DEVELOPMENT OF INTEGRATED CURRICULUM AND TEACHING MATERIALS FOR SCIENCE/ENGINEERING COURSES

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ABSTRACT

The research is an outcome of the Focus Group Discussion (FGD) held on 18-19 November 2014 on the effect of curriculum and teaching materials on the grounding of Islamic foundations into science/engineering education system and how to invest and further develop the integration of Revelation into science/engineering courses. The FGD involved active discussions with a total of 9 groups of participants. The participants include those who have been involved in the implementation of Islamization of Knowledge at the Centre for Foundation Studies (CFS) and Kulliyah of Engineering (KOE), both at IIUM as well as several members of PERINTIS (Malaysian Muslim Scientists Association - an NGO). Participants addressed many critical issues related to the curriculum and teaching materials used in the implementation of Islamization of Knowledge (IOK) in the teaching of science/engineering subjects in local education institutions. The research provides some input pertaining to the concepts, evaluation methods and the methodology of integration to be considered for the effective instruction of science for engineering students in the context of International Islamic University Malaysia. The research suggests two major steps to establish a solid foundation for the integration project. First, reviewing of the content of the existing curriculum and teaching materials from an Islamic perspective (in-content) parallel with Islamic courses. Second, reformulating and developing integrated curriculum and teaching materials that are in line with the objectives of IOK and able to create the ideal learning environment for the sciences with a holistic approach.

Keywords: integration, science, Revelation, curriculum, training materials.

Introduction

Since its establishment in 1994, the Kulliyah of Engineering (KOE) has been committed to the implementation of the Islamization of Knowledge (IOK), in line with the IIUM's vision and mission. The actual achievement of this implementation, however, is still far from being perfect and seems more challenging as compared to other Kulliyyahs such as Kulliyyah of Laws and Kulliyyah of Economics (Ssekamanya, S.A. et al., 2011). Ssekamanya, S.A., also stated that one of the weaknesses in the implementation of the IOK at IIUM is the curriculum, where there is a dearth of suitably Islamized materials and textbooks and the existing references comprises of a confusing mixture of Islamic and secular ideas. According to Ahmad, Z., et al. (2011), the existing curriculum and teaching materials at KOE are inadequate, unbalanced and are evidently lacking when it comes to the integration of engineering subjects with Islamic perspective and values at all levels of studies. This particular weakness should provide ample motivation to the educators to seek a practical solution to reformulate the curriculum and subsequently develop integrated textbooks and the supporting teaching materials.

The purpose of this paper is to analyse the extent that the existing curriculum and teaching materials at KOE and CFS are in line with the concept of IOK. This study will reveal the strengths, weaknesses and constraints of the existing curriculum and teaching materials from the integration perspective. The analysis hopefully will consequently identify the effective method to redesign or reformulate an integrated curriculum and develop teaching materials according to the IOK's approach. The outcomes from this study will be the beginning of a concrete plan to expand the development of an integrated curriculum and Islamized teaching materials.

Methodology

This study involved active discussion with a total of 9 groups: 5 of the groups comprised of educators at IIUM, 3 of the groups comprised students of IIUM and 1 group consisted of invitees from an NGO called PERINTIS (Malaysian Muslim Scientists Association), which were represented by lecturers from various local universities. Table 1 clearly outlines the groups as categorised above.

Table 1: Groups of respondents

Educators' groups	Students' groups
Group 1 : Senior lecturers, KOE, IIUM	Group 7 : Postgraduates students, KOE, IIUM
Group 2 : Junior lecturers, KOE, IIUM	Group 8 : Undergraduate students, KOE, IIUM
Group 3 : Lecturers, various Kulliyah, IIUM	Group 9 : Students of CFS, IIUM
Group 4 : Lecturers, CFS, IIUM (Group A)	
Group 5 : Lecturers, CFS, IIUM (Group B)	
Group 6 : Educators from PERINTIS (NGO)	

Most of the educators and students in the FGD have been involved in the implementation of Islamization of Knowledge at their respective university/kulliyah/centre. Two sets of research questions were prepared respectively for the group of lecturers and students. The research questions for both sets were divided into three parts comprising of A: Conceptual, B: Evaluation and C: Techniques.

In general, the information from the discussion comprised of the collective experiences of the participants, which was significant in measuring the level of achievement of the implementation of IOK at CFS and KOE, especially in the development of integrated curriculum. The data from the discussion and also from other related literature were analysed using qualitative approach and categorized into the three aforementioned parts. Therefore, the main findings of this study can be categorized into: Conceptual of Islamization of Knowledge; Evaluation of the existing curricula and teaching materials; and methodology for development of integrated curricula and teaching materials.

Results & Data Analysis

The Concept of Islamization of Knowledge in the context of engineering education.

In this session, the participants discussed the concept of science and values from the Islamic perspective, their understanding about Islamization of Knowledge (IOK) and also their thoughts on the concept of integration of curriculum in science and engineering courses.

(a)   Science and Values from Islamic perspective

Since the first question was more philosophical, it was raised to the educators' groups only. The educators were asked to give their viewpoint about the definition of Islamic science. Fundamentally, they agreed that rather than the simpler terminology of Islamic science, the better way to frame the question is how to look at science from the Islamic perspective. From the knowledge point of view, the educators agreed that science, whether from Islamic or western perspective brings forth the sense of universal

definition. They stated that science can be defined as a branch of knowledge that explores documented proof, empirical and systematic knowledge, tangible and arbitrary, changes constantly and contributes to the benefit of the humanity and can be useful to mitigate harms. The educators' groups, however, were in collective agreement that science from the Islamic perspective differs greatly from the western perspective. In their point of view, the main difference is the ultimate goal of science from the Islamic perspective was to lead human beings to Syahadah and Iman. They believed that by studying science, a human being, either Muslim or non-Muslim was actually studying God's wisdom, this will inevitably lead him or her to Iman, Tawhid and ultimately Heaven (Jannah). The educators' second point was the sources of science from Islamic perspective were not from non-revealed knowledge only, but also derived from revealed knowledge (al-Qur'an and Sunnah). They believed that science from Islamic perspective is a dewesternised version of the modern science infused with the Tawhidic knowledge.

The word science comes from the Latin "Scientia" meaning knowledge (Anuar, A., 2009). Hashim, R., (1999), meanwhile, described knowledge as "integral or holistic as suggested by the Tawhidic world view". She elaborated further that there is no compartmentalization of knowledge into Islam and secular spheres. As a Muslim, we believe that Allah is the source of all knowledge. The source of knowledge can be classified into two types: a) Revealed Knowledge - al-Qur'an and hadith, and b) Acquired Knowledge - knowledge that is acquired by thinking and through experience (Migdadi, M.H., 2011). Science is a branch of Acquired Knowledge; however, some of the facts were recorded in general in the al-Qur'an and/or Hadith.

From the active debate on the definition of science and Islamic science, the authors may conclude that science from the Islamic perspective are based on Tawhid where all the knowledge and discoveries are signs of the Existence, Greatness and Oneness of Allah SWT. Although sciences from the Islamic perspective are comparable to the western perspective in the knowledge acquisition processes, the authors however conclude that the two perspectives are different in terms of the ultimate goal, sources and values.

Meanwhile, most of the groups defined Islamic values as values that derived from the al-Qur'an and Sunnah, with universal characteristics or what is famously mentioned as *Rahmatan lil-'alamin* (blessing for the whole world and its content). From the definition, they accentuated that the purpose of Islamic values was clearly to encourage and support all the efforts to benefit humanity and environment and to simultaneously mitigate harms.

(b)   Islamization of Knowledge (IOK) in the context of engineering education

Islamization of Knowledge is not a new concept among the educators and students at IIUM. The efforts to introduce and implement the project have started since the establishment of the university in 1983. The educator's groups were asked about their understanding of IOK in the context of science and engineering education. In general, they defined IOK as a response to westernization in constructing new knowledge based on Islamic principles, by replacing the western oriented philosophy and values to the Islamic perspective.

All of the participants in the educators groups concurred to the idea that the approach that can be implemented in the IOK is by executing two significant processes that is, 'omitting' from the western based curriculum and 'infusing' with Islamic inputs. This is explained clearly in Table 2.

Table 2: The approach of the Islamization of Knowledge

Omitting Process	*Infusing* Process
▫ eliminate the philosophy from western view	▫ remember the Islamic history & civilization
▫ eliminate non-Islamic values e.g. Darwinism, nature	▫ instil Islamic values & good ethics
▫ eliminate destructive knowledge (e.g. the making of nuclear bombs)	▫ infuse knowledge that will increase Tawhid (Oneness) and bring human beings closer to Islam
	▫ infuse constructive knowledge (for the sake of being beneficial to mankind)

According to Al-Faruqi, I.R., (1982), the concept of IOK can be defined as "To Islamise, is to recast knowledge as Islam relates to it." He also highlighted that the vital goal of IOK is to develop the textbooks at the university level on the basis of the Tawhidic epistemology (Muhammad, O., 2010).

The students' groups, meanwhile, were asked to share their learning experiences under the Islamization approach (at IIUM) as compared to their previous experiences under conventional method. Collectively, they recounted the many advantages under the Islamization approach, from the appearance of the educators, the teaching delivery, and the learning environment as well as the learning materials. They admitted that the approach has given positive impacts on their spirituality, knowledge, mind-set and personality. Some students, however, shared their dissatisfactions on the presentation of the existing textbooks and learning materials, where they felt there is an obvious lack of Islamic elements. This issue led to the discussion about the participants' understanding of integration in science/engineering subjects.

Even though each group arrived at different points and examples, fundamentally, they all agree that integration involves the process of integrating of the Revealed Knowledge (Tawhidic, the Qur'an, Sunnah, Akhlaq, etc.) and Human Knowledge (e.g. science and engineering subjects). They insisted that the process will effectively relate the Islamic essence to the syllabus, and simultaneously dewesternise the contents and values. Value-added elements such as history were also suggested to be infused to the syllabus to glorify Muslim scholars and Islamic civilisation. At this point, the participants seemed to have a similar understanding of IOK terminologies and their views were hardly contradictory to each other and were in line with the concept. The authors describe the respondents' understanding of the concept of integration as outlined in Chart 1, where there are three elements of Islamic inputs to be instilled into the science/engineering curriculum. The elements are Tawhidic and Syari'ah, Islamic values and value-added elements such as History, Ethics and the like. These activities will be parallel with the desecularisation process of the existing content.

Chart 1: Integration of Islamic Inputs into science/engineering subjects
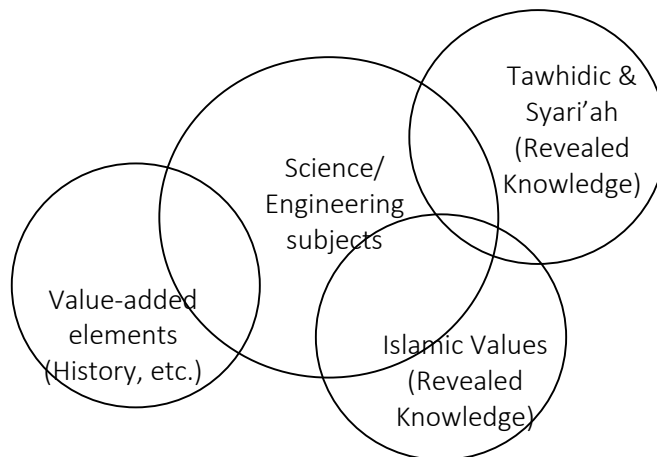
Evaluation on the existing curriculum & teaching materials

In this session, basically the participants were required to share their opinions about the achievement of IOK at their respective centre/kulliyyah/ university, in particular the aptness of the current curricula and teaching materials from the Islamic integrated curriculum perspective. The first question to the educators' groups was to what extent the current curricula in their respective departments integrate Islamic contents and values. Unexpectedly, most of the groups admitted that the implementation was still at infantile stage. They disclosed that there were no collective strategy and system to implement the integration process, and most of efforts were done at individual levels. As a result, there were no standard integrated textbooks and teaching materials used. However, the CFS' lecturers (Group 4 &5) claimed that they had performed decent progress where they managed to conduct several workshops to standardise the integration process of the teaching materials. There were also continuous mentoring activities between the lecturers to deliver the integrated contents at CFS.

The above explanation was consistent with what Ahmad, Z., et al. had found in 2011. She observed that the KOE's students were having difficulties in making references due to the fact that the existing textbooks and teaching materials were significantly lacking in the integration of science/engineering subjects with Islamic concepts and values. In another paper, Ahmad, Z., (2011) also exposed that most of the existing engineering subjects were adopted from the western syllabus, where the approach and essence were based on materialistic and modern ideologies.

The next question stimulated a lively discussion. All groups were asked about their perspectives on whether or not Islamic courses should be integrated in the science/engineering syllabus, in contrast to the current approach where the Islamic courses are offered parallel with the science/engineering courses. Most of the participants in the educators' groups suggested that the isolation of Islamic courses and science/engineering subjects were irrelevant and there should be integration. The senior lecturers (Group 1) suggested that the integrated subjects should be introduced at the fundamental level, while for postgraduate level, the students may write a section about ethics/Islamic worldview in their thesis. CFS' lecturers (Group 5), however, disagree with the idea and believe that the current approach is still relevant but is insufficient. Nevertheless, they too agree that integration of some subjects should be implemented to allow for deeper understanding. Among the students, KOE's postgraduate students (Group 7) and CFS' students (Group 9) supported the idea to integrate the subjects in one single syllabus instead of separating them. The KOE's undergraduate students (Group 8), however, prefer the present system. Their reasoning was that the present system meets the Islamization, Integration, Internationalisation and Comprehensive Excellence (IIICE) requirements and it makes it easier for them to differentiate between the human knowledge and revealed knowledge. They also pointed out that integration would be very challenging and difficult to implement.

From the authors' perspective, University Required courses (UNGS) can be classified into two categories, core courses and supporting courses. The supporting courses such as English, Fiqh for Everyday Life, Tilawah etc. are designed to assist the students in accelerating their studies and provide added value to them, hence, the subjects are not really related to the

science/engineering subjects. Therefore, these courses should remain separate and taught concurrently with the science/engineering subjects. Core courses such as Islamic Worldview and Islam, Knowledge and Civilization, however, are subjects which contain elements that closely related with the science/engineering subjects. The contents of these subjects should be integrated with any science/engineering subjects whenever relevant and applicable. This will allow the integration process to be implemented. External inputs that are not part of the curriculum, such as Qur'anic verses, history of Muslim Scholars, Islamic values etc. should also be instilled into the science/engineering subjects to complete the recasting process. Contents in the core courses that are not really related to the science/engineering subjects could remain in the courses and taught separately, like other supporting courses. The aforementioned process of integration is described in Chart 2.

Chart 2: Proposal for the integrated curriculum

Existing curriculum   **Integrated curriculum**
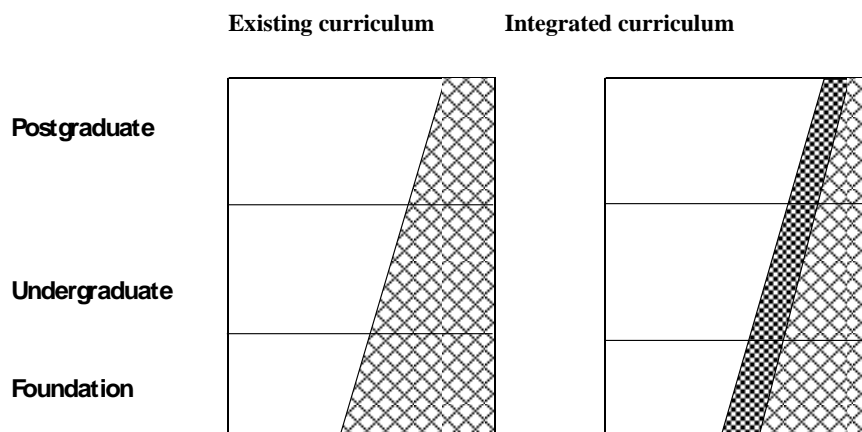
The respondents were asked to comment in depth about their opinions on the weaknesses of the existing textbooks and teaching materials from the point of view of integrated curriculum. On the issue of textbooks, most of the groups agreed that the issue was not fit for discussion because up until then, there were no integrated Islamised textbooks available either at CFS or KOE. Therefore, the focus of the discussion was shifted to other teaching materials. Lecturers from PERINTIS group (Group 6) stated that there were no requirements in the OBE (Outcome Based Education) approach to include the integration process. This may have contributed to the unsuccessful integration of the curriculum. The students, however, shared that there were Islamic inputs in the presentation of some teaching materials such as slides and lecture notes, unfortunately the contents were still lacking in terms of providing the Islamic perspective and the integration is still far from being perfect.

The last question in this part may answer the issue of the unproductiveness in terms of the integration of curriculum. The educators' groups were asked to discuss the skills and expertise required for educators who engage in the integration process. There were two competencies proposed. First, on top of mastering the subject matters, the educators were proposed to have basic knowledge on Islamic science (Tafsir, al-Qur'an, hadith) as well as knowledge on Islamic worldview. Group 1 also suggested KOE to offer Diploma in Islamic Studies for lectures to fulfil the demand. According to Ahmad, Z., (2011), the Diploma programme has been obligated to all new lecturers. She also suggested the programme to be reintroduced with basic 'tasawuf' subject. Second, the educators were suggested to be well trained in the Islamization methodology and integration processes, to ensure they were capable and competent to relate the Islamic sciences to science/engineering subjects. Group 1 contributed an idea to prepare engineers to be the lecturer; meanwhile Group 5 suggested that mentoring activities among lecturers should be activated. Ahmad, Z., et al., (2011) proposed a collaboration activity between educators from KOE and Kulliyyah of Islamic Reveal Knowledge to work together to implement the integration process. The authors agree with the above points and would like to suggest that the relevant departments to conduct a strategic planning for the development of competent educators to execute the integration activity in order to actualise these ideas.

Techniques to integrate curriculum and teaching materials

The final part of this FGD was even more interesting and challenging. Since there was no effective method of integration of curriculum available so far, the first question put forth to the educators' groups was which strategy was more effective: (i) develop the integrated curriculum from 'scratch' or (ii) improve the existing curriculum. The groups were requested to brainstorm on the advantages and disadvantages of each approach. The collective outcome of the brainstorming is outlined in Table 3.

Table 3: Advantages and Disadvantages of the two approaches in the development of integrated curriculum

Strategy	Advantages	Disadvantages
Develop from 'scratch'	⊡ Can be tailored to our needs ⊡ Very clean - focus on context (the right objectives from beginning) ⊡ There is always a new branch of 'ilm.	⊡ A lot of work ⊡ Time consuming ⊡ Throwing away the ideas of earlier scholars ⊡ Not enough expertise

		⊡ Limitations :
		◆ Consider accreditation by professional body – EAC/MQA
		◆ SLT – student learning time
		◆ Compulsory University courses (e.g. Islamic courses)
Improve the existing curriculum	⊡ Framework already developed ⊡ Shorter time	⊡ Cannot achieve ultimate goal ⊡ Filter the unwanted secular (non-Islamic) elements

There was an active debate among the educators, which strategy offers better solution. In terms of time, a modification of the existing curriculum may take less time to be implemented. This strategy however may jeopardise the ultimate goal and philosophy of the IOK. Developing the integrated curriculum from scratch, on the other hand, required competence and experience resources, and involve more work. The development team also must consider the limitation by IIUM and related bodies such MQA and Board of Engineers Malaysia (BEM). From the authors' point of view, improving the current curriculum is more practical at this early stage. Even though this approach may not achieve the ultimate goal of integration, this approach requires shorter time and most importantly, creates an effective technique of integration. This technique also seems to be more practical in dealing with the limitations.

The next big question was 'What' are the applicable techniques to implement the integration process? There was many opinions put forth by the educators' groups, most of which complemented each other. IIUM's lecturers (Group 1, 2 and 3) suggested several methods to integrate the curriculum, which include desecularising the contents and values, incorporating relevant verses from the Qur'an, infusing Islamic values and providing proper supporting materials (textbooks, slides etc.). Hashim, R. (1999) supported this idea where she insisted that the curriculum must be free from secular or Westernized elements that were contradictory to Islam, and must be replaced with the Islamic worldview. CFS' lecturers (Group 4 & 5), meanwhile suggested the instructional strategies should be improved to make it more balanced (wasatiyah concept). In the same spirit, lecturers from PERINTIS (Group 6) proposed an improvement of the assessment method to make it more Islamic. The responses from the students' groups were more practical. KOE's undergraduate students (Group 8) and CFS' students (Group 9) agreed with the previous idea to introduce a balanced curriculum. They wished more practical activities, both indoors and outdoors should be introduced as it is more effective for the younger generation. KOE's postgraduate students (Group 7) meanwhile suggested an interesting idea to set up a council to develop and endorse comprehensive and integrated teaching materials. Hashim, R. (1999) stressed that the Qur'an and the Sunnah of the Prophet must be the primary references in the Islamization of curriculum processes.

The participants also discussed about elements of Islamic inputs that should be incorporated in the curriculum. KOE's lecturers (Group 1 &2) proposed that all elements should be incorporated, depending on the relevancy of subjects or topics. The other educators' groups, meanwhile, specifically proposed Tawhidic, history, values and ethics as the main elements. The students' groups basically appeared to share the same ideas with the lecturers groups. In general, the respondent's proposals are in line with Ahmad, Z.'s model (2011) where she proposed to enrich the engineering curriculum with Islamic perspective by reflecting the contribution of Islam and its civilisation, amalgamated with the sacred aspects. The idea was also supported by Muzakkir, S., where he believes that instilling Islamic values in very logical subject such as Mathematics is applicable and will potentially change the students' ways of thinking.

The last question in this final part was about the need and effect of intensive Quranic study as well as Arabic language to the integration progress. In general, most groups came to an agreement that good understanding of the relevant knowledge of al-Qur'an provide positive impact to make the integration process to be more effective. Good Arabic literacy, meanwhile, from their opinions was an added value not only to those involved in the integration process, but to the educators and students in as a whole.

From the robust brainstorming sessions, the authors would like compile the diverse opinions and proposals to create a practical method that can be used to execute the development of integrated curriculum, textbooks or teaching materials. This method, as described in Chart 3 is a cycle process that can be executed by improving the existing curriculum, textbooks or teaching materials. This approach, from the authors' opinion is more practical and viable as compared to the 'develop from scratch' approach. The first process is desecularizing the content, where every single point that is identified as unislamic must be eliminated and replaced by the Tawhidic and Islamic perspective. The next process is to insert related verses from the Qur'an and hadith wherever relevant. This process is crucial because it describes the integration of revealed knowledge and acquired knowledge (science/engineering content). This can be followed with the infusing of Islamic values to the syllabus and teaching materials. These values include the history and contribution of Muslim scholars. The first three processes represent the omitting and infusing approach of integration as discussed earlier. The next two processes are for improving the teaching delivery and assessment techniques, and are not the main focus of this paper. This method hopefully can be applied to the existing curriculum, textbooks and teaching materials to measure its effectiveness, improve upon it and eventually as a standard tool of integration for future expansion.

Chart 3: Applicable Technique of Integration
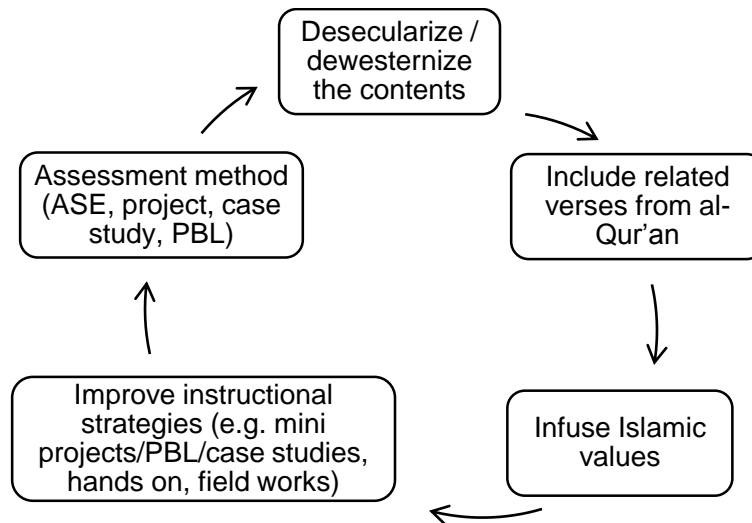
The Way Forward

Most of the participants agreed that the current curriculum and teaching materials are still dominated by the Western worldview and the process of infusing Tawhidic and Islamic perspectives are still at an infantile stage. For that reason, they agreed that more effort must be put to realize the integrated curriculum and teaching materials. The long term and short term planning must be reviewed and strategized to be more realistic and viable. Since CFS as the main entry point for engineering students has been proactive of this aspiration, it is suggested that the new approach of IOK at KOE to be commenced at CFS. The effort must be focused on producing a good model of integrated curriculum or textbook. One of the noteworthy outcomes from the FGD is the suggestion for a method of integration process by improving the current curriculum/teaching materials. This method should be applied first to produce the model and the method must be improved from time to time until it becomes very effective. From this point, the method can be formally standardised and could be applied to islamise other curricula, textbooks and teaching materials in a larger scale at KOE.

Conclusion

The conclusions derived from the FGD show that the respondents have had very good experiences in the implementation of IOK at their university/ kulliyah/centre. Generally, their understandings of IOK are considerably mature, as proven by their ideas and contribution to the FGD. The problem, however, is that the implementation of integrated curriculum and utilisation of teaching materials are still far from perfect and seems to veer off the track. There are two bottlenecks decelerating the progress; lack of expertise among educators and unviable technique to execute the integration process. The focus of this FGD is to formulate a viable technique to produce integrated curriculum and teaching materials. The authors have compiled the ideas and created a method/tool that is anticipated to be applicable to future activities. The method must be continuously improved and incorporated as a standard procedure or at least a standard guideline for integration. Apart from this integration effort, the management and educators have to play their part in deploying other strategies such as producing experts in integration, and reformulating the integrated assessment to actualise the implementation of IOK especially at CFS and KOE.

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