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Quality Assessment in Engineering Education for Better Job Opportunity in Nepal

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Abstract

Following privatization in higher education, investments of Nepali people in medical and engineering education have tremendously increased in comparison to the rise in the portion of income of general people. Moreover, alike medical education, engineering education too is becoming inaccessible to the common people including even people coming from the middle class and lower middle class backdrop. Besides causing financial impediment for common people to attain engineering education, privatization and subsequently, mushrooming of engineering colleges (those affiliated with new-cum-already established universities) have also rendered quality degradation of engineering education. Huge amount of investment in engineering education without quality considerations is prevalent. Increasing quality degradation in engineering education (impinging negatively into proper manpower generation for the country) demands immediate and full-fledged assessment of quality of engineering education. To compete in both the national as well as international levels of job market, Nepal requires clear cut policy of quality engineering education. Most of the universities and colleges in other countries go through accreditation policy (generated either through national level or international level accreditation bodies) to assure their quality of engineering education. As a consequence, they are able to produce manpower capable enough to compete globally. The national level bodies in Nepal responsible for the assessment of quality of engineering education are Nepal Engineering Council (NEC) and University Grant Commission. These two institutions have a very vital role to play in quality assurance of engineering education through appropriate policy. Considering above mentioned scenario, this paper will first of all, discuss about international system of quality assurance policy. The paper will then proceed on to highlighting external as well as the internal system of assessments in Nepal, its shortcomings and scope of improvement for better job opportunity in Nepal.

Keywords: *Quality Assurance; Accreditation; Assessment; Engineering Education; Job Market.*

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1. Introduction

In the absence of sound and accessible education, sustainable economic development of the country is not possible because education forms an integral part of human development and as a corollary, a significant impetus to poverty alleviation [1]. Quality of education depends on number of factors and needs such as influence of curriculum, quality and level of that curriculum and society's demand of certain kind of educational programs. Monitoring and funding agencies like Nepal Engineering Council and University Grants Commission have right to set performance indicator of higher education through academic audit system [2]. Generally, the universities are the arbiters of the quality and level of the programs that they offer, the ultimate test is whether or not the graduates of an engineering program are employable and are in demand by employers [3].

The educational and research functions of most colleges of engineering in Canada are highly interdependent and mutually supportive. Without a climate of research and development, a university or a college of engineering is simply an advanced technical school. If the engineering students are to obtain required skills and mental outlook to respond to the changing scientific functions, they must be taught by faculties, who are committed to the advancement of knowledge and the values of research and scholarly activity [4].

Devastating earthquake of 25 April 2015 and its aftershocks struck Nepal killing about 9000 people and destroying 500,000 houses, including historical monuments in Gorkha, Dhading, Rasuwa, Nuwakot, Kathmandu, Bhaktapur, Lalitpur, Kavre, Sindhupalchowk, Dolakha, Ramechhap and its neighboring districts with a huge economic loss amounting to Rs 700 billion. Majority of the people of these areas became homeless [5]. This earthquake destroyed government institution buildings, university college buildings, most of the rural school buildings etc., compelling all the students to study outside open spaces or temporary sheds. Most of the single storey school buildings have not been found properly built to withstand earthquake force despite being supervised and designed by the government engineers. They were in fact found collapsed. Similarly, other institutional buildings designed and supervised by consultants have also got collapsed due to improper design and detailing, and, lack of quality of construction. These structures need thorough investigation as a part of research in order not to repeat mistakes and learn appropriate methods of design and construction. And, this demands highly qualified and conceptually capable skilled manpower. This is possible only through quality engineering education.

2. UNIVERSITIES AND PROGRAMS.

Out of 9 universities, 6 universities run engineering programs. Mid-Western (MW) and Far-Western (FW) are the recently established universities. Tribhuvan University is the oldest and caters 90% of the students of the country. Khwopa is the only community engineering institute managed by the Bhaktapur Municipality. It runs engineering programs through two affiliate colleges of Tribhuvan University and Eastern Region University. About 6 private engineering colleges are sustaining by single program like Civil or Geomatics Engineering. Table 1 provides information about programs and number of constituent, community, and affiliate engineering colleges of different universities.

Table 1. Universities, Programs (undergraduate), and Engineering Colleges.

Programs	Universities and Programs					
	Purbanchal	Kathmandu	Tribhuvan	Pokhara	Mid-Western	Far-western
Civil	√	√	√	√	√	√
Electrical	√	x	√	x	x	x
Electronics & Communication.	√	x	√	√	√	x
Mechanical	x	√	√	x	x	x
Computer	√	√	√	√	√	x
Architecture	x	x	√	√	x	x
Agriculture	x	x	√	x	x	x
Industrial	x	x	√	x	x	x
Geomatics	√	√	√	x	x	x
Bio-medical	√	x	x	x	x	x
Environmental	x	√	x	x	x	x
Information Technology (IT)	x	x	x	√	x	x
Software	x	x	x	√	x	x
Electrical & Electronics	x	√	x	√	x	x
Total programs	6	6	9	7	3	1
Constituent Colleges	1	1	4	1	1	1
Affiliate Colleges (Private)	17	0	9	14	0	0
Community College	1	0	1	0	0	0
Totals Colleges (51)	19	1	14	15	1	1

Source: Nepal Engineering Council [http://nec.gov.np/university/country_detail]

3. STUDENTS' ENROLMENT CRITERIA

Students, who have completed Higher Secondary Education with 45% score is eligible for entrance examination. Initially, when engineering program was introduced at Tribhuvan University, 50% weightage was given for each 10+2 score and written entrance exam equally. To avoid fake higher score brought from schools across the border, weightage had been given only to written test. Written subjective examination was not possible for 13 thousands of students, except objective type of questions. Online entrance exam system is conducted at Tribhuvan University, with multiple choices of questions without negative marks. There had been debate in the number of choices in a question; usually 4 multiple choices are given. However, number of choices need to be increased to reduce the guess work or negative marks for wrong choice. Researcher (the paper writer) had demanded to increase the number of choices or negative marks to be given for wrong choice. Institute of Engineering has made provision of 10% negative marks for each wrong answer in 2016 entrance exam. Except constituent campuses of Institute of Engineering like Pulchowk Campus, Thapathali Campus, Western Region Campus, and Eastern Region Campus, there were no strict instructions given to private engineering colleges to follow admission on merit basis till 2015. Mostly, private colleges want to fill up seats earliest as possible fearing that their seats won't be filled up on the "first come first served basis". Till date, Bachelor of Civil Engineering course is in high demand. So the seats for this course get filled up quickly.

Table 2. Admission merit list of BE Civil Program 2016 at IOE TU

Campus/ Colleges	Merit score ranges (%) Category	1st Merit list	2rd Merit list	3rd Merit list	After 3rdMerit list	Numbers enrolled / quota
1. Pulchowk	Regular	67.7-90.5	69.3	-	-	107/108
	Full fee	66.2-74.2	65.5-70.1	65.4, 70.1	-	83/84
2. Thapathali	Regular	71.8-77.2	67.0-72.1	65.4-69.3	68.8	24/24
	Full fee	64.8-72.1	62.4-66.7	62.2-65.7	59.9-65.4	72/72
3. WRC Pokhara	Regular	67.5-78.0	67.7-65.8	65.4-65.7	65.4	36/36
	Full fee	59.1-67.7	56.7-61.6	56.0-60.7	56.0-63.0	108/108
4. ERC, Dharan	Regular	62.2-75.6	63.8-65.4	61.5-63.8	55.2	24/24
	Full fee	53.6-65.4	52.8-58.7	52.0-57.5	56.7-57.5	71/72
5. Khwopa	Regular	60.7-71.0	50.5-60.7	49.7-57.5	53.6-63.8	48/48
	Local quota	46.5-60.7	40.2-48.1	40.2-41.8	36.3, 37.9	48/48
6. Kathmandu		57.5-74.0	52.0-58.3	48.9-61.5	44.2-56.1	121/121
7. Advanced		58.3-76.4	54.5-59.9	50.5-54.5	36.3-61.5	118/120
8. National		52.8-70.2	46.5-54.4	43.4-47.3	37.1-46.5	96/96
9. Himalayan		55.5-76.4	51.2-57.5	47.3-51.4	35.5-54.4	96/96
10. Janakpur		44.2-67.9	38.7-44.2	35.5-38.7	35.5-54.5	72/96
11. Kantipur		58.3-78.1	56.0-62.2	52.0-56.7	36.3-63.8	88/88
12. Kathford		48.1-66.7	44.2-54.5	42.6-49.7	35.5-46.5	72/80
13. Lalitpur		52.8-67.9	48.1-52.5	44.2-47.5	35.0-52.5	35/48
14. Sagarmatha		55.2-68.5	49.7-57.7	47.3-53.8	36.0-62.2	48/48

Source: www.ioe.edu.np

However, in other faculties, colleges have hard time getting the quota of admission filled up. On the other hand, students' first choice is Pulchowk Central Campus. The entrance examination system conducted by Institute of Engineering is considered to be reliable in Nepal. Since 2016 academic year, TU central admission board decided to publish up to third merit list for admission. In 2016 academic year, about 10,800 candidates appeared in the entrance exam, out of which 6175 were declared "pass" with minimum score of 35%. Usually in the past, "pass" score in the entrance was 50%, which was later brought down to 40%. This year, eligibility score was pushed down to 35%. This was done to accommodate all the quota of admission given to 4 constituent campuses and 10 community and private colleges. Total enrollment capacity of all the 14 colleges in undergraduate level is 3,712. First choice of the candidates for engineering is Tribhuvan University. Among the engineering courses offered, civil engineering is the most preferred and sought course. About 85% of the full quota has been enrolled. Table 2 provides the score range of students of different merit lists in the entrance examination, giving an indication of students' choice of campus/colleges according to the performance, faculty strength, and infrastructures.

4. Evaluation System at Tribhuvan University.

4.1 Internal Evaluation

The direct evidences provide persuasive quantitative assessment of the extent to which students have achieved course outcomes. Direct evidences are derived through analysis of students' results in exams, projects, homework

assignments, or laboratory reports [6]. Principally, evaluation during semester and quantitative assessment of the course may be done through the process of:

a. Quizzes (Individual assessment)
b. Home assignments (Individual or group assessment)
c. Mid-term exams(Individual assessment)
d. Presentations (Group assessment)
e. Lab reports (Mostly in group assessment)
f. Project works (Individual and group assessment)
g. Viva voce (Individual assessment)
h. Final exam (Individual assessment)

Allocation of internal marks are different in different universities of Nepal, but at Tribhuvan University, Institute of Engineering, 20% out of 100% marks is allocated for internal continuous evaluation and 80% marks are allocated for final evaluation in the course works. The internal evaluation has been considered as continuous evaluation with minimum of 3 assessments, averaging all three with minimum of 40% pass marks. Later with the changes in curriculum, this system of tests has been authorized to the teachers in terms of how they would conduct exams. Some teachers evaluate students' performance through single test, some through three or more tests, and, a few teachers adopt best of two. There are also a few teachers, who evaluate students' performance based on mere attendance. Despite all, administration of Institute of Engineering expects marks of minimum of two tests.

Continuous evaluation is the process to allow the students to study their course to understand every topic of the subjects, so that students could be ready all the time for final exams with in-depth knowledge. There are examples of higher range of marks of 100%, above 90%, and some teacher distributing equal marks to all the students [7]. To control higher range of marking by the faculty, Kathmandu University has made provision to control over the assessment marks; if percentage of marks in assessment exceeds by 25% of final exam marks, the assessment marks will be cancelled and student will obtain same percentage of marks as obtained in the final exams. Tribhuvan University has been adopting numerical grade, whereas other universities have been adopting letter grade so that allocation of marks are 50% for internal and 50% for final marks.

Provision of internal evaluation either in lab works or in theory course is important to find out the level of skill and knowledge of students in order to enhance the knowledge of the students. The faculty involved in teaching has moral responsibility to find out level of skill and knowledge of individual students implementing proper procedures of evaluation system creating proper environment of continuous study [8].

4.2 Students' Final Evaluation

80% of the total marks are allocated for final examination in all semester examinations. Examinations are centralized by examination board under Dean's office. Any teachers of any colleges including private colleges are asked to prepare questions with certain payment; questions collected from different teachers are moderated by moderation committee and kept in question banks. Any questions from the banks may be selected for the final exams. Final examinations are centralized and conducted in different campuses/colleges. The collected answer papers are coded with different numbers and the papers are distributed to the different teachers from different colleges. This system is considered as the only reliable, where there is very little chance of manipulation in the exam system. Final grade is decided by total marks calculated from internal theory and internal practical, final theory and practical. Score of more than 80% is considered as distinction, 65 to below 80% falls into first division category, 50 to below 65% falls into second division category and 40% to 55% falls into pass category.

4.3 Attendance of Students as a Part of Evaluation

Theory classes as well as practical/lab classes have been disturbed in most of the session due to field work

practical, field tour etc. Even in such situations, teachers manage to finish course within one month earlier than scheduled time. In most of the courses, practical works are completed within half of the allocated time period. In most of practical works, students prepare reports in the last moment in haste, compromising their quality of work and making it impossible to achieve proper knowledge and skills. Nevertheless, teachers still enjoy providing full marks to most of the students. There is a provision of class attendance of 70%, which has never been implemented. Other cases of non-occurrence of classes are political disturbances, unscheduled official holidays' declaration by the government, disturbances of political agitation etc. Preparation of back paper exams, students leaving classes for a week earlier at constituent campuses and two to four weeks in most private colleges add more to the problem. Most of the teachers, who keep attendance record of students, allocate 20% to 40% extra marks in their internal marks to make students attentive in the class room.

Table 3. Non-occurrence of classes (Building Technology of BE Civil 2016 Pulchowk Campus)

Non-occurrence of classes		Total allocated classes
Survey camp and viva	2.5 weeks	
Irrigation field visit	1 week	
Teacher on leave	0.5 week	
Students absent for assessment preparation	1 week	
Total	**5 weeks (33.3%)**	**15 weeks (66.7%)**

Table 4. Students' attendance and internal evaluation (Building Technology BE Civil 2016 Pulchowk Campus)

Students' attendance		Evaluation of students' attendance
Above 70% attendance	28 nos.	Additional marks for attendance
Below 70% attendance	12 nos.	No additional marks for attendance
	5 Nos	Failed to secure 40% marks, not qualified (NQ) for final examination.

Internal evaluation was done by an examination of subjective questions, two quizzes of objective questions, and an assignment with viva voce; marks were equally divided to 5 internal exams, and were averaged.

5. FACULTY STRENGTH

Recruitment of faculty starts from part time teacher. There is no selection criterion for part time faculty but when they are converted into full time contract faculty, some sort of exam and/interview has to be given but it is not mandatory. There is no timely recruitment of permanent staff. Hereby, pilings (pending) of contract faculty staffs for longer period are given chances to become permanent through exams and interview. No one is allowed from outside to compete. Similarly, in case of promotion only, working in the university is allowed to compete; there is no lateral entry. Qualification demanded of faculties is minimum level of Master degree for any level of faculty position, from Assistant Professor to Professor. However, among the professors, who were promoted recently, most of them do not have a single publication in peer review journal or any history of paper presented in any national or international conferences/seminars. The effect of political influence in new appointment and promotion is pervasive discouraging the talented faculty members having no political connection.

6. FEE STRUCTURES

Fee structure for bachelor level course at Institute of Engineering has two categories: first category is regular students admitted on merit basis whereas second category is the full fee paying, and this category (those who can afford higher fee) is also admitted on the merit basis. Regular students pay about NRs. 26 thousand for the course and full fee paying students pay NRs. 260 thousand for the course. Both the category of students is provided same facilities after the admission at the constituent campuses during their entire period of study. Only community college, Khwopa College of Engineering is the lowest fee structure after Institute of Engineering with fee structure of approximately NRs. 509 thousand. Other private colleges have fee structure of about NRs. 1.1 million. There is a provision of fee waiving for 10% of the total students in private colleges. However, only students who top the class are eligible to waiving of fee. Waiving of fee also depends upon the semester exam results.

7. QUALITY ASSURANCE AND ACCREDITATION

Both the "demand of type of engineering manpower" and the "choice of field of studies" have been changing in Nepal. Few years back, there was local demand in Computer and Electronics Engineering. Now this has been shifted to Civil Engineering. With the establishment of new universities within the country, universities have felt convenient to establish new engineering colleges. Such mushrooming of engineering colleges without proper monitoring has degraded quality of engineering education. Especially new universities without qualified faculties, infrastructures, research capabilities and starting from zero have created a challenge for the stakeholders to find quality technical manpower. Every country desires quality of education through proper monitoring system. In Nepal, government funding agency for higher education viz., University Grant Commission (UGC) has provision of accreditation policy; only a few academic programs of a very few universities have gone through quality accreditation process.

Arab universities have made modest advanced engineering dent, if any, and their deliveries fall short of what is desired; they are perpetually challenged to make it to the top rankings worldwide. However, recently, in Arab universities, to make their higher education of high quality, most of their programs are going through accreditation from ABET (Accreditation Board for Engineering and Technology) [9a]. The 2014-2015 ABET Criteria for accrediting engineering technology programs accreditation states that it is the responsibility of the program seeking accreditation to demonstrate clearly that the program meets the criteria related to (1) Students, (2) Program Educational Objectives (PEO), (3) Student Outcomes (SO), (4) Continuous Improvement, (5) Curriculum, (6) Faculty, (7) Facilities, and (8) Institutional Support [9b]. Assessment of "level of attainment" of course outcomes can be conducted using direct and/or indirect evidences. The direct evidences provide persuasive quantitative assessment of the extent to which students have achieved course outcomes. Direct evidences are derived through analysis of students' results in exams, projects, homework assignments, or laboratory reports. In contrast, the indirect evidences are typically qualitative pertaining to students' or faculty's self-perceptions of level of achievement of course outcomes. Indirect measures may include survey responses and results of interviews [10].

University Grant Commission of Nepal has offered Quality Assurance and Accreditation to those Higher Education Institutions (HEIs) who seek to demonstrate quality of education to the stake holders. Quality assurance needs HEIs to demonstrate required criteria prescribed by the accreditation institution. A few campuses/colleges of Tribhuvan University, and Kathmandu University School of Science and Engineering, are recipient of accreditation from University Grant Commission [11]. Tribhuvan University have about 700 colleges, and many colleges have come up with affiliation of new universities. Therefore, there is an immediate requirement of new accreditation body for engineering and technology education institutions.

8. LICENSING PROFESSIONAL BODY

In Nepal, those who have received degree from the university are entitled to get license from Nepal Engineering Council (NEC) to practice as a full-fledged professional engineer with charge of fee. NEC charges fees to the students enrolled in the campus. NEC authorities visit engineering colleges as a monitoring agent taking certain amount of service charges. However, this has not shown any kind of substantial progress in terms of quality improvement [12]. In USA, to become licensed engineers, engineers must complete a four-year college degree from an accredited engineering program, work under a Professional Engineer for at least four years, pass two intensive competency exams and earn a license from their state's licensure board [13]. In the United Kingdom, a Chartered Engineer is an engineer registered by the Engineering Council (the British regulatory body for Engineers). Contemporary Chartered Engineers are degree-qualified and have gained professional competencies through training and monitored professional practice experience [14].

9. CONCLUSION

With the phase out of the I. Sc. (equivalent to 10+2 science) from the university program and increasing 10+2 science in higher secondary schools, children of lower middle class families have less opportunity to study science. Moreover, to compete with the boarding school graduates is quite impossible and access of these people to the urban centred campuses is next to impossible. The engineering education in Nepal has literally become a reservation for the rich rather than the deserving candidates. Subsequently, the engineering results indicate that the quality of education offered by the engineering colleges of Nepal is far below the expectation of the stakeholders. Developing country like Nepal needs highly qualified engineers, who are capable of working as an independent practitioner in different parts of the country from urban to remote areas. Those, presently working in different corners of the country are unable to provide professional expertise. The recent occurrence of earthquake in the country has emphasized more upon the need of quality engineers with great expertise.

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