

FLAWS IN PAKISTAN TERTIARY ENGINEERING EDUCATION

Zohaib Asif Lodhi

¹[Student ID-12767354, University of Technology Sydney, Sydney, 2007, Australia]

Article Information

Article Type: Research Article

Dates:

Received: 12 October 2023

Revised: 23 Dec 2023

Accepted: 15 Feb 2024

Available online:

Copyright:

This work is licensed under creative common licensed and ©2024 All rights reserved Innovate Humanity Publisher

Corresponding Author:

ORCID 0009-0009-4536-4995

ABSTRACT

Tertiary Engineering education is the base of every engineer to start their career in engineering field. It teaches the essential capabilities to students to work effectively. The research conducted in this paper highlighted the lack of those capabilities in graduated engineering students of Pakistan. The judging factor used in this paper is related to the human capabilities achieved through engineering education. Research approach is based on the questionnaires formulated among the graduate students with their introduction questions, choice questions and their comments about their previous education. The geographical area of this research is large. This project is done in one year with phases of understanding the research methodology and how it needs to be conducted to get the results that is helpful for policy makers to work on it. The data collected was connected with literature review to better understanding of the flaws. The soft system methodology is applied to think technically about this socio-technical system. The research results are clear to one extend but still needs more time to simplify the idea of finding flaws.

Keywords: system methodology, Research

INTRODUCTION

The personal story of being an engineer is a start of this project. I studied computer engineering from Comsats Lahore campus Pakistan. I moved to Australia for my masters in engineering after my graduation of bachelors. The pattern of study in Pakistan is different as its curriculum and focus is more on theory rather than its applications. The exams were conducted in three phases there, one is first sessional, conduction of second test in same semester and at last the final semester exam. According to my personal thinking it cooks me in pressure but never enhance my vision and make me to think like an engineer.

Many questions arise when I start studying in Australia. I realize the fact that engineering education is solely the choice of a person and it can't be done without personal interest. The pressure of studies may teach a student to score marks to pass the exam. The studying can be the way to fulfill the target to score marks but if the target is marks then the student may find the ways to do it in other means. The creativity of a human can be used negatively as it depends on the environment of its mind growth. The factors

affecting the students to grow in those universities is vast topic for the discussion. This research is a first step to analyze the components of the graduated engineers from Pakistani universities. My engineering skills to see the system analytically and my final year project is an opportunity to put a light on those defects of graduate engineers and their surrounding and compile them as a flaw in Pakistan tertiary engineering education. Extensive study is conducted on the issues arises in engineering education and used to extract the research gap. The requirement to do the research is mention in this topic for better understanding of the field and its related attributes. Success of engineers relies on student's technical skills and their innovative minds (Memon et al.2007). Innovation is the process of learning and relearning as it defined by Alvin Toffler quote, "The illiterate of the twenty-first century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn." (Pianfetti & Reese 2011). Measurement of generic engineering competency factors of engineering graduates directs engineering educators for continuous improvement in the system (Male, S.A., 2012). The research was conducted by a student of UET (university of engineering and technology) Taxila, Pakistan to transform content based system to research-based system to fulfill the requirements of Washington accord. Course structure, examination standards and class decorum was judgement factors for the analysis. Using those factors system transformation technique performed to search the results (Manzoor et al 2017). Research by Khalid and his team in 2017, stated the SWOT analysis to extract strength and weakness in engineering education system of Pakistan and results are suggested to PEC (Pakistan Higher Education) for the upgradation of their standards. Nowadays, Pakistan is facing a lot of different problems known as terrorism, sectarianism, poverty and other security issues (Ahmad, I., 2014.). The education sector was one of the lowest budget allocated industry in Pakistan. The root cause of the problem arises in this developing country is directly or indirectly connected to the education of people (Ahmad, I., 2014). The research article says that educated terrorists are far more dangerous than the uneducated one. Education nourishes society with awareness and literacy (Rehman H. and Khan N, 2011). According to one research, some flaws highlighted in studies. Those are defective examination system, inadequate physical facilities, and lack of teacher quality, directionless education, high scale dropouts, low enrollments, outdated curriculum and corruption (Louis D. H., 1987). These defects can be solved through the formation of national policies and the proper implementation of those in the system (Iqbal M., 1981).One study was conducted to test the anxiety and depression of engineering studies of Pakistan, 73.8% students (out of total 557 students) were facing the stress and health issued due to their study pressure.(Ali, A., et, al 2014). In most universities, teacher's spoon feeding to the students without testing their learning power, the examinations are memory test, old traditional theoretical course structure of the subjects and number of teachers do frauds within their jobs without even being noticed. The problem in education sector is divided into three parts: consideration of necessary background, understanding the quality of university in Pakistan and exploring solutions for those spaces (Hoodbhoy, P., 2009). To get investment from global resources, the workforce should be technically skilled and educated. Secondly, it also benefits the macroeconomics, from which every person at the country level can take benefits from it (Stern, N. 2001).Graduate engineer from the engineering course always exposed to outer world language of science and mathematics. Most of the students complain that engineering degree was most stressful and theoretical, but it's infrequent they use the same theories in their further practical life. It's about stress management and having the capabilities to handle the different scenarios through critical thinking what they got from their work during the course. It does not matter from where you graduate whether from first

world country or its third world country, but the capabilities development is essential for the engineers to deal with critical thinking process in their professional life (Trevelyan, James, 2014).

The topic of research is about the critics made to tertiary engineering education of Pakistan. The two main techniques proposed for data collection, one is questionnaire formulation, and other is the self-study for the better understanding of the issue. Soft system methodology is an integral part of this project for the production of precise results.

METHODOLOGY

Design of Research

The practicality of the assumptions can be assessed through the individualism of data. The engineering education system is taken as a complete system to verify the hypothesis. Methodology created to prove the hypothesis is formulated through the foundation data of individual assessment. Further, that root is applied to connect with other similar data. The comparison is produced with the existing research to generate answer to the research questions formulated at the start of this project. The steps of the research design is given in the image below:

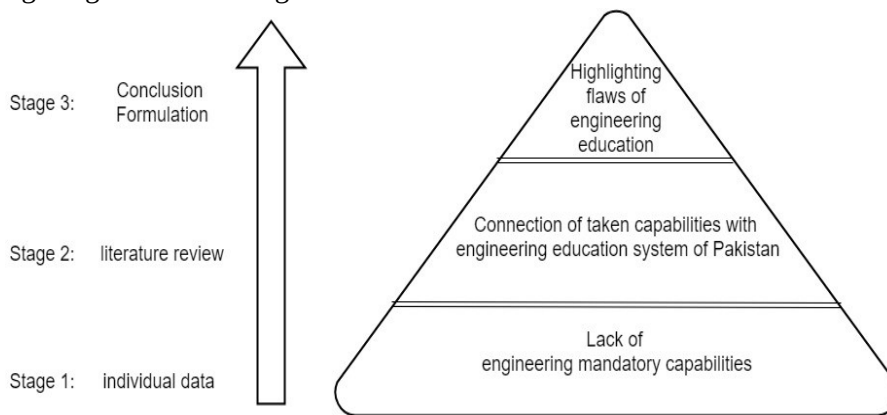


Figure 1: Methodology

Individual data

The assessor taken to prove the assumption is based on the capabilities attain by every graduated engineer with various backgrounds. The structure of the questionnaire should be design in order effect (Dillman 2000). The capabilities must be narrowed down to the specific verb with the examples associated with it to clarify the questions in the questionnaire (McFarland 2004). The competencies must be a verb so that the participants check whether they performed them or not (Morgeson et al. 2004).

Following capabilities are converted into question to extract the data from the graduated engineers of Pakistan.

- Teamwork
- Design formulation
- Presentation of ideas
- Socially responsible
- Study of subjects beyond the course
- Self-improvement

These factors present in engineers make them competent to prosper in the future. The versatility of the education quality in Pakistan plays an important factor in teaching these capabilities. Introduction portion addition to the questionnaire is compulsory to segregate the answers according to their background learnings. The introduction section is comprise of following elements of conducted questionnaire.

- Name of the university
- Sector of the university (Government, Semi-government and private)

The later addition is made to the questionnaire with their experience in the engineering field that can affect the opinion of the graduates about the selected capabilities.

Last area of the questionnaire is the comments added by the student regarding their learnings in their taught education.

The questionnaire is present in appendix 1.

Gathering literature

Time allocated to this research is one year, the first 6 months was spend to make the research proposal and understanding the area to conducted research. The number of responses compile gives the ideas of the patterns to answer the research questions but still the fuzziness was there. Comparison of pattern with the literature review is important to create an authentic conclusion. Research papers searched on internet through the similarity of the work executed in this project. The third step of this methodology is stated further in Result part.

Implementation of Design

The questionnaire is launched in google document to spread it to maximum number of graduates. Alumni groups of different universities are assigned with the duty to post the survey in their university groups. Social media is the strong chain of connection to connect with the relevant friends, teachers and employers of various institutes. The selection requirement of the graduates are not there as the research is to highlight the flaws in tertiary engineering education of Pakistan. The limitation was set to collect the data is listed below:

- Graduate must be from Pakistan
- Person completed his engineering degree from PEC aggregated university
- Graduate should not exceed the time limit of 5 years after compilation of its qualification

The core requirement is checked before getting the response from relevant person. The source of friends included in the checking of these requirements to complete the survey.

RESULTS AND ANALYSIS

Collected Data

Total 66 responses are compiled in this research paper. The introduction of the passed student, capabilities approach and comments are the sections formed in the survey. The question given with choice is compiled in table 4 with their results given in percentages.

Questionnaire breakdown :

Results (total 66 responses collected)

Graduated university	27.3% private 57.6% semi-government 15.2% government
Current occupation	21.2% student 31.8% doing job in engineering field 24.2% working in another field 7.6% Entrepreneurial 15.2% Others
Capabilities achieved by each graduate	62.1% strongly agree
1. Teamwork	34.8% agree 3% Neutral
2. Design formulation	33.3% strongly disagree 56.1% agree 10.6% neutral
3. Presentation of ideas	34.8% strongly agree 43.9% agree 18.2% neutral 3% disagree
4. Socially responsible	53% yes 21.2% no 25.8% to a limited extend
5. Extra research of their studied subjects	15.2% strongly agree 37.9% agree 25.8% neutral 19.7% disagree 1.5% strongly disagree
6. Continuous self-improvement	22.7% daily 12.1% weekly 28.8% monthly 7.6% yearly 28.8% rarely

The list of university students involved in this survey is in table 5 and table 6 shows the experience of those graduates in their professional field after graduating from the bachelor's degree.

University name
• Comsats Lahore • Hajvery University Lahore • The Islamia University of Bahawalpur • NUST • Lahore University of Management Sciences • Fast -nucers

- SCET
- UET lhr
- Air University
- Bahauddin Zakariya University Multan Pakistan
- Ghulam Ishaq Khan Institute
- UMT
- Bahria University
- The Superior College Lahore
- University of central Punjab
- Comsats University Islamabad
- Gcu
- PUCIT

Years	0	0.5	1	1.5	2	2.5	3	3.5	4
Count	11	8	3	3	3	3	8	4	4

The comment portion of the questionnaire is given in finding patterns part.

Finding patterns

Quality of engineering in private universities is better than the government universities as it evident above that government is not allocating enough budget to education sector to improve the quality. The percentage shows in engineering graduate universities that majority students are graduating from semi-government and private universities in the data. The Jobs in engineering field is limited as per the data that only 31.8% students are employed in engineering industry. The entrepreneurial field is just 7.6% means the students are less capable of producing their own businesses under their provided resources.

Experience of students in their field after their graduation degree has an impact on the learning percentage of the capabilities of the questionnaire. Data shows that only 11 people out of 66 are not attached with engineering. Other 47 persons are whether engaged in jobs or studying further. This is the later added question to survey validate their learning capabilities solely on their tertiary education in engineering. The possibility arises that current characteristics of candidates may affect by their experience. Over estimating themselves can be another factor to affect the authenticity of the data.

Teamwork, Design formulation skill, Presentation of ideas and Socially responsible capabilities are achieved characteristics evident by the taken data. Studied beyond subject need focus because only 53.1% did that job completely past in their studies. Continuous self-improvement is also the case of consideration because 65.2% people are updating their personnel skills monthly, yearly and rarely. The rarely percentage is also not acceptable when the use of human in economic and social growth is the aim of development.

Third part of survey contains the comments of students on their engineering degree. It contains skills and attributes they achieved and how they feel about their degree. The comments are categorize through

SWOT analysis to find weakness and strengths of tertiary engineering education system, the opportunity its creating for students and how its threatening the students and system around them.

SWOT Analysis	
Strengths	Weakness
• Technical • Professional Performance • Research • Creativity and innovative • Achievement and success • Knowledge and hard work • Degree, career and reputation • Problem solving • Communication • Management • Brain storming • Confidence • Analytical thinking • Enjoyable • Made me tough • Vision and smartness • Pressure handling	• Frustrating • Pressured • Tough • Degree is just scrap • Just a tag to be an engineer • Tiring • Burdening • Intense and critical • Stressed • Long • need to educate our student with work physiology • waste of time • Depression
Opportunity	Threats
• Tackling training • Project control specialist • Job security • Hands on experience • Technology driven	• Unpractical • Old Fashioned • Useless • Joblessness wasted • Requires technical skills

The repetitive comments are omitted in the analysis and the required comments are filtered to stick to the research topic. It perception of students in open question matches with the choice question's result. Approximately, all strengths are identified in the analysis.

Conclusion

The methodology of capability approach are used in this topic taught the little ideas of the defects that students are pressurized with their studies but still fuzziness is there to point out the exact factors of the downfall of engineering education in Pakistan. The level of education is measured and come up with results that engineering education is teaching which is required to be a good engineer. The system is

making minds that are capable of executing essential tasks as being an engineer. The environmental components are not consistent for them to learn those things as the weakness explains that students are struggling with their depressions. The confusion arises that how they are learning those things under the circumstances which are no in favor of them?

Following are two main points which this questionnaire research is able to conclude:

- The required engineering capabilities seem to be taught in education institutes of Pakistan
- The system, culture, social norms and economy are the main factors to be considered in performing those capabilities in that environment.

Knowledge gathered during this research able to conclude other two points.

- To think in under-resourced, less technological and not advanced society produces their behaviours to be static and stick to their past beliefs which lead them to travel in a constant circle of thinking after their graduation.
- There is an oversupply of engineering graduates in Pakistan which increase the competition among engineers and underestimate the confidence of normal engineer to be successful in Pakistan's society.

Discussion

The hypothesis makes at the start is about finding out flaws in Pakistan's tertiary engineering education of Pakistan. This thinking of approaching to highlighting flaws conducted through the individual learning of the student through that system. The literature gathered shows the negative aspects more than the positive side of the education. Research breaks the circle of negative thinking of the researcher that flaws are there but students are learning what is required. The amazement is still there that how?

James Trevelyan research struggle in finding competitive engineer in Pakistan may answer this question that if you compare the fresh graduate from third world country from first world country, they have same capabilities but the experience of them in the society polish them or diminish them. The diminishing factor can be taken through his work which are affecting the engineers to be productive and walk with the world to make successful society.

Future Recommendations

Pakistan is a third world country, struggling to improve their economy. Engineering education plays an essential part in transforming society to well-developed beings. Education gives strength to the people to stand on their own and work for individuals and society. The situation of Pakistan is crucial as its unemployment rate touched to 18.3 % in the last 13 years (Manzoor, U. et.al 2018). The reason for unemployment is the set of jobs are not demand of job seekers (Mohsin, M., Majeed, M.K. and Naseem, S., 2018).

The cultural norms and professionalism needs to be distinguish to work efficiently. The corruption at any level can be improved with improve of economy. Thinking on society level is required to align the education system accordingly. Education sectors needs to put more input to create creative and innovative minds which can produce more entrepreneurial for the benefit of the economy and the society. The speed

of the first world countries in technology is hard for the third world to cope up and needs more research centers to produce their own work according to their society needs.

Now, is the time to realize that what is lacking in Pakistan's system for graduate students? Why are they not contributing to the economy? Are domestic culture and norms are interfering with the professional growth of engineers of Pakistan? What are the ways to take out students from less innovative thinking circles for the betterment of the society? How these flaws are making dent in the economy of Pakistan?

Acknowledgements: Acknowledgments and Reference heading should be left justified, bold, with the first letter capitalized but have no numbers. Text below continues as normal.

Author contributions: All authors equally contributed to this study

Ethical Statement:

Consent to Participate: Before conducting this research study, the researcher has taken permission from the host department at the University. The researcher explained the objectives of the study before interviewing the respondents. The respondents were assured that the information would only be used for research purposes. The respondents were told that they could withdraw at any stage from the interview if they felt uneasy or did not want to continue the interview.

Competing Interests: The author declares that this work has no competing interests.

Grant/Funding information: The author declared that no grants supported this work.

Data Availability Statement: The associated data is available upon request from the corresponding author.

Declaration Statement of Generative AI: The author(s) of this work used the [name of tool or service] to [reason or the parts of the manuscript prepared with the assistance of AI tools, remember: Grammar checking tools and Referencing tools do not require to declared]. After using this tool or service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content. OR Author's declared for not using AI during the preparation of this study

REFERENCES

Ahmed, A. and Ahsan, H., 2011. Contribution of services sector in the economy of Pakistan. *Working Papers & Research Reports*, 2011.

Akhtar, K.H., 1997. Education in Pakistan: fifty years of neglect. *The Pakistan Development Review*, 36, p.4.

Akhtar, S. and Sadiq, M., 2008. Occupational status and earnings inequality: evidence from PIHS 2001-02 and PSLM 2004-05. *The Pakistan Development Review*, pp.197-213.

Amjad, R., ul Haque, N. and Colclough, C., 2005. Skills and Competitiveness: Can Pakistan Break Out of the Low-level Skills Trap?[with Comments]. *The Pakistan Development Review*, pp.387-409.

Anis, H. and Khan, S.A., 2009. Skill Shortage versus Subject Choice: Case of Pakistan. *Pakistan Development Review*, 48(4).

Beanland, D. and Hadgraft, R., 2013. Engineering education: Transformation and innovation. *Engineering education: Transformation and innovation*, p.xii.

Farooq, S., 2011. Mismatch between education and occupation: A case study of Pakistani graduates. *The Pakistan Development Review*, pp.531-552.

Kousar, M. and Mahmood, K., 2015. Perceptions of faculty about information literacy skills of postgraduate engineering students. *International Information & Library Review*, 47(1-2), pp.52-57.

Mirani, M.A. and Yusof, M., 2016. Entrepreneurial engagements of academics in engineering universities of Pakistan. *Procedia Economics and Finance*, 35, pp.411-417.

Khan, M.A. and Rehman, H.U., 2012. Regional disparities in human capital: The case of Pakistan. *Pakistan Economic and Social Review*, pp.57-69.

Memon, G.R., 2007, 'Education in Pakistan: The key issues, problems and the new challenges'. *Journal of Management and Social Sciences*, vol 3, no.1, pp.55-47.

Manzoor, A., Aziz, H., Jahanzaib, M., Wasim, A. & Hussain, S., 2017, 'Transformational model for engineering education from content-based to outcome-based education'. *International Journal of Continuing Engineering Education and Life Long Learning*, vol 27, no.4, pp.286-266.

Pianfetti, E.S. & Reese, G.C. 2011, 'Transforming education, Fostering Human Development Through Engineering and Technology Education', *Springer*, New York, pp.293–281

Saleem, S., Moosa, K., Imam, A. and Ahmed Khan, R., 2017. Service quality and student satisfaction: the moderating role of university culture, reputation and price in education sector of pakistan. *Iranian Journal of Management Studies*, 10(1), pp.237-258.

Trevelyan, J.P. and Tilli, S., 2003, May. Observations from a Study of Professional Engineering in Australia and Pakistan. NBER/Sloane Foundation Workshop on "Internationalization of Science and Engineering: Issues of Work, Education and Security," Columbia University.

Tahir, A. and Mohamed, A., 2015. Probing agricultural engineering education in Pakistan a changing world. *Education*, 2(1), pp.21-28.

Tunio, R.A. & Soomro, M.M., 2017,' Students Satisfaction in Higher Education Institutions: A Case Study of Mehran University of Engineering & Technology, Pakistan'. *International Research Journal of Arts & Humanities (IRJAH)*, vol 45, no.45.

Khalid, J., Ali, A.J., Khaleel, M. & Islam, M.S., 2017,' Towards Global Knowledge Society; A SWOT Analysis of Higher Education of Pakistan in Context of Internationalization'. *Journal of Business*, vol 2, no.2, pp.15-08.

Kakepoto, I., Hadina, H., Omar, N.O.M. and Omar, H., 2012. Conceptions on low motivation of engineers in engineering workplace of Pakistan. *European Journal of Business and Management*, 4(18), p.149.

Khan, A., Ahmed, S., Khan, A. & Khan, G., 2017,' The impact of digital library resources usage on engineering research productivity: an empirical evidences from Pakistan'. *Collection Building*, vol 36, no.2, pp.44-37

Raza, A. & Khalid, M.I., 2017,' Obstacles in the Enhancement of Technical Education in Pakistan: Views and Reviews'. *Bulletin of Education and Research*, vol 39, no.1, pp.127-117.

Sabir, R.I., Ahmad, W., Ashraf, R.U. and Ahmad, N., 2013. Factors affecting university and course choice: A comparison of undergraduate engineering and business students in Central Punjab, Pakistan. *Journal of Basic and Applied Scientific Research*, 3(10), pp.298-305.

Kanwal, F., Rehman, M., Bashir, K. & Qureshi, U., 2017,' Critical Factors of E-Learning Adoption and Acceptance in Pakistan: A Literature Review. *Engineering', Technology & Applied Science Research*, vol 7, no.4, pp.1893-1888.

Rizvi, N.F., Gulzar, S., Nicholas, W. & Nkoroi, B., 2017,' Barriers in adopting blended learning in a private university of Pakistan and East Africa: faculty members' perspective'. *mHealth*, 3.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations or the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim made by its manufacturer, is not guaranteed or endorsed by the publisher.