MALAYSIA AND THE WASHINGTON ACCORD: WHAT IT TAKES FOR FULL MEMBERSHIP

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ABSTRACT

In 2003, Malaysia was admitted to the Washington Accord as a provisional signatory nation alongside Germany and Singapore. This development has been described as "significant in the history of the Washington Accord" [1] since it implied that these nations have demonstrated that their accreditation systems are conceptually similar to those of the full signatory members with respect to quality assurance in their engineering education programmes. In this paper, the authors will highlight the significance and implications of the Washington Accord agreement with special reference to developing countries. The paper will also document experiences of an engineering faculty in Malaysia and the Engineering Accreditation Council (EAC) of Malaysia in meeting the requirements of the Washington Accord sponsors and mentors. In particular, efforts by the Engineering Faculty of Universiti Kebangsaan Malaysia (National University of Malaysia) in introducing elements of Outcome-Based Education as a key requirement for full membership of the Accord will be presented.

Key words: *Washington Accord, Accreditation System, Quality Assurance, Engineering Education*

THE WASHINGTON ACCORD

The Washington Accord is a multinational agreement which recognizes the substantial equivalency of engineering degree programmes accredited by the responsible bodies in each of the current signatory countries. The two most important elements of the agreement are that it:-

- recommends that graduates of accredited programs be mutually recognised as having met the academic requirements for entry to the practice of engineering in any member country, and;
- establishes that graduates of programs accredited by the accreditation organisations of each member nation are prepared to practice engineering at the entry level.

Apart from these two elements which are essentially regulatory in nature, admission to the Accord more importantly is an endorsement that the engineering education system of the member nation have demonstrated a strong, long-term commitment to quality assurance in producing engineers ready for industry practice in the international scene.

The Washington Accord agreement covers only professional engineering undergraduate degrees. Engineering technology (covered by the Sydney Accord), Engineering technician (covered by the Dublin Accord) and postgraduate-level engineering programs are not covered by the Washington Accord.

The agreement was first signed in 1989 and currently has eight full signatory member nations represented by their respective accreditation bodies for engineering education (See Table 1).

Further information on the Washington Accord is readily available in their website, ww.washingtonaccord.org.

ADMISSION TO THE WASHINGTON ACCORD

As an agreement for the accreditation of engineering education programmes with the largest international participation, an increasing number of countries have expressed interest in membership of the Washington Accord. In this context, its signatories have in fairness noted the following [1]:-

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- Some of the interested nations may have well-developed accreditation systems that already align closely with those of existing signatories. Others will have systems that are at an early stage of development, or are radically different in character. In these latter cases it may take considerable time and developmental effort to achieve equivalence, in nature and standard, sufficient for admission to signatory status.
- The Accord is at a crossroads in its approach to admitting new members. On the one hand, it must uphold the standards it represents, which form the incentive for others to join. On the other hand, it must not behave like an exclusive club. Gaining admission must not be so difficult that applicant countries become discouraged and turn away.
- The Accord does not claim to be superior to other systems. It is simply a voluntary agreement of equivalence among similar systems, using tried and tested approaches to accreditation and mutual verification, and sharing a common view of evolutionary directions. The signatories welcome to membership other countries that wish to adopt similar approaches and share the existing experience.

Table 1: Summary of Various Assessment Tools and Related Details

Country	Signatory Organization	Entry Year
Australia	Institution of Engineers, Australia	1989
Canada	Canadian Engineering Accreditation Board of the Canadian Council of Professional Engineers	1989
Hong Kong	Hong Kong Institution of Engineers	1995
Ireland	Institution of Engineers of Ireland	1989
New Zealand	Institution of Professional Engineers New Zealand	1989
South Africa	Engineering Council of South Africa	1999
United Kingdom	Engineering Council	1989
United States	Accreditation Board for Engineering and Technology	1989

Admission Requirements

In principle, admission to the Accord will be granted if an applicant country has proven that its accreditation system and criteria are of equivalent standard to those of full signatory nations. This equivalency will be established by a set of requirements [1], the most important of which are :-

- Does the operating documentation focus attention on the fundamental criteria for accreditation – in particular, the required graduate attributes – in a way that is clearly evident to the educational institution concerned? Do the criteria translate into procedures that evaluate in depth the outcomes of each program and how they are assured?
- Is the outcome standard, as evaluated by existing signatories during live observation and interaction, consistent with that represented by the Washington Accord?

The other requirements are mostly procedural in nature and should not pose a major obstacle to most applicant nations.

Process for Application

The process for application generally involve a two stage procedure, i.e. (1) Provisional Membership, and (2) Full Membership. Provisional membership requires that the accreditation system of the applicant nation is conceptually similar to those of the other signatories of the Washington Accord and has the potential capability to reach full signatory status . The Award of provisional status in no way implies any guarantee of the granting of full signatory status.

A summarised version of the procedural steps required for a country applying for full membership of the Accord is as follows [1]:-

1. The applicant country writes to the Washington Accord Secretariat indicating her intention
2. The secretariat invites the applicant country to submit a set of preliminary documentation required for initial assessment.
3. If the documentation does not appear to meet the Requirements in principle, the Secretariat will advise the applicant country that its system differs from the Requirements in certain fundamental respects (to be indicated) and ask whether the country wishes to undertake major development work and pursue its application further when it believes the issues identified have been addressed and the Requirements met.
4. If the documentation appears to the Secretariat to meet the Requirements in principle, the Committee will assign a team of two or three existing signatories to act as mentors to assist the applicant country in progressing to membership.
5. When the applicant country feels that it is ready for Provisional Membership, it will request two of the existing signatories, usually the designated mentors, to act as nominators.
6. If the nominators agree and are satisfied on the applicant country meeeting the requirements, they will submit the Provisional Membership recommendation to the signatories. Provisional Membership will be accorded only by agreement of at least two third of all existing signatories.
7. Upon formal admission to Provisional Membership, the Secretariat will then assign again two or three signatories as mentors to assist the applicant country in the transition to Full Membership status.
8. When the applicant country feels that it is ready, it will request the Accord Secretariat for a review exercise for Full Membership.
9. If the mentors agree and are satisfied on the applicant country meeeting the requirements, the Secratariat will assign three signatories as Reviewers to examine and report on the applicant country's accreditation system and submit their recommendation on the application. Full Membership will be accorded only by agreement of all existing signatories.

THE EXPERIENCE OF MALAYSIA

In Malaysia, the accreditation of engineering programmes falls under the jurisdiction of the Engineering Accreditation Council (EAC). The EAC is formed by the Board of Engineers Malaysia (BEM), the government body which has the legal responsibility of registering and regulating the engineering profession in the country. The EAC derives its membership from the Institution of Engineers Malaysia, Accreditation Board of Malaysia, the Public Services Department of Malaysia, The Malaysian Council of Engineering Deans, and several members appointed by the President of the BEM from among industry practitioners.

Malaysia through the EAC, was admitted as a provisional member in 2003 with the United Kingdom and Australia as nominators (at that time known as sponsors). This was a result of a mentoring process achieved through a series of meeetings and visits which, among others, saw the publication and adoption of a document, "Engineering Programme Accreditation Manual". The Accord has subsequently appointed three countries as mentors, namely, Australia (acting as lead mentor), USA and Hong Kong. Currently the Malaysian

accreditation system for engineering education is undergoing a major improvement exercise with the assistance of its mentors through a series of visits, discussions and seminars.

In the most recent exercise, Professors Alan Bradley (Inst.of Engineers, Australia) and Skip Fletcher (ABET, USA) served as a mentoring team to assist the EAC in preparing for admission to the Washington Accord. The team participated in accreditation visits to Universiti Kebangsaan Malaysia (UKM), a National (public) University in Bangi, and Universiti Multimedia (MMU), Cyberjaya Campus, a private university in Putrajaya. The two-day visit to UKM included 9 degree programs in the Department of Chemical Engineering, Civil Engineering, Electrical Engineering and Mechanical Engineering. The two-day visit to MMU Cyberjaya Campus involved 6 degree programs all in the Faculty of Electrical and Electronic Engineering. The accreditation visits were conducted using EAC accreditation guidelines with an accreditation panel for each department or faculty (four panels of three evaluators at UKM and one panel of four evaluators at MMU). The panel chair was a representative from a university (who was a registered professional engineer) and the panel members consisted of one academic and one industry representative.

After completion of the visits, the last day in Malaysia the mentoring team met with the Chair of EAC, appropriate council members, and staff to discuss the visits and provide recommendations for strengthening the EAC accreditation process.

Based on participation in accreditation visits, discussions with university administrators, department heads, and faculty, and discussion with various panel members, it became clear to the mentors that while the BEM/EAC has made progress toward implementing an outcomes based engineering accreditation process, there were a number of issues which must be addressed prior to a recommendation for admission to the Washington Accord. These included inconsistencies in the stated accreditation criteria and the accreditation manual, the lack of clarity in the type of material requested from the universities, the manner in which the panel evaluations are conducted, training of the panel members, and outcomes assessment education of the university faculty and staff. The mentors further noted that the philosophy of outcomes assessment is not clearly understood by members of the EAC, the accreditation panel chairs and members, or the engineering faculty and administration.

Therefore, as a first step, it is essential that the EAC:

1) Completely revise the Engineering Programme Accreditation Manual and Appendices to remove inconsistencies and to clarify the purpose and expectations of engineering accreditation in Malaysia;
    - Clarify the guidelines for materials to be submitted by universities as well as materials to be displayed for review by the panels during the accreditation visit;
    - Carefully define the responsibilities, assessment procedures, and report guidelines for accreditation panels to ensure fair and equal evaluation for all engineering programs;
2) Conduct multiple training programs for members of the Board of Engineers, the Engineering Accreditation Council, the accreditation panel chairs, as well as the accreditation panel members. Similar training should be provided for engineering deans, department heads, and faculty at all institutions.

There are many other additional issues that must be addressed in preparing for the outcomes assessment paradigm, and these will be addressed along the way.

[Most of the write-up in this section are excerpts, with some adjustments, from the unpublished draft report prepared by Professor Skip Fletcher following the July 2004 visit.]

THE REQUIRED CULTURE SHIFT

The most significant requirement that became clear from the experience of Malaysia's application process is the need for a genuine shift of the engineering education system from the conventional prescriptive-based system towards an outcome-based system. This requires engineering faculties as well as the accreditation body to effect a comprehensive cultural shift from a system which currently focuses on facilities, resources and processes,

towards one which focuses instead on the outcomes and long term objectives of the educational programmes. In this new outcome-based culture, programme structures and curricula are means to an end, and not the end itself. Attention will have to significantly shift towards establishing, achieving, and implementing effective measuring and monitoring tools for programme outcomes and objectives.

Quality systems in the conventional approach tends to be limited to checking the quality processes surrounding the setting of examination papers, the security of the examination process, the moderation of the assessment process, and the policy, processes, and practices in place for the proposal and approval of new academic programmes, rather than embracing and assuring the whole cycle of setting objectives and targets, learning design, delivery and performance measurement across a wide range of targeted graduate capabilities**.** Accreditation exercise tends to be pre-occupied with a step by step validation of quantitative data provided by the university and fine tuning the technical contents parameters in an already crowded and technically intense curriculum and making statements of need with regard to staff profile and physical resources. The conventional approach focuses too much on the **process** of education rather than on the **products or graduates**. There is thus a need to reengineer our educational philosophy, process, and accreditation.

However, the process of educating and convincing academicians on the merit of outcome-based education is a difficult one as many are quite satisfied with the status quo. They have argued that there is nothing wrong with the old approach, so why is there any need for a change? Some went to the extent of saying; "Please don't promote this new kind of colonisation". Some even claimed that they had been employing the approach all along, but they actually do not really understand the whole concept of OBE. Another typical response would be, "The current system has already produced engineers of high standard who have become leaders in the government and corporate sectors, and even politicians, so why bother changing the education system?" In attempting to effect this cultural shift, wise judgment need to be exercised in addressing resistance by those have opposition tendencies without trying to understand the real concept is an act of ignorance and signals a lack of professionalism.

OUTCOME-BASED EDUCATION (OBE)

What is OBE? OBE focuses on outcomes in the preparation of graduates for professional practice and requires documented evidences on how the programme imparts and develops them rather than than focusing on the process in achieving the outcomes even though this may be equally important. Programme objectives (long term) and outcomes (short term) are identified and tracked for the various contributing components. The objectives and outcomes must be assessed and evaluated. If the graduates can demonstrate they that have achieved certain required outcomes from an engineering programme that they have undergone, surely the whole process in educating them can be said of a good or high standard. On the other hand, if the graduates produced by any engineering programme cannot demonstrate the achievement of the required outcomes by the time they graduate, it can definitely be confirmed that the programme offered are of a low standard and quality. This does not necessarily agree with the concept of the end justifying the means. The means must still be logical, reasonable and legal. The Western Australian Education Department document describes **OBE** as:

> *'an educational process which is based on trying to achieve certain specified* ***outcomes*** *in terms of individual student learning. Thus, having decided what are the* ***key things students should understand and be able to do or the qualities they should develop****, both structures and curricula are designed to achieve those capabilities or qualities. Educational structures and* ***curriculum are regarded as means not ends.*** *If they do not do the job they are rethought*'

Whether is *capabilities, qualities, attributes,* or *outcomes*, the curriculum should be designed to achieve the desired objectives. Most importantly, in the OBE approach, the programmes must demonstrate that the graduates have achieved the required outcomes. Employing proper assessment and evaluation tools can help achieve this. In short, the whole education process in terms of teaching, learning design, assessment and evaluation must be reorganised. The OBE approach would change the methods in which subjects are being delivered, the method in which students are assessed and evaluated, thus making it more innovative and flexible. Teaching methods involving active learning and encouraging students to learn and experiment such as project based learning, are to be introduced instead of the old teacher centred approach. The lecturers would be demonstrators and role models, whilst the students themselves are responsible in acquiring the knowledge, skills and attitudes with the help of the lecturers.

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Another important concept in the OBE approach is that Continous Quality Improvement (CQI) is a must. CQI is part and parcel of OBE where right from the very beginning, i.e. from formulating the curriculum until the execution and implementation of the program, CQI must be in place continuously. Opinions of stakeholders or constituencies must be taken into consideration. OBE gives emphasis on stakeholders and constituencies as they are at the receiving end of the educational process. Surveys to see how the graduates perform several years after their graduations are necessary in the OBE approach.

Therefore, some of the immediate effects and advantages of an outcome-based approach are:-

- Universities are always alert and concerned about the quality of the graduates produced.
- Development of more systematic, innovative and flexible teaching methods, for example, project based learning within an integrated learning environment, etc. will be encouraged.
- Increase in student exposure to professional practice through industrial training, site visits and industry-linked projects or assignments will be encouraged.

OBE IN THE FACULTY OF ENGINEERING, UKM

First Awareness

The faculty started embarking seriously in efforts towards OBE in November 2003 when two of its senior faculty management team members, i.e the Deputy Dean for Academic Affairs & a Head of Department, attended the *2nd ABET International Faculty Workshop on Continuous Program Improvement* held at the National University Singapore (NUS) between 9 – 11 December 2003. The workshop proved to be very informative and instrumental in initiating efforts towards implementing OBE at Universiti Kebangsaan Malaysia.

Regulatory Requirements

Prior to this, elements based on objectives and outcomes for continuous programme improvement are mentioned in at least two regulatory documents, i.e. the EAC Manual (Board of Engineers Malaysia) and the Code of Practice for Quality Assurance (Department of Higher Education Malaysia). However, the emphasis and the clarity in these documents are not as explicit as the requirements spelled out as Criteria 2 and 3 in ABET Criteria (revised Nov. 2003).

As is now widely recognised and anticipated, programme objectives and outcomes will feature more prominently in subsequent engineering accreditation exercises in Malaysia as well as internationally.

Anticipation of Real Benefits

Apart from the above regulatory requirements, Faculty management is convinced that by initiating and sustaining a genuine shift towards OBE, the engineering programmes can anticipate real benefits and improvement, including :-

- resulting in a more directed and coherent curriculum,
- producing graduants with attributes more relevant to industry stakeholders, and
- achieving Continuous Quality Improvement (CQI) as an inevitable consequence.

Such conviction further strengthens management's commitment to OBE.

First Steps

Amongst the early steps taken in the process of implementing OBE are: -

- Organising a faculty workshop and an awareness Seminar on OBE for 30 selected faculty members on 30th December 2003 and 25th May 2004 respectively.
- Establishing OBE-CR committees at the faculty and departmental levels.
- A special Faculty Meeting to present and discuss the principles and implementation of OBE.
- Establishing **Programmes Educational Objectives (PEO), Programmes Outcomes (PO), and Course Outcomes (CO)**.

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- Getting feedback and views from employers, alumni, parents, faculty members, and students on the **proposed PEO** and **PO**.
- Getting feedback from employers, alumni, parents, faculty members, and students on the **achievement** of the **PEO** and **PO**.
- Reviewing existing curricula and courses to take into account PEO, PO and CO, and feedback from the various constituencies.
- Implementing suitable **assessment** and **evaluation** tools to measure the achievement of the PEO, PO and CO.
- Facilitating a two-day workshop on OBE Awareness & Sharing of Experience organised by the Board of Engineers (BEM)/Engineering Accreditation Council (EAC) for EAC members and representatives from Engineering Faculties on 25th & 26th May 2004.

The Faculty has established an **Outcome-Based Education and Curriculum Review (OBE-CR) Committee** both at faculty and departmental levels. Members of this committee are committed to disseminating awareness and initiate efforts towards promoting and establishing OBE in the curricula and teaching of courses.

Assessment Of Programme Outcomes And Results

Additionally, using a variety of assessment tools to assess the outcomes, the results of assessments are used to implement changes in courses and the curriculum as needed for success in achieving the PEO. The various assessment tools and the results of assessment are discussed next, followed by changes prompted by the assessment results.

Overview of Assessment Tools

Table 2 provides a summary of the various tools employed for assessment of programme outcomes (PO) and programme educational objectives (PEO). In many cases, the PO are directly assessed by the stakeholders. In other cases, assessment is indirect, with the results providing useful information concerning the attributes of the graduates.

Table 2: Summary of Various Assessment Tools and Related Details

No.	Items Assessed	Assessment Tool	Administered by	When Administered
1	PO specific to courses	Self-evaluation	Departments	May 2004
2	PO achievement	Student Survey	Departments	May 2004
3	PEO	Parent	Departments	May 2004
4	PEO	Alumni survey	Departments	May 2004
5	PO, PEO achievement	Alumni survey	Departments	May 2004
6	PEO	Employer survey	Departments	May 2004
7	PO, PEO achievement	Employer survey	Departments	May 2004
8	Exiting competency	Senior exit survey	Departments	March 2004
9	Entry competency	First year student	Departments	May 2004

Sample survey results (taken from the Civil & Structural Engineering Department) are shown in FIGURE 1, along with the results from the student and alumni surveys. The alumni survey results were not available to the academic staffs at the time they responded to the survey. Thus, the academic staff ratings for Programme Outcomes (1) to (11) as spelt out by the EAC Manual can be considered the inverse of the student and alumni ratings; that is, a low student rating (indicating poor departmental performance) correspond to a high faculty rating (indicating need for improvement). From the survey results, there appears to be broad agreement among the surveyed groups on outcomes (1), (3), (4), (5) and (9), with relatively low student and alumni ratings and relatively high staff ratings.

Accordingly the OBE-CR committee concluded that a focused attention was needed to address the situation with regards to these five outcomes as part of the continuous improvement of the overall curriculum in terms of all outcomes.

Future Plans

The Faculty will continue its efforts in increasing the awareness and understanding of OBE amongst Faculty members. The assessment of outcomes and objectives using the appropriate tools will be further intensified within the framework of the current implementation of the 5-year curriculum review exercise. At the present time, a lot of work has been completed for at least two programmes in the Civil & Structural Engineering Department. Other departments have commenced a significant amount of work as well which will be further expanded accordingly based on the experiences and the preliminary results obtained in by the Civil & Structural Engineering Department.

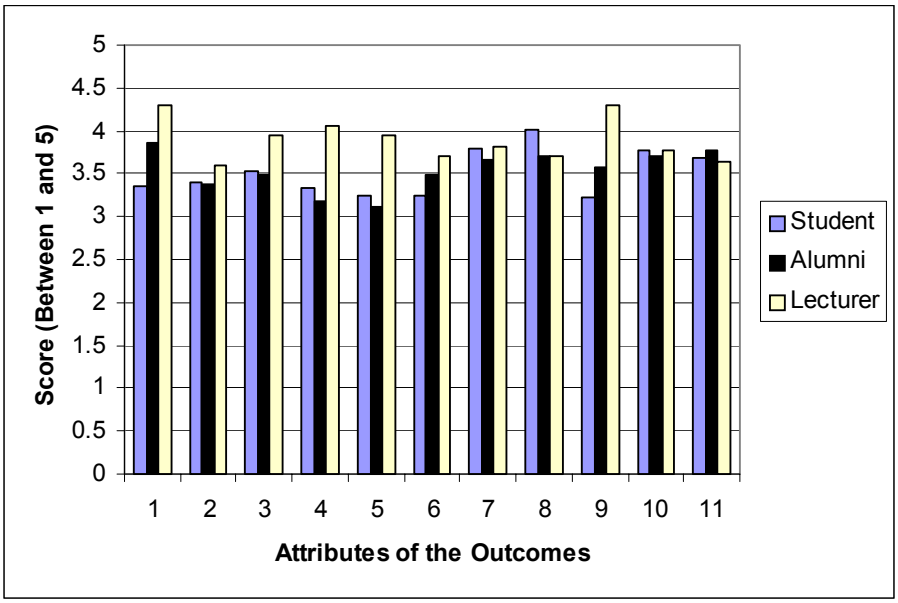

Figure 1: Ratings for Programme Outcomes (PO) (1) to (11) for Three Surveyed Groups. [All the Civil & Structural Engineering Department undergraduates (blue bars) were asked in May 2004 to assess how well the department had helped them develop the attributes of an engineer described in PO (1) to (11). Alumni who graduated between 1996 and 2002 (black bars) were asked in May 2004 to make the same assessment using the same scale. Academic staff (yellow bars) were asked in May 2004 to assess the degree to which each outcome (1) to(11) they gave attention for improvement in the curriculum.]

The current course syllabi is being reviewed in concept and detail. The results of the assessment tools will necessarily be used as an important basis for curriculum and teaching improvement. Professor Felder's paper on "Designing and Teaching Courses to Satisfy the ABET Engineering Criteria " (*J.Eng.Education*, January 2003) has been distributed to all academic staff to be used as a practical guide for establishing outcomes, revising content and improving delivery for each individual course. In addition, the Faculty has started to initiate and introduce new teaching processes and learning designs in order to achieve the programme outcomes.

Amongst the specific corrective measures that will be considered for implementation in the future are:

1. Reviewing learning design to reduce classroom instruction and include more innovative teaching approaches such as Problem-Based Learning (PBL) and Cooperative Learning.
2. Modifying existing laboratory implementation from several experiments to one large-scale experiment in certain subjects to achieve a predetermine goal where the students are required to design and conduct their own experiment.

3. Introducing discovery projects to train the students to be more independent in self-learning process.
4. "Spreading" the achievement of certain soft-skill outcomes over several appropriate courses, such as "communication skills" development in to be formally incorporated (part of assessment) in Design Project & Research Projects I & II (apart from the non-technical courses such as English for Engineers).
5. Introducing capstone projects to train the students to work in multi-disciplinary teams, to be able to utilise systems approach and to communicate effectively.
6. Introducing current issue engineering projects to train the student to be more sensitive to the current issues.
7. Introducing case studies to train the students to analyse problems systematically and professionally.
8. Increasing activities such as industrial visits and the use of invited guest lecturers from industries to expose students to real engineering practice.
9. Modifying academic projects or thesis such that the students are able to undertake problem identification, design and conduct research and interpret data.
10. Oral presentation will be strengthened in each subject where every student has to explain and defend his/her project.

These measures will be planned for implementation within a possible programme framework as shown in the following figure (Figure 2).

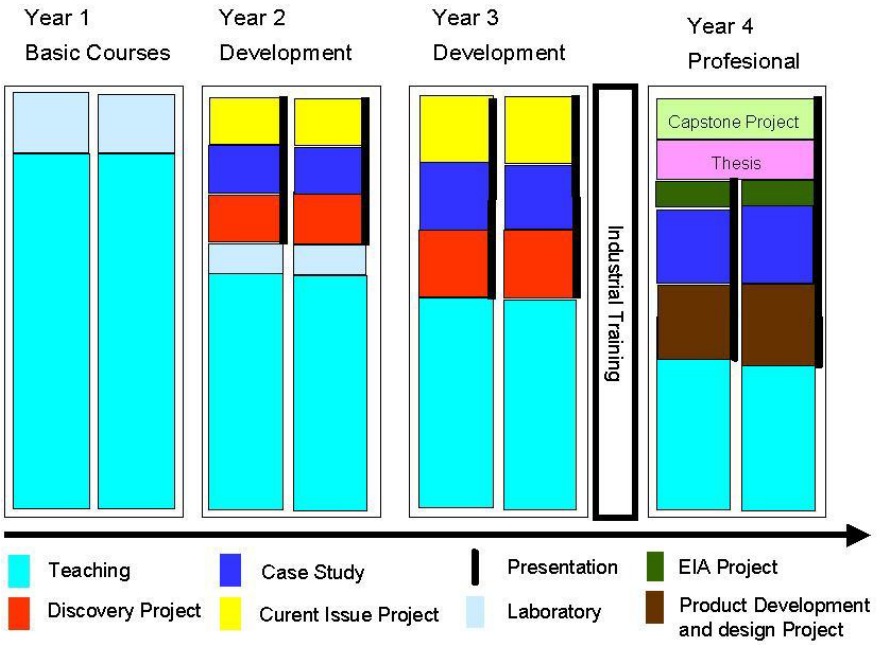

Figure 2: Basic Components in the Revised Faculty Curriculum

CONCLUSION

Malaysia is currently the only Islamic nation that has secured Provisional Membership of the Washington Accord and is on its way towards applying for full signatory status. Its experience suggests that any applicant nation must carefully prepare for admission by understanding the need for and implementation of a major culture change in the engineering education system. This culture change will inevitably contribute very significantly towards strengthening quality assurance for graduant outcomes, thus making the effort highly desirable regardless of membership status.

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