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Complementary Effect of Curricula Modifications, OBE and Students' Performance in College of Engineering, King Saud University – Case Study

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Abstract : Engineering education require timely changes in curriculum in order to keep its relevance with technology upgradation. The outcome-based education (OBE) has become a preferred vehicle of education reform through curriculum upgradation. In the College of Engineering King Saud University three reform regimes have been undertaken.

Plan A was from 1990-2002, Plan B was from 2003-2007 and Plan C from 2008-2018. Curriculum plans B and C were considered ABET accreditation requirements in their constitutes. The consistent increase in number of students earning GPA from 4.5 to 5 was 2%, 7% and 33% during Plan A, B and C. The increase in mean average GPA of plan B registered 10% increase in comparison of plan A bench mark. However, the mean average GPA of plan C registered significant increase of 34%. The percentages of honor degree holders in each successive curriculum plan A, B and C exhibited increase of 0.9%, 2.1% and 16% respectively. The average number of years taken by the students to complete the graduate program decreased from 6 years to 5.5 years and to 5 years under plan A, B and C respectively. All above parameters exhibited fulfilment of OBE criteria and justifies the modifications in plans of curriculum.

Keywords : Curriculum; OBE; ABET; Assessment

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1. Introduction

The present time is the era of blistering changing technologies. The engineers and technocrats shall therefore be equipped with them to keep pace with the society. In the first half of 19th century, engineering education built upon the basics of engineering practice, and relied on industry experienced faculty members (Lang et al.1999). The influence of engineers on the society has increased tremendously in the last half century which was also existing earlier but has almost occupied the central stage. This role of engineers requires their education and training from a new well-conceived design so that their efforts can result in positive contribution. Nearly, fifty years back in in the 1970s, technical and professional education planners started thinking to give space to incorporate the changes regarding personal and professional moral predicaments of engineers on continuing basis (Center, 1980). However, this was not the first time that curriculum incorporation modifications were under discussion; its various aspects were evaluated including ethics (Cooper, 1955). This educational model was dramatically changed after the fifties as the industry focus has shifted toward commercial enterprise causing it to be focused on technical problem solving and design. Thus, it became based on scientific research and more relied on understanding of the basics of mathematics and science. Subsequently, faculty members were appointed on the merits of research experience and less emphasis was put upon industrial experience. However, this educational model did not explain the technical practice adequately (Mills and Treagust, 2003). Mills and Treagust (2003) identified the mismatch of the industry needs and the outcomes of engineering education as follow: (1) lacking strong communication and teamwork skills, (2) lacking of the understanding of the issues concerns engineering profession, (3) lacking of applying fundamental knowledge of engineering in practice.

The advent of computer application and application of information technology in almost every sphere of life witnessed major changes in the last half century. This rapid evolution of the industry virtually made it obligatory for every engineering academic program to revise their curriculums and pedagogy accordingly. Barry and Ohland (2012) stated that a major reason for making curriculum changes is to satisfy the requirements of accreditation standards (e.g., ABET accreditations)

(https://www.ieagreements.org/accords/washington/signatories/ , 1989).

The accreditation board of engineering education (ABET) was founded in 1932, to ensure that new engineering graduates shall possess the skills needed to be good engineers. It consisted of eight criteria namely; Criterion 1. Students' performance; Criterion 2. Program Educational Objectives (PEOs) consistent with the mission of the institution; Criterion 3. Student Outcomes (SOs) (1) through (7) supporting the PEOs to identify, apply, communicate, recognize ethics, team leadership, conduct experimentation and acquire new knowledge; Criterion 4. Continuous Improvement; Criterion 5. Curriculum consistent with SOs and PEOs; Criterion 6. Faculty - sufficient and competent; Criterion 7. Facilities e.g., Classrooms, offices, laboratories, libraries etc.; and Criterion 8. Institutional Support.

Since then, ABET kept updating its criteria- especially criterion 3- to ensure that they are richer and measurable, but above all realistic (ABET, 2000). In the year 2000 ABET made major revision in its accreditation policy and procedure manual (ABET, 2000) by emphasizing outcomes over process to amend the misalignment between engineering practice and academia (Shuman et al., 2005).. The U. S. Department of Education set standards of accreditation by way of attainment of quality and all engineering programs are required to meet established learning outcomes of the curriculum (ABET 2008). Furthermore, the ABET accreditation 2000 which consisted of eight above-mentioned criteria; of which criterion # 3 revised to eleven-student outcome by including professional and ethical responsibility in the curriculum, in which students are expected to know and able to attain when they become graduate. Criterion 3.f states that all engineering graduates must possess a proper "understanding of professional and ethical responsibility" (ABET, 2000).

Rest of the remaining criterion out of list of eleven technical and professional outcomes were same as mentioned above. The expandable role of technology in social development enlarged the role of ethics. Therefore, it was felt that engineering students shall possess sound professional ethics while arriving technical decisions using modern technological tools. The ABET outcome model based on courses examinations designed to attain set target levels, the overall goals and specific curriculum objectives described in detail in the Self-Study report prepared by the engineering institution. Such program goals are then mapped with the specific objectives of the curriculum (ABET, 2000).

The National Academy of Engineering in USA published the proceeding of a workshop on Emerging Technologies and Ethical Issues in Engineering in 2004. It emphasized that, "Engineers are in a unique position to comprehend, assess, and shape these technologies and to inform the public about them. But they generally lack in addressing the social and ethical implications of technology" (NAE, 2004a). NCE moved further by anticipating the role of professional and ethical attributes of the future engineer as, "Complementary to the necessity for strong leadership ability is the need to also possess a working framework for the development of high ethical and professional standards in future" (NAE, 2004b).

Among all stakeholder societies of engineers, the

American Society of Civil Engineers (ASCE) possesses the unique distinction of very old and active in the field of professional engineering and technology and its education and research The ASCE in 1998 issued a policy (#465), which supported the engineers to embody attainment of a defined Body of Knowledge (BOK) upon graduation followed by the licensed entry into the practice of civil engineering. The subsequent BOK2, identifies 24 outcomes based on Bloom's Taxonomy (American Society of Civil Engineers). Body of Knowledge Committee., 2008 (Bloom 1956). Fig. 1 shows graphical reproduction of OBE model execution (Green and Stone, 1977).

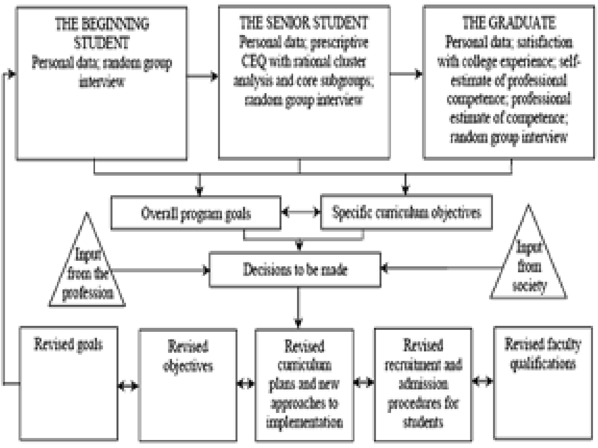


Fig. 1: The Outcome Based Education Model (Green and Stone, 1977).

The revised curriculum at this stage set revised objectives and goals and this stage is assessed on the basis of students' performance both by direct and indirect tools. Thus, all engineering accredited programs reformed their curriculum content and plans to meet the new ABET standards. In summary the ABET announced revisions to criteria 3 and 5 for the 2020-2021 accreditation cycle. The revision addressed the following topic area: (1) Engineering problem solving, (2) Engineering design, (3) Measurement, testing, and quality assurance, (4) Communication skills, (5) Professional responsibility, (6) Professional growth, and (7) Teamwork and project management (www.abet.org/accreditation/). There are variety of methods evolved for the inclusion of professional and ethical aspects into engineering curriculum. The methods include core courses within the discipline, elective courses within the discipline, elective courses outside the discipline, across-the-curriculum with specific linkage of social ethics (Herkert , 2000; Herkert 2002). Initially out of a variety of methods of OBE evaluation with reference to engineering education professional and ethics-based teaching and learning, a selective group of institutions were assessed and reviewed and an examination was used as an assessment tool. Initially it was applied on the nine academic institutions in the southeast United States namely; Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD. 2007).

Although ABET set the standards to accredit engineering academic programs, it does not prescribe a specific curriculum content. Furthermore, it is the responsibility of program's faculty to assure that the curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Varying amount of curriculum content is being used in engineering curricula (Herkert , 2000; Herkert 2002; Rabins 1998). Previous studies assessed the impact of curriculum reform in engineering programs to meet ABET accreditation standards in relation to educational attributes, industry expectations, etc. (Volkwein et al. 2004). Limited studies compared the efficiency degree of curriculum content before and after changing it to satisfy the requirements of accreditation standards (e.g., ABET accreditations). Furthermore, this study aims to assess the effectiveness degree of a curriculum content in relation to student academic performance by comparing three curriculum plans (A, B and C) and student academic performance with in the same institute at different time. It sought to determine how much changes in technical curriculum content occurred between 1990 to 2020, as well as, what curriculum content substituted the technical content. Subsequently, statistical analysis is carried out to evaluate the validity of these changes in term of student academic performance.

2. Methodology

The King Saud University possesses a robust, secure system of examination system through its website https://edugate.ksu.edu.sa/ksu maintained by Deanship of admissions and admissions online portal. All the data from this portal is accessible to faculty and individual students as well. The same data after its necessary approval by the concerned authorities is loaded on https://obeengineering.com/Home the website of outcome based education management website of KSU. All the data was taken from the above-mentioned sources with necessary permissions, moreover the author himself possesses account in these portals being faculty and former Chairperson of the department of civil engineering. The analysis of variance (ANOVA) was carried out to determine the significant mean difference between the Grade point average (GPA) and the curricula changes.

A. Retrospective of Civil Engineering Curricula Changes Since 1990

In line with the vision of the university, the College of Engineering has always stood for academic excellence, scientific temper and to serve as quality human resource provider to the society and industry. The COE through its OBE program always strive to offer state-of-the-art facilities for knowledge transfer, make policies and atmosphere to attract and retain best faculty, create an ambience in which new ideas and cutting-edge research flourish through effective curriculum and infrastructure so as to produce the leaders and innovators of tomorrow, produce ethically strong & morally elevated human resource to serve mankind, undertake collaborative projects and consultancy for long term interaction with the academia and industry and be among the top engineering institutions. ABET accreditation of different programs of engineering in the COE of KSU is explained in detail by Khan et al. (2016). The overall assessment is done through setting up of student outcomes (SOs) based on the criteria set by the ABET to achieve program educational objectives (PEOs). These outcomes (SOs and PEOs) are directly attained through prescribed each Course Learning Outcomes (CLOs) of every part of the individual course and its questions thereof through performance in the examination. Moreover, involvement and assessment of other stakeholders namely; alumni and industry contribute indirectly. This ultimately results in weaknesses and strengths of the curriculum and the

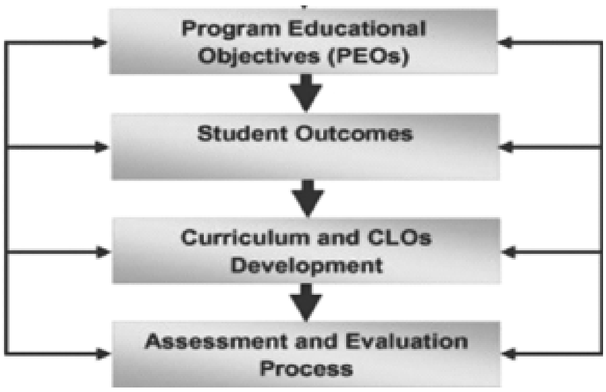


Fig. 2: Curriculum Development Through Obe Assessment (from Khan, 2016)

program. Therefore, OBE assessment and curriculum modifications are complementary to each other (Pradhan 2021; Walkington, 2002; Memon 2009).

Khan et al. (2016) summarized the KSU OBE program through repetitive steps of planning, assessment, review of curriculum content and CLOs both on short term basis (semester wise) and on long term (curriculum plan wise) as shown in Fig. 2 and 3. King Saud University has achieved the desired result in each curriculum plan by attaining the required goals to conform ABET criterion. Each time it is done by reviewing and updating the curriculum.

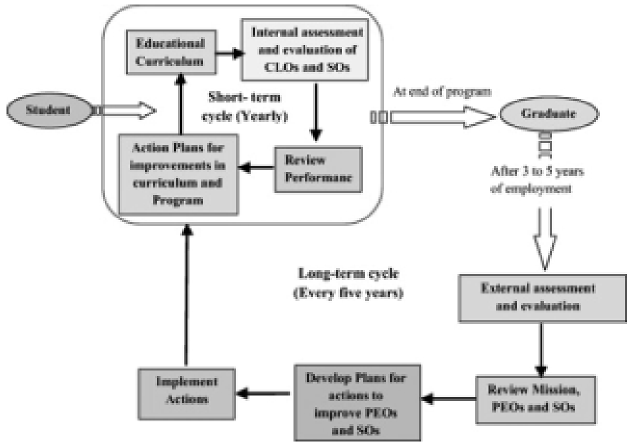


Fig. 3: Main Steps Involved in Short and Long-term Cycles for Improving a Program (from Khan Et Al., 2016).

Baseline data were collected on the current and previous civil engineering curriculum plans at King Saud University (KSU). The curriculum plans at the civil engineering department were revised and changed over the years to account for the rapid growth of civil engineering discipline in the Kingdom of Saudi Arabia. This article will discuss three curriculum plans namely; (1) The 1990-2002 curriculum plan: Plan A, (2) The 2003-2007 curriculum plan: Plan B and (3) The 2008-2018 curriculum plan: Plan C.

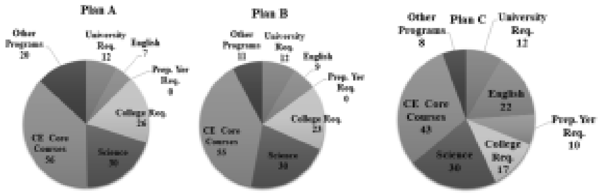
The curriculum changes show that the KSU engineering programs responded to ABET Criterion 3.f. This resulted in increase in the total number of courses/credits related to professional and ethical responsibility. However, a reduction in coverage of mathematics, basic science, and engineering science took place (Table 1), particularly during plan C. The curriculum plans B and C under study are under constraints of limit on the available credit hours in the crowded engineering curriculum to cover the vast amount of material required to meet the expectations of all stake-holders.

This section identifies the core materials offered for each curriculum plan, and it identifies the curricula changes that has been implemented to meet the ABET engineering criteria.

Table 1 and Figure 4 shows the subject wise credit (Cr. Hr.) and courses of detailed curriculum information for each plan. The various courses that comprise the curriculum are characterized in relation to the outcome that they can serve in accordance with Welch et al. (2007). In essence, each curriculum plan has been broken-down into the following components: (1) math and science, (2) engineering Science, (3) engineering fundamentals, (4) engineering, (5) professional, and (6) humanities and social sciences. Tables 2, 3 and 4 show the detailed breakdown of curriculum plan based on the previously categorized as mentioned above.

Table 1: Detailed Structure of Curricula Plans From 1990 – 2018

Curricula information		Plan A (175 Cr. Hr.) 1990 - 2002	Plan B (160 Cr. Hr.) 2003-2007	Plan C (163 Cr. Hr.) 2008-2018
Math and Science	No. of Credit Hours	35	35	35
	No. of Courses	11	11	11
Engineering Science	No. of Credit Hours	20	16	12
	No. of Courses	7	6	5
Engineering Fundamentals	No. of Credit Hours	14	11	13
	No. of Courses	6	5	5
Engineering	No. of Credit Hours	77	71	58
	No. of Courses	22	22	22
Professional	No. of Credit Hours	10	6	12
	No. of Courses	4	2	6
Humanities and Social Science	No. of Credit Hours	19	21	35
	No. of Courses	10	8	11
	Total Credit Hours	175	160	165
	Total Courses	60	65	60



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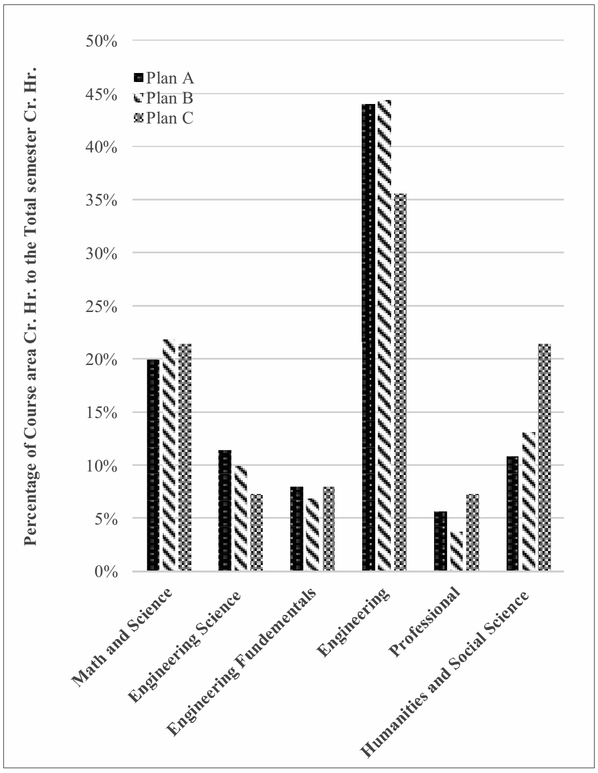

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Figure 4: Subject wise (a) no. of credit (Cr. Hr.) (b) % age of credit (Cr. Hr.) and courses details for each curriculum plan.

Plan A was built upon the experience of faculty members and it was oriented toward research-based program. Therefore, it is noticed that it has 175 semester credit hours, whereas Plan B and Plan C is more oriented toward fulfilling the requirements of ABET accreditation standards. Fig. 4 shows that engineering core courses in plan A and plan B has the highest percentage of 44 % of the total courses. However, this percentage was reduced to 35% in plan C in addition to increase in percentage of humanities and social science courses and professional courses to be 21% and 7%, respectively, to fulfill other ABET requirements related to Communication skills, Professional responsibility, Professional growth, and Teamwork and project management.

Table 2: Courses Distribution and Cr. Hr. in Plan A.

Plan A - (175 Cr. Hr.) 1990 - 2002			
No. of Hours		**No. of Hours**	
Math and Science	**35**	**Engineering Science**	**20**
Math1	3	Statistics	3
Math 2	3	Dynamics	3
Math 3	3	Mechanics of Materials	3
Math 4	3	Fluid Mechanics	3
Math 5	3	Thermodynamics	3
Math 6	3	Engineering Chemistry	3
Statistics and Probability	3	Materials Properties and Testing (Lab)	2
Chemistry 1	4		
Geology	2	**Engineering**	**77**
Physics 1	4	Survey-1 (Lab)	2
Physics 2	4	Survey-2 (Lab)	2
		Concrete Properties and Testing (Lab)	2
Engineering Fundamentals	**14**	Structural Analysis- 1	3
Engineering Workshop	1	Structural Analysis- 2	3
Engineering Drawing 1	3	Concrete Design- 1	3
Engineering Drawing 2	3	Concrete Design- 2	4
Computer Applications in Engineering	2	Steel Structures	3
Industry and Environmental	2	Hydraulic Engineering (Lab)	4
Principals of Electrical Engineering	3	Hydrology	2
		Water/Wastewater Systems	3
Professional	**10**	Water/Wastewater Treatment	3
Environmental Management	2	Soil Mechanics-1 (Lab)	3
Engineering Management	2	Soil Mechanics-2	2
Project Engineering Management	3	Foundation Engineering	3
Engineering Economics	3	Transportation Engineering- 1	3
		Transportation Engineering- 1	4
Humanities and Social Science	**19**	Construction	3
English (4)	7	Architectural Design for Civil Engineers	2
Islamic Studies (4)	8	Civil Engineering Electives (6)	18
		Senior Design 1	2
		Senior Design 2	3

Table 3: Courses Distribution and Cr. Hr. in Plan B.

	Plan B - (160 Cr. Hr.) 2003- 2007		
	No. of Hours		**No. of Hours**
Math and Science	**35**	**Engineering Science**	**16**
Math1	3	Statistics	3
Math 2	3	Dynamics	3
Math 3	3	Mechanics of Materials	3
Math 4	3	Fluid Mechanics	3
Math 5	3	Thermodynamics	2
Math 6	3	Materials Properties and Testing (Lab)	2
Statistics and Probability	3		
Chemistry 1	4	**Engineering**	**71**
Geology	2	Survey-1 (Lab)	2
Physics 1	4	Survey-2 (Lab)	2
Physics 2	4	Concrete Properties and Testing (Lab)	2
		Structural Analysis- 1	3
Engineering Fundamentals	**11**	Structural Analysis- 2	3
Engineering Workshop	1	Concrete Design- 1	3
Engineering Drawing	3	Concrete Design- 2	3
Computer Applications in Engineering	2	Steel Structures	3
Industry and Environmental	2	Hydraulic Engineering (Lab)	4
Computer Programming	3	Hydrology	3
		Water/Wastewater Systems	3
Professional	**6**	Water/Wastewater Treatment	3
Project Engineering Management	3	Soil Mechanics-1 (Lab)	2
Engineering Economics	3	Soil Mechanics-2	3
		Foundation Engineering	3
Humanities and Social Science	**21**	Transportation Engineering- 1	3

English (2)	9	Transportation Engineering- 1	4
Islamic Studies (4)	8	Construction	3
		Architectural Design for Civil Engineers	2
		Civil Engineering Electives (4)	12
		Senior Design 1	2
		Senior Design 2	3

Table 4: Courses Distribution and Cr. Hr. in Plan C.

	No. of Hours		No. of Hours
Math and Science	**35**	**Engineering Science**	**12**
Math1	2	Statistics	3
Math 2	3	Dynamics	3
Math 3	3	Mechanics of Materials	3
Math 4	3	Mechanics of Materials Lab	1
Math 5	3	Fluid Mechanics	2
Math 6	3		
Math 7	3	**Engineering**	**58**
Statistics and Probability	3	Survey-1 (Lab)	3
Chemistry 1	4	Structural Materials Properties and Testing (Lab)	3
Physics 1	4	Structural Analysis- 1	4
Physics 2	4	Concrete Design- 1	4
		Hydraulic Engineering	2
Engineering Fundamentals	**13**	Hydraulic Engineering Lab	1
Engineering Drawing	3	Hydrology	2
Computer Applications in Engineering	2	Water/Wastewater Systems	2
Industry and Environmental	2	Water/Wastewater Treatment	2
Computer Programming	3	Water/Wastewater Treatment Lab	
Computer Skills	3	Soil Mechanics-1	2
		Soil Mechanics Lab	1
Professional	**12**	Soil Mechanics-2	2
Engineering Management	2	Foundation Engineering	2
Engineering Economics	2	Transportation Engineering- 1	2
Business Entrepreneurship	1	Transportation Engineering- 1	3
Learning, Thinking, Research Skills	3	Transportation Lab	1
Communication Skills	2	Construction	3
Introduction in Engineering Design	2	Architectural Design for Civil Engineers	2
		Civil Engineering Electives (4)	12
Humanities and Social Science	**35**	Senior Design 1	2
English (4)	22	Senior Design 2	2
Islamic Studies (4)	8		
Arabic Literature (2)	4		
Health and Fitness	1		

3. Results And Discussion

Every curriculum plan initiated with exploration of requirement of academic content reform through well-established committees in the department namely; departmental and university councils. Prior to the council's curriculum sub-committees in the department collect opinion on the requirement of changes in components of individual courses, changes in teaching methods, on the basis of CEOs attainment and stakeholders' surveys. The objective was always to timely incorporate the requirements of stated criterion of the ABET. Baseline data method (Olds and Miller 1998) was adopted to examines the impact of curricula changes on student learning. Furthermore, student learning was measured by means of student performance such as: GPA distributions, number of honor degree holders, and average years taken up by the students to complete the program under each curriculum plan. Students' performance data were collected from students' registration portal (e-register) at KSU (complete performance data are saved on the system since 1990). Civil engineering department has admitted and graduated more than 2111 students since 1990 to 2021. Only students whom completed their program and graduated were considered in this study. Curricula changes were identified for each group of students based on their semester of enrollment.

The statistics performed on the data clearly indicates that successive curriculum change has delivered good results in terms of the performance of the students. However, plan A lacked any structured mechanism of students' assessment and finally course learning outcomes, which were later incorporated in plan B and C.

To determine the significant of curricula changes on students' performance, Analysis of variance (ANOVA) was carried out to determine the significant mean difference between the Grade point average (GPA) and the curricula changes. Results from ANOVA shows a significant mean difference ($F(50,2444)=28.594, p<0.001$). The strong correlation suggest that the average GPA depends on curricula changes. Thus, implying the association between students' performance and changes in curricula.

Fig. 4 compares the 2008-2018 curriculum plan grade distributions to previous curriculum plans. The 1990- 2002 histogram represents the grade distribution of students at the earliest curriculum plan which was built upon faculty members expectations and it was research oriented. The latter curriculum plans considered ABET accreditation requirements in their constitutes. With the implementation of ABET requirements through the emphasizing of communication skills, professional responsibility, professional growth, and teamwork and project management in the curricula, there is clear shift in the grade distribution bell-shape in the 2008-2018 histogram from the other histograms in Fig. 4. The proportion of students earning a GPA 4.5 to 5 is 33 % in 2008-2018, 7% in 2003-2007, 2% in 1990-2002.

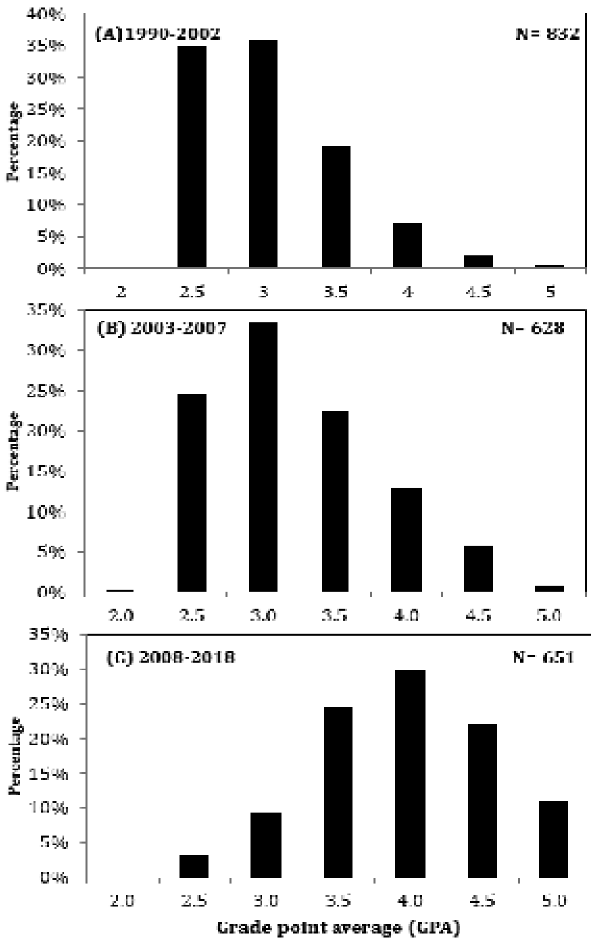

Fig. 5: The mean average GPA of (A) Plan A; (B) Plan B and (C) Plan C.

Fig. 5 compares the mean average GPA of the 2008-2021 to previous plans. The mean average GPA of the 2003-2007 showed a slight increase of 10% from the 1990-2002. However, a significant increase of 34% in the mean average GPA of the 2008-2018 from the mean average GPA of the 1990-2002 is observed.

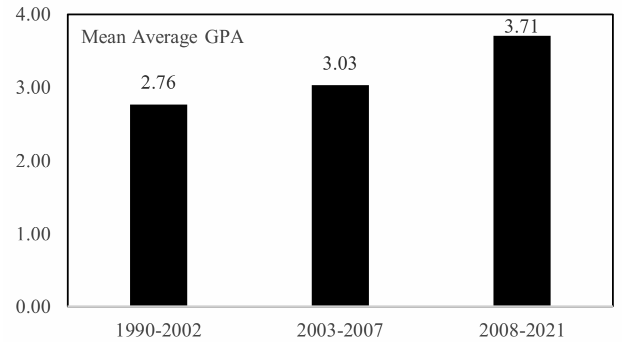

Fig. 6: The Mean Average Gpa Increase During Successive Plans.

Fig. 6 and 7 shows percentages of honor degree holders for each curriculum plan. A significant increase in the honor degree holders were observed in the students whom have been graduated according to the 2008-2021 curriculum plan compared to other students.

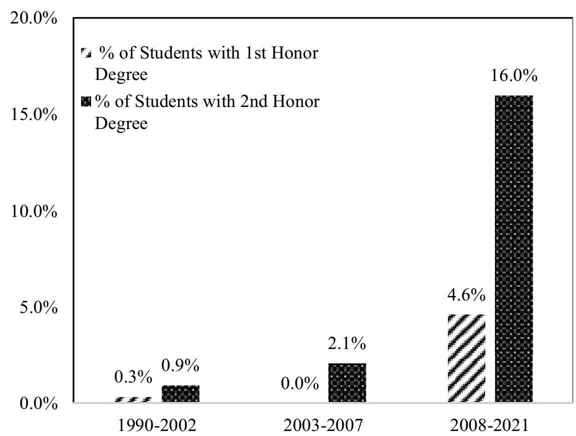

Fig 7: Percentages of Students Obtained the Degree With Honors Under Each Curriculum Plan.

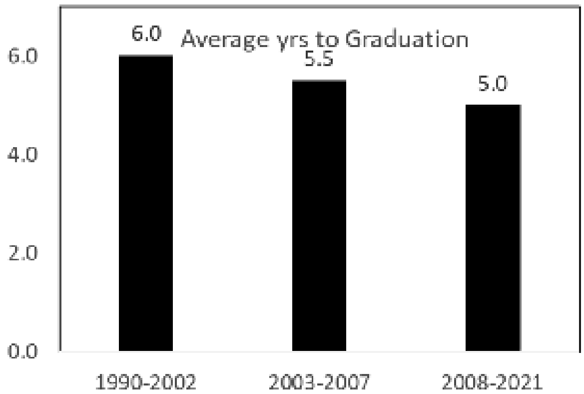

Fig. 8: The Average Number of Years Taken by the Students to Complete the Program Successfully.

Fig. 8 shows the average number of years taken by students to complete the graduate program requirements to obtain a degree in civil engineering. The data shows that the average number of years taken to complete the program requirements has decreased from 6 years for students following the 1990-2002 to 5.5 years for students following the 2003-2007 to 5 years for students following the 2008-2021.

The results discussed above indicate that core curriculum of civil engineering can be handled with less credit hours. Focusing on giving more flexibility and more credit hours for more professional growth and teamwork will be reflected positively on students' performance.

The ABET Engineering Criteria 2000 involves stakeholders to help universities define goals and objectives and design an engineering curriculum to meet desired outcomes (Koehn and Parthasarathy, 2005). Students, Industry, parents, alumni are key stakeholders of this process and has been reliable tool. Plan B and C would have been closer to requirement had these indirect tools would have been addressed in a structured way.

A properly designed curriculum with respect to content is one of the factors of desired outcomes, however, the suitability of content in relation to ethics and professional requirements is not a standalone critical factor, but other factors, such as infrastructure, educational environment, availability of required local and global faculty capable to deliver instructions excellently and their optimum engagement have a significant impact on student self-efficacy and competency. All these factors are reflected in present study, however could not be quantified in terms of absolute numbers.

It is recommended for future analysis agenda to replicate the similar study among different sections of curriculum namely; science, humanities, engineering and core engineering in terms of performance by the students under each plan.

4. Conclusion

In the present stage of technology dependent social development, it has become imperative to evolve institutional mechanism for the evaluation of technical and professional education. The concept of structured evaluation came into being through OBE evaluation process. However, the role of education therefore, is not just to impart knowledge and skills that enable the stakeholders to function as socio-economic change agents, but also to impart professionalism and ethics and this change in OBE was incorporated through criterion 3.f in 2000. This required curriculum changes. The role of curriculum change is always considered as perfect vehicle of progress for learning process however it's not the sole reason on improvement in the scholastic credentials of the students. The association of courses outcome assessment generated an absolute sense of delivering the targets both among teacher and taught. At the same time the regular third-party inspection keeps administration on their toes to maintain the infrastructure up to the mark.

The performance of curriculum plans A, B and C assessment in terms of increase in student's percentage attaining GPA from 4.5 to 5, increase in mean average GPA, increase in percentages of honor degree holders and decrease in number of years taken by the students to complete the graduate program suggest the success of curriculum revision.

The coupling of timely change in curriculum and OBE has delivered progressively excellent results as analyzed in the above three implemented curriculum plans in the undergraduate studies of the college of engineering of King Saud University, Riyadh, Saudi Arabia. In order to obtain more meaningful conclusions, it is important to differentiate the results of different sections separately namely; science, humanities and core engineering.

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