering were engaged to seek for their viewpoints, validating the content of the instrument used in the study; 7 of them looked into the area of Islamic thoughts and Education, while the other 3 dealt with the content from the engineering perspective. This survey questionnaire was then administered for a pilot study involving 59 Muslim students to test its reliability. The reliability test of the survey instrument revealed a Cronbach’s alpha of 0.8, which is considered high.

The interview instrument was meant to validate the students’ perceptions based on the questionnaire data and to have further explanation on why the respondents responded the way they do. 20 respondents representing from 4 different universities volunteered to participate in the interview that was conducted upon completing survey questionnaire.

IV. RESULTS AND DISCUSSIONS

The Muslim engineering undergraduates profile consists of five items that includes information on gender, school background, program, year of study and current cumulative grade point average (CGPA).

The profile shows the number of Muslim engineering undergraduates who have participated in the study and represented six different universities. From the 557 respondents, 27.3% of them were from Universiti Teknologi Malaysia (UTM), 19.6% from International Islamic University Malaysia (IIUM), 16.7% from Universiti Sains Malaysia (USM), 9.1% from University of Malaya (UM), 16.2% from Universiti Teknologi Petronas (UTP) and 11.1% from Universiti Tenaga Nasional (UNITEN).

The analysis of respondents’ profile exhibits that the gender representation was 54.6% male and 45.4% female that appeared to be fairly proportionate for this study. In terms of educational background, most of the respondents (84.1%) came from the public schools which left only 15.9% of them came from the religious school. In terms of the year of study, the largest number came from the final or fourth year students that represented 46.2% of the sampling followed by the second year (27.7%), third year (22.3%) and finally the respondent from the first year students (3.8%). On the whole the large portion (68.5%) of the respondents was represented by the third and fourth year students which would portray a better representation of the result as they have gained more exposure to the engineering concepts and profession.

CGPA in which majority of the undergraduate, or to be more precise 75.9% of them were average achievers who score from 2.5 to 3.49 point. In detail, 40.9% of them have the CGPA’s score of 3.00 to 3.50 and 35% of them score from 2.50 to 2.99 point. The low achievers of the respondents have represented 13.1% of the respondent who 12.5% of them score from 2.00 to 2.49 and a small portion of 0.6% score below 2.00. The high achievers of the respondents, on the other hand,

have been represented by an acceptable portion of 11% of the undergraduates who score from 3.50 to 4.00 point. In general, the profile of the respondents has shown an acceptable well-balanced result that could fairly represent the Muslim engineering undergraduates in Malaysian higher learning institutions.

TABLE I
DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Demographic Variable	Category	Frequency (N = 557)	Percentage (%)
University	A – UTM	152	27.3
	B – IIUM	109	19.6
	C – USM	93	16.7
	D – UM	51	9.1
	E – UTP	90	16.2
	F – UNITEN	62	11.1
Gender	Male	304	54.6
	Female	253	45.4
School Background	Religious	88	15.9
	Public	409	73.8
	Others	57	10.3
Year of Study	1 st Year	21	3.8
	2 nd Year	151	27.7
	3 rd Year	122	22.3
	4 th Year	252	46.2
Programme	Chemical	36	6.5
	Engineering	70	12.6
	Mechanical	102	18.4
	Engineering	41	7.4
	Civil	183	33.0
	Engineering	122	22.0
	Petroleum		
	Engineering		
	Electrical		
Engineering			
CGPA	3.50 – 4.00	60	11.0
	3.00 – 3.49	223	40.9
	2.50 – 2.99	191	35.0
	2.00 – 2.49	68	12.5
	Below 2	3	0.6

A. Survey Analyses and Findings

The respondents’ perception on *al-‘adl* is gauged through their comprehension and awareness towards five essential components that constitute the element of *al-‘adl*. These components deliberate the context of Religious Values, Relevance Factor, Objective Reasoning, Truth Oriented and Religious Stimulation. The mean score of these components which indicated its level of perception is shown in table II.

TABLE II
THE MEAN DISTRIBUTION OF *AL-‘ADL* COMPONENTS

<i>al-‘Adl</i> Components	Mean	Std. Deviation	Intpretation
Religious Values	3.76	0.69	Moderately High
Relevance factor	3.01	0.51	Moderately High
Objective Reasoning	3.82	0.53	Moderately High
Truth Oriented	3.59	0.45	Moderately High
Religious Stimulation	4.08	0.60	High
Overall Average	3.63	0.38	Moderately High

As shown in the table, the perception of the Muslim

engineering undergraduates on the element of *al-'adl* was moderately high with an overall mean score of 3.63 (SD = 0.38). The result is reflected from the mean scores of all its components that range from 4.08 to 3.01. The highest mean component was Religious Stimulation with the mean value of 4.08 (SD = 0.60) which indicated a high perception towards the element. Whereas the lowest mean value was the component of Relevance Factor with the score mean of 3.01 (SD = 0.51). This is however close to a moderately low perception. The remainder three components labeled as Objective Reasoning, Religious Values and Truth Oriented have recorded a moderately high perceptions with the respectively mean score of 3.82 (SD = 0.53), 3.76 (SD = 0.69) and 3.59 (SD = 0.45) which implied a fairly satisfactory perception of the element. The finding details on the items that composed each components is shown in table III.

TABLE III
THE DISTRIBUTION OF PERCENTAGE AND MEAN
OF THE COMPONENTS OF *AL-'ADL*

<i>Al-'Adl</i>	Item Description	SDA %	DA %	N %	A %	SA %	Mean	Interpretation
Religious Values	Relate engineering with Islamic values	2.3	7.5	36.1	38.2	15.6	3.57	Moderately High
	Concerned Islamic values in engineering design	0.9	6.5	19.9	44.7	28	3.92	Moderately High
	Weigh decision base on Islamic Values	0.7	5.9	36.1	44.3	12.9	3.63	Moderately High
	Adopt Islamic virtues in engineering project	0.9	4.5	22.3	46.1	26.2	3.92	Moderately High
Relevance factor	Not consider self-interest in decision making	15.8	37.2	30.3	13.1	3.6	2.51	Moderately Low
	Not influenced by personal/group interest	2.5	13.6	33.9	38.6	11.3	3.43	Moderately High
	Make decision in stressful condition	7	30.7	30.7	23	8.1	2.94	Moderately Low
	Disregard emotion in decision making	5.6	17.8	40	28.7	7.9	3.16	Moderately High
Objective Reasoning	Critical action is guided by good reason	0.7	2.2	14	55.7	27.3	4.07	High
	Objective in making judgment	1.3	3.8	23	54.2	17.4	3.83	Moderately High
	Put aside restraints of good judgment	2	7.7	33	48.1	9.2	3.55	Moderately High
	Open to argument and defend justification	1.3	1.8	26	52.6	18.3	3.85	Moderately High
Truth Oriented	Look for reason to find out truth	0.5	1.1	10.2	54.2	33.8	4.20	High
	Support Islamic value assimilation with rational argument	0.5	1.4	16.2	46	35.9	4.15	High
	Does not accept weak argument as the sign of Allah	34.6	31.6	22.1	8.3	3.2	2.14	Moderately Low
	Reason the truth in objective manner	0.4	2.3	21.2	60.1	16	3.89	Moderately High
Religious Stimulation	Make fair judgment based on Islamic view	0.7	1.6	24.1	50.1	23.5	3.94	Moderately High
	Religiously obliged to make just decision	0.7	0.9	13.8	45.8	38.6	4.21	High
	Religiously inspired to reason the truth	0.5	2.3	16.9	48.5	31.8	4.09	High

There were five items that have the mean score above 4.00 which implied a high level perception on the element of *al-'adl*. The first and the fourth highest items were 'religiously obliged to make just decision' and 'religiously inspired to reason the truth' from the Religious Stimulation component which scored the mean of 4.21 and 4.09 with 84.4% and 80.3% of the respondents, strongly agreed and agreed with the items, respectively. The second and third highest items came from the component of Truth Oriented, which were labeled 'look for reason to find out truth' and 'support Islamic value assimilation with rational argument' with means of 4.20 and 4.15, i.e., 88% and 80.9% of the respondents strongly agreed and agreed with the items, respectively. The fifth and the last highest item were labeled 'critical action is guided by good reason' that scored the mean of 4.07 with 83% of the respondents have strongly agreed and agreed with the item.

There were eleven items which implied moderately high perception of the element with the mean scores range from 3.94 to 3.16. The highest mean item within this level of perception was labeled 'make fair judgment base on Islamic view' under the component of Religious Stimulation that have the mean of 3.94. Whereas the lowest mean item was 'disregard emotion in decision making' from the component of Relevance Factor that scored the mean of 3.16. However the finding also indicated that the mean items of the moderately high perception level was inclined towards its higher edge with nine of this group items scored the mean more than 3.5.

The result also shows that there were three items that exhibited a moderately low level of perception with the mean score below 3.00. The first item was 'does not accept weak argument as the sign of Allah' under the component of Truth Oriented that scored the mean of 2.14 with 66.2% of the respondents strongly disagreed and disagreed with the item. In fact this was the lowest of all items across the components. The second and third lowest mean items were 'does not consider self-interest in decision making' and 'make decision in stressful condition' under the component of Relevance Factor with 2.51 (strongly disagreed) and 2.94 (disagreed) respectively.

In general, the result of the study has manifested that Muslim engineering undergraduate have a moderately good understanding and consciousness on the element of *al-'adl* based on its overall mean. The respondents seem to be aware of the common and direct religious motivation, values and objectivity that are to be incorporated into the engineering profession. This inference was rather apparent from the result of items under the components Religious Stimulation,

Objective Reasoning and Religious Values in addition to other related items from different components that emphasized the similar concern and scored a relatively high mean.

On the other hand, the components and items that have scored a comparatively low mean of perception have also attracted the researcher's concern. The explanation on the respondents' fairly low perception of the element may basically relate to their deficient interpretation of the concept of *al-'adl* in a delicate manner. This weak pattern of

perception could be observed in the components and items with a relatively low mean score which most of them touched on the refined nature of *al-'adl* element instead of a commonly plain statement. Thus, in general, the result of the respondents' perception on *al-'adl* element has shown a satisfactory and acceptable understanding and awareness on the basic concept of *al-'adl*. However, these Muslim engineering undergraduates may seem to face difficulties in comprehending the implicit features of the element that complement and complete the concept of *al-'adl*.

B. Interview Analyses and Findings

TABLE IV
EXCERPTS OF RESPONSES REPRESENTING THE THEMES FOR THE FIRST QUESTION OF AL-'ADL

Question: Do you think we can accept a weak argument as a sign of Allah? Why?		
Respondents	Excerpts	Themes
S2	<i>Although it is weak, but it implies implicit meaning...</i>	Vulnerable acceptance
S4	<i>...we can accept weak argument but if we have strong foundation... we can accept it better...</i>	
S5	<i>As long as the argument proves the greatness of Allah, although it is weak, I still can accept it.</i>	
S6	<i>...we can accept it, but to believe, we have to reconsider...</i>	
S9	<i>...I don't care. As long as it shows the greatness of Allah, I will believe it...</i>	
S15	<i>...could be... because a weak argument is maybe due to the reason because it cannot work properly.</i>	
S17	<i>...so we can accept... If we already know...</i>	
S19	<i>...I can accept but 50-50... Not everybody can talk about the greatness of Allah.</i>	
S3	<i>...it must have a sound argument because even the Quran...</i>	Religious rejection
S12	<i>...Islam itself suggested that if you want to argue... must have strong reasons...</i>	
S16	<i>I cannot accept a weak argument on the signs of Allah...the argument of the Quran and Hadith was strong enough...</i>	
S7	<i>...the argument would be acceptable if it is strong.</i>	Rational rejection
S8	<i>If the argument can be defeated, how do we want to make people believe that God really exists.</i>	
S18	<i>...cannot... Because we need a strong argument to relate to the greatness of Allah...</i>	
S1	<i>I will accept because... it is already stated in the Quran...</i>	Forced acceptance
S10	<i>Of course we have to accept...regardless of whether it is weak or strong...</i>	

In the attempt to gain the students' insight to the perception of *al-'adl*, two engineering related questions were asked to get the general view of interviewees' perceptions and comprehensions on these concept of Justice as to explain, validate and justify the result of the quantitative study conducted among these engineering students. The first

question was intended to reveal the interviewees' perception on their objective justification and rational reasoning in supporting the truth of Islam.

Table IV shows the excerpts of the interviewees' responses that can be grouped according to the identified themes labeled as "vulnerable acceptance", "religious rejection", "rational rejection" and "forced acceptance", arranged in descending order of prevalence. Basically these four themes can be divided into two larger groups; the themes that accepted weak argument and those rejected it. "Vulnerable acceptance" refers to the statements that acknowledge weak argument which, ironically, was supported with another weak and questionable argument, whereas "forced acceptance" refers to the acceptance that would based on the implausible and misleading understanding of the Qur'anic instruction. "Religious rejection", on the other hand, refers to the refutation of the weak argument based on religious argument compared to "rational rejection" that used logical argument to refute weak argument.

TABLE V
EXCERPTS OF RESPONSES REPRESENTING THE THEMES FOR THE SECOND QUESTION OF AL-'ADL

Question: How do the Islamic values relate to engineering decision?		
Respondents	Excerpts	Themes
S1	<i>...must contain aspects that are proper for all segments of society to utilize...</i>	Public interests
S7	<i>...a project or design that is not harmful to people...</i>	
S9	<i>...we can use the technology available to help many people...</i>	
S12	<i>...all of these things relate to human... so, mastering engineering... able to help the society...</i>	
S17	<i>...as engineers... we build buildings...</i>	
S18	<i>...in many branches, for example ... building roads... bridges.</i>	
S11	<i>...Islam is indeed related to the engineering because in engineering we were taught of...</i>	Islamic knowledge
S13	<i>...Islamic values in engineering... important with the facts...</i>	
S14	<i>...can produce an engineer who has Islamic thinking...</i>	
S19	<i>...in learning engineering we have indirectly learned the knowledge of Allah.</i>	
S8	<i>...of the concepts of ethics... very much in line with Islamic teachings, where we really cannot cheat, or even commit small wrongdoings.</i>	Islamic ethics
S10	<i>...Islamic values such as ethics in study...</i>	
S15	<i>...Islamic values like... they don't cheat people...</i>	

The most popular theme mentioned by the interviewees was "vulnerable acceptance" which denoted rather a low comprehension on the respondents' objective reasoning in seeking for the truth as briefed in the element *al-'adl*. It was quite apparent from the result that the acceptance responses

were more dominant than the rejection responses. This implied that Muslim engineering undergraduates were inclined to accept anything to be claimed as evident of truth even though it is not based on a sound argument and justification.

This finding of the qualitative study has generally corresponded to the result of questionnaire survey that specifically state the item 'does not accept weak argument as the sign of Allah' under the component of Truth Oriented which actually has scored the lowest mean of all items across the component. Thus both quantitative and qualitative findings have evidently signified the biasness and lack of objectivity in reasoning for the truth.

The second question with regard to *al-'adl* element was meant to examine the interviewees' perceptions on Islamic values and its relation to engineering decisions. The findings of the analysis, as illustrated in table V shows the excerpts from the interviewees' responses can be grouped into three different themes that appeared from their responses. These three themes that emerged in the responses were then labeled as "public interests", "Islamic knowledge", and "Islamic ethics".

The most prevalent theme brought up by the interviewees was "public interests" that is concerned with the community value orientation as stressed in the concept of Islamic science. The following themes of "Islamic knowledge" and "Islamic ethics" were also closely related to the Islamic science concept in terms of integrating engineering with the Islamic dimensions of knowledge and ethics. This indicated that the overall interviewees' responses on the perception of Islamic values with its relation to engineering enterprise were fairly commendable.

Moreover the themes appeared from the responses were appeared to be in accordance to the quantitative survey result. It seemed to fairly interpret and correspond to the finding of Religious Values component in the survey that implied a moderately high perception in its items of "relate engineering with Islamic values", "concerned Islamic values in engineering design" and "weigh decision based on Islamic values". Thus the findings of this interview have comparatively validated and confirmed the survey result on the perception of Muslim engineering undergraduates regarding the Islamic values. This has completed the qualitative analysis of the undergraduate's perception on *al-'adl* element in which both interview's result have seemed to support the finding of the survey study.

On the whole, the qualitative analysis based on the interview instrument has indeed provided various interpretations on the respondents' score in the survey study. The interview's responses have explored and elaborated the common feedbacks of the survey to reveal the interviewees' insight of the three elements of Islamic critical thinking. In principle, the finding of the analysis have mostly justified and confirmed the survey feedback.

C. Discussions

The survey finding of the study has shown that Muslim engineering undergraduates have a moderately good

perception on the element of *al-'adl* based on its overall mean of 3.63 (SD = 0.38). It also indicated that they were quite strongly moved by the religion in pursuing their engineering ventures based on the high mean score in the Religious Stimulation component (4.08, SD = 0.60). On the other hand, the survey implied that the undergraduates may have some difficulties in making relevant arguments with regard to their assertions by looking at the comparatively low mean (3.01, SD = 0.51) scored in the Relevance Factor component.

Nevertheless the issues of these two components were not picked out to be addressed in the interview questions. The qualitative study was rather interested in exploring the interviewees' insight of their feedbacks in the components of Religious Values (3.76, SD = 0.69) and Truth Oriented (3.59, SD = 0.45). These two components were believed to provide more significant findings in term of the undergraduates' perception on *al-'adl* element.

The interview analysis with reference to Religious Values component has shown a commendable perception of the interviewees in relating Islamic values to engineering decision which was quite parallel to finding of the respondents' survey feedbacks. The themes "public interest", "Islamic knowledge" and "Islamic ethics" that emerged from the responses have signified that the students were quite aware of the various contexts of Islamic values extracted from the Qur'anic guidance. Islam has laid down its value system which covers the criteria of greater spiritual refinement, moral goodness, beneficial knowledge [12] as well as the terminal values of *maqasid al-syari'ah* (the Objectives of Islamic law) that always concern with the communal issues. Thus the finding has shown a positive response where the students were seemed able to relate engineering ventures to the relevant Islamic values in term of its objective, perspective as well as ethics. This is essential for these future engineers to be conscious of and to equip themselves with the righteous personal and societal core values.

The finding of the interview analysis regarding to Truth Oriented component, on the other hand, has shown a rather poor responses with regard to the interviewees' rational and objective reasoning in supporting the truth of Islam. This deficient responses have well corresponded with its item of "does not accept weak argument as the sign of Allah" that has the lowest mean score (2.14) of all items across the component. Apparently a large portion of the interviewees were willing to accept weak arguments to be the sign of Allah even without any sound justification. Moreover a couple of them felt that they were forced to accept anything claimed to be the evidences of Allah's supremacy regardless of the soundness of the argument.

This rather inauspicious finding indicated a poor perception of the students towards the concept of Islamic truth. In Islam, the absolute truth must be based on just and objective reasoning. It is quite inconceivable for a Muslim to believe Islam as an absolute truth (*al-haqq*) but, at the same time, not willing to adhere to the concept of *al-'adl* in making a fair, just and objective justification to support his or her claim of truth [16]. Thus it is important for them not to merely believe

in the ultimate truth, but to also be aware of its practical truth that is concern with rational justice as presented discuss by al-Kindi. They need to equip themselves with a sound rational justice, which is the product of reason, in order to reach the ultimate divine justice which is based on revelation but always in agreement with reason [17].

V. CONCLUSION

In brief the finding of the students' perception on the element of *al-'adl* has shown a reasonably laudable comprehension in relating the religious stimulation and values with the engineering effort. This result reflected their consciousness and anxiousness to assimilate the Islamic values into the engineering enterprise. The lacking aspect of their perception of *al-'adl* however, can be observed from their deficient understanding of rational justice in Islam as the means to grasp the ultimate truth. This poor perception could suggest that the undergraduates, to some extent, still possessed a static or dogmatic mode of thinking instead of critical thinking. They were rather happy just to accept the Islamic truth without any initiative to reflect and ponder the legitimate reason behind it as to ascertain their faith to Allah.

REFERENCES

- [1] Don E. Kash, "Engineers as Revolutionaries", in *Social, Ethical, and Policy Implications of Engineering*, Joseph R. Herkert, Ed. New Jersey: IEEE Press, p. 55, 2000.
- [2] Angelene Gisela McDaniel, "The Role of Engineers: Designing Society", Retrieved December 30, 2008 from: <http://www.engr.utexas.edu/braden/documents/MacDaniel%20Essay2.pdf>.
- [3] Ibn Manzur, Jamal al-Din Muhammad bin Mukrim, *Lisan al-'arab*, Beirut: Dar Sadir, vol. 11, pp. 430 – 436, 1990.
- [4] Murtada al-Zubaydi, Muhammad bin Muhammad, *Taj al-'Arus Min Jawahir al-Qamus*, vol. 8, pp. 9 – 12, n.d.
- [5] Ahmad bin Muhammad bin 'Ali al-Fayyumi, *al-Misbah al-Munir*, Beirut: Maktabah Lubnan, pp. 150 – 151, 1987.
- [6] Majid Khadduri, *The Islamic Conception of Justice*, Baltimore and London: The Johns Hopkins University Press, p. 11, 1984.
- [7] See: Murtada al-Zubaydi, *op.cit.*, vol. 8, p. 9 and Ibn Manzur, *op.cit.*, vol. 11, p. 430, 1990.
- [8] Al-Ghazzali, Abu Hamid, *Ihya 'Ulum al-Din*, Beirut: Dar al-Kutub al-'Ilmiyyah, 3rd ed., Vol. 3, p. 55, 2002. Zulm is also etymologically related to the notion of darkness and gloom that denies one's basic right. As such, zulm is often interpreted as oppression although in reality it encompasses a broader and deeper meaning. See: Mahmoud Ayoub, "The Islamic Concept of Justice", in Nimat Hafez Barazangi et.al. (Eds.), *Islamic Identity and the Struggle for Justice*, Gainesville: University Press of Florida, p. 22, 1996.
- [9] In the Islamic law of inheritance, a woman inherits half of what her male counterpart inherits. However, this inequality in the distribution is considered fair because a woman has no financial obligation and the economical responsibility lies on the shoulders of the man in fulfilling the needs of his family. See: *al-Nisa'* (4): 176.
- [10] Al-Kindi, Ya'qub bin Ishaq, *Rasa'il al-Kindi al-Falsafiyah*, ed. Muhammad 'Abd al-Hadi Abu Ridah, Cairo: Matba'ah Hassan, 2nd ed., pp. 30 – 36, 1978.
- [11] In fact al-Kindi considers justice as the central of all virtues (such as wisdom, courage, temperance and others) for its function as the balancing and coordinating instrument whenever the other virtues come into operation. See: Majid Khadduri, *op.cit.*, p. 82, 1984.
- [12] Rob Niewoehner, "Critical Thinking in the Engineering Enterprise", *The Magazine for Professional Engineers*, Washington D.C.: the National Society of Professional Engineers, pp. 16 – 17, November 2008.
- [13] Board on Manufacturing and Engineering Design, *Theoretical Foundations for Decision Making in Engineering Design*, Washington D.C.: National Academy Press, pp. 8 – 11, at The National Academies Press: http://www.nap.edu/openbook.php?record_id=10566&page=8, 12 October 2011.
- [14] S. Waqar Ahmed Husaini, *Islamic Environmental Systems Engineering*, London: The Macmillan Press Ltd, pp. 7 and 72, 1980.
- [15] See: *Ibid.*, pp. 8 – 9.
- [16] Muhammad Fazl Ur Rahman Ansari, *The Quranic Foundation and Structure of Muslim Society*, Karachi: The World Federation of Islamic Missions, Vol.1, p 249 – 241, 2008.
- [17] Jamal al-Banna, *Nazariyyat al-'Adl Fi al-Fikr al-'Urubiy wa al-Fikr al-Islamiy*, Cairo: Dar al-Fikr al-Islamiy, pp. 95 – 98, n.d.