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BUILDING A "TECHNICAL CULTURE": EXPERIENCES OF ENGINEERING STUDENTS IN A TECHNICAL INSTITUTE

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This paper seeks to discuss how engineering students' aspirations and professional identities are shaped by the broader neoliberal and patriarchal socio-political structures that they are part of Employing in-depth interviews of six engineering undergraduate students and discussion threads in social media, the paper discusses students' attempts at building technical identities in an educational system that privileges self-motivated learning. Students allude to the deteriorating "Technical culture" in the campus as a hindrance to the development of their technical capabilities. While the article documents how they define the notion of "technical culture", it is striking that the technical culture is especially alienating to women. When it comes to learning, students view the university as a hindrance to and not a facilitator of learning and devise their own strategies to learn-these are documented and interpreted in the light of literature that discusses the impact of neoliberalism on education.

ENGINEERING EDUCATION IN INDIA: STATE OF THE ART

The Nehruvian imagination of postcolonial India positions technoscience as a central actor in the path to modernisation and development (Nandy, 1988). Post-independence, the state invested heavily in science and technology based development projects. Science and engineering thus came to acquire respectability as professions, but were not necessarily seen as lucrative professions, in the manner in which they are viewed today. It was in the 1990s, following liberalisation, that many of the regulations that controlled Indian businesses and foreign enterprises were dissolved and the private sector began to tighten its clutches on the Indian economy.

Engineering as a coveted profession of the middle classes needs to be understood in this context (Khandekar, 2013). The middle classes in India, according to Khandekar (2013), came to pin their hopes on neoliberal-reforms' professions because of a unique set of historical reasons that pitted them against the state. This, along with the unique status that technoscience has always occupied in the vision for development, vests within science and engineering the 'the promise of modernity'.

Modern engineering education of an institutionalised nature in India can be traced back to the colonial era of the 18th century. Since then, the number of engineering education institutions have grown gradually till the latter half of the 20th century. However, it is the 1990s that witnessed a tremendous growth in engineering colleges (Subramanian, 2015). This period ushered in an increased investment in professional education by

the private sector (Srivastava, 2007). Kapur and Mehta (2004) note: "the private sector, which accounted for just 15 percent of the (engineering) seats in 1960, now accounts for 86.4 percent of seats (and 84 percent of all engineering colleges)" (p.6).

However, the quality of these institutions remains suspect. A very small proportion of engineering graduates are considered employable by prospective employers and only a handful of the engineering institutes in the country are considered to be of good quality (Varshney, 2006). The National Employability Report (Aspiring minds, 2016), for instance, which presents a study of the employability of fresh Indian engineering graduates in relation to IT roles, engineering roles and non-technical roles reveal worryingly low levels of employability. Alongside this, the job market is shrinking (Siddiqui & Sharma, 2017). This is perhaps a major reason, along with other social hierarchies prevalent in elite institutions that severe depression among professional college students is reported (Ghosh, 2018). Of late, there have been several media reports of student suicides in top engineering institutes. All of this points to a crisis within engineering education as well as the engineering sector, despite efforts on the part of the government to launch campaigns such as Make in India and Start-up India[1].

THE POLITICAL ECONOMY OF ENGINEERING EDUCATION

Engineering practices and institutions need to be understood in relation to the broader political economy, which, in the present context is overdetermined by neoliberal structural policies. Neoliberalism is a political ideology that emphasises greater freedom of the market, withdrawal of the state from the public sector and subsequently its welfare functions (Carter, 2008). Thus, competitiveness and individualism become acceptable human conduct, which, in the educational context, translates to the learner being expected to "take responsibility for their learning throughout their educational career while showing an adaptable approach to job seeking and reskilling in an employment market characterised by uncertainty and career instability" (Patrick, 2013, p.3). Knowledge comes to be viewed in a utilitarian sense and learning gets equated with the acquisition of 'skills' which can be measured through standardised assessment measures.

It is within this overall scenario that the reported study is being conducted. It seeks to examine the ways in which students reflect the anxieties that are an outcome of the socio-political context presented above and the ways by which they anticipate and negotiate the uncertainty of an educational system that is built on the aforementioned principles.

METHODOLOGY

The study is being conducted in a private engineering institute which, as per the National Institutional Ranking framework (MHRD, 2018), falls within the top 20 engineering colleges in the country. Students are admitted to the institute based on their performance in a national eligibility test. The students hail from fairly

[1] These were launched to boost the manufacturing sector and entrepreneurship respectively.

privileged socioeconomic backgrounds[2] and the men students (82%) outnumber the women students (18%). The model of education within the institute follows the principle of self-motivated learning wherein students have the option to not attend classes and learn on their own. The primary inspiration for the study came from a meeting that the author of this article and a co-researcher attended in March, 2019 wherein students' academic and non-academic issues were discussed. Many students spoke eloquently about the academic culture within the campus. Among others, they talked about inadequacies in the "technical culture" extant in the campus as well as the necessity to hone their "skill sets" to increase their employability. They lamented about the lack of drive and the rising mental health crisis among the students.

In the aforementioned context, our research objective is to understand the ways in which students negotiate their professional educational experience in a system where maximum "freedom" and "choice" is afforded to students to learn and innovate. The time spent in the institution is also a period of time wherein they "come of age" and become solely responsible for their future professional trajectories, which places immense pressure on them. The study can be methodologically placed within the interpretive research tradition and involves data collected through in-depth interviews (of about an hour each) of six engineering undergraduate students[3], as well as analysis of online blogs and discussion threads on social media. The latter were shared by the participants themselves to shed further light on specific concepts that were discussed in the interviews.

PARTICIPANTS

The six students whose interviews are presented here are Akash, Suraj, Ankit, Asha, Seema and Shreya (refer to Table 1 for their profiles). Four of these students were present in the initial meeting that discussed technical culture in the campus and were articulate about their views. The six cases represent i) different areas of specialisation ii) differences in 'techie' identities and iii) different genders. Among the men students, Ankit seems very much a techie, being inclined towards research and development within his domain, while Akash and Suraj have chosen to steer away from engineering into management and finance. Among the latter two, Suraj appears to move seamlessly between techie and management identities, which is evident in his discussion about the various roles he has taken vis-à-vis various technical projects on campus. Among the women students, Asha has chosen to move away from engineering to social sciences, having done excellently in her humanities and social sciences electives. Shreya, at the time the interview was conducted was in a state of confusion regarding what she finds interesting in her engineering branch and was still figuring out what she wanted to do. She had just completed an internship with a start-up in Bangalore and had found the experience useful. Seema has already completed her degree and is working with a non-profit organisation in Karnataka. Her job profile in the organisation is non-technical in nature. She was invited to participate in the study after the researchers came across a Facebook post of hers (from her student days at the institute) regarding the lack of technical culture among girls on the campus.

[2] According to the data on socioeconomic profiles shared by 71% of the students, the parental annual income of 34% of the enrolled students exceed 10 lakh Rupees per annum. 13% earn 6-10 lakhs, 11% between 3-6 lakhs and 7% between 0-3 lakhs. 87% of the enrolled students hail from the general caste category.

[3] The study is currently in its preliminary stages and we adopted a snow ball sampling strategy. We intend to interview more participants who would reflect diversity in terms of gender, caste and class. While this article was being written, only a few participants were interviewed

Participant (pseudonyms)	**Age**	**Specialisation**	**Parental income per annum**	**Caste background**
Akash	20	BE Manufacturing Engineering	10 lakhs	General Category
Suraj	20	BE Electronics and Electrical Engineering	10 lakhs	General Category
Ankit	23	Integrated MSc/BE degree in Physics and Mechanical Engineering (5 year course)	10 lakhs	General Category
Shreya	19	Electronics and Communication	10 Lakhs	General Category
Asha	20	Electronics and Communication	10 lakhs	OBC
Seema	24	Electronics and Instrumentation	10 lakhs	General Category

Table 1: Participants' profile

RESULTS

Students reveal tendencies/aspirations that are circumscribed by the neoliberal as well as patriarchal socio-political context within which their education and profession is embedded. This is evident in their motivations for choosing engineering, their concerns about 'skill sets' that are required to be employable, their disinterest in academic learning, and in their articulations of how they wish to shape their careers in future. However, at the same time, they are agentive and wish to bring about changes to their predicament, which they characterise as alienating. In the following section, we discuss these aspects.

a. Motivations for choosing engineering

Among the six participants, Akash chose engineering because it is a "family thing": there is no engineer in his family. Seema, Shreya, Asha and Suraj also mentioned aptitude in mathematics and sciences as a reason. Suraj mentioned engineering being a "safe option" as a reason for his choice, since opting for the arts or journalism can make it difficult to get placed. All participants except Ankit mentioned that they did not actively chose engineering, and that it was a practical decision, in part guided by their parents. Unlike others, engineering was Ankit's career choice since the 9th standard. His father owned a manufacturing company and wanted him to study mechanical engineering in order to expand the family business. However, in his discussion of why he chose mechanical over computer science too, we see the notion of security (with regard to job security in the event of an economic meltdown) invoked. In sum, all six participants' discourses reflect the typical middle-class Indian mind-set that views engineering as a "safe" and respectable profession for the academically bright.

b. Technical culture

As mentioned, a recurring term that surfaced in the meeting was the notion of the "technical culture". Most students mentioned the necessity to build a technical culture and the lack thereof in the campus. They shared

concerns about how, for most students, life was only about partying and college fests. Ankit, in his interview mentioned that this concern goes back to the year 2016 and shared a Facebook discussion on the matter from a students' Facebook group[4]. The post captures the angst regarding the perceived absence of a technical orientation among students:

[…]

> If tech has been woven in your past, present and future #WeNeedToTalk
> If you have ever been enthusiastic about some tech project but never followed through #WeNeedToTalk
> If you think that our technical culture is not good enough #WeNeedToTalk
> If you want to be part of the solution rather than the problem #WeNeedToTalk

(Dated: 27 March, 2016)

In the interviews, the participants were probed regarding how they understood the term. A technical culture for Akash is a vibrant campus where technical projects are executed. For Suraj, the technical culture of a campus indicates how well a campus knows and is good with its technology. He went on to elaborate that most people on campus were only interested in placements and were not interested in "giving back" to the campus. He discussed the successes and travails of a project that he was involved in which aimed to make the entire campus "smart", through the development of a web-based app. These included the development of services such as a cashless system for money transactions on campus, a bus tracker that would help students on the campus access the bus conveniently and other platforms that would help make life smooth on campus. However, he lamented that the freshers on campus were reluctant to learn web development and coding from the seniors, the former only being concerned about placements.

Ankit too believed that students in the campus were disinterested in immersing themselves in projects, and that they execute projects merely to put them on their resume. For Ankit, apart from hands-on projects that would involve making something in the campus, having fun needs to be an integral part of a vibrant technical culture: "So problem solving and just doing *something for the fun* of it is part of technical culture for me…not just making robots and all that (emphasis added)."

When it comes to the women students and their perceptions of technical culture, Seema's Facebook post is self-explanatory:

> I had this thought running through my head about the Technical culture of the campus, specifically, the plight of the Girls' side of the scenario. It is abundantly clear that the percentage of Girls involving themselves in the Technical Activities is very low compared to Boys. I have been wanting to start working in the fields like Robotics and Web-Dev but the problem is that there is a lack of a specific type of motivation. There is no denying that watching someone work is enough motivation to carry-on. But girls don't have an active environment of this sort where they can go to each other, inspire, get inspiration and learn. Yes, we can do so with the Boys but it is not always comfortable for everyone to go to a completely strange guy and try to learn from him. There are no gender issues but there is no denying that the comfort level varies. I know a few girls who want to do the same but there is no such community and so, there has been no real advancement. So, hereby, I want to propose that the

4 The posts were sourced from a student only Facebook group. Permissions were obtained from the moderators to use the posts pertaining to technical culture without disclosing the identity of those posting.

> girls who want to participate in the Tech-activities join hands by forming an informal group where we come together and work for Projects. Interested girls please comment and based on the response we can proceed further. Please tag the girls you know who would want to join this cause and also, put-in your thoughts about the way we should go with the whole process. (Dated: 27 March, 2016)

When invited to provide more context on the post, Seema shared that a technical culture on campus was absent among the girls since they do not team up and work together. She lamented about the lack of inclination among girls (unlike the boys) to get together and make things. She also mentioned how a lot of informal technical projects were executed by the boys in their hostels which did not happen in the girls' hostels. Furthermore, she mentioned instances wherein she and other girls faced sexism when working with boys. Asha believed that even when the boys are not sexist, they do not perceive women as "one of their kind" to actually work with them. She believed that girls were also more "academic" and individualistic in their approaches to learning. Shreya believed that the sheer fact that the boys out-numbered the girls makes it difficult for the girls, and the existing socialisation patterns in society forbade the opposite sexes from mingling with one another, making it difficult to learn from each other.

c. Skill sets and knowledge

Another phrase that the students used in the faculty-student meeting was the lack of "skill sets" among the students and the need to develop these. In the interviews, we specifically asked participants what they understood by the term. Akash believed that a, "Skill set defines how employable a person is, how flexible or versatile as a person is." Ankit and Suraj did not define "skill set" clearly…but acknowledged that these vary from domain to domain. Both Akash and Suraj believed that learning coding and basic programming are important skills that make one versatile and employable in the job market. Shreya, Asha and Seema were not specifically probed on what they understood by skill sets as they were interviewed later and by then we had realised that students seemed to hold convergent views on what they understood by the term.

d. How to learn

A question that was asked of the participants in the interview was how they go about acquiring the "skill sets" that they deemed missing among students in the campus. All six students believed that skill sets need to be acquired by immersing oneself in a hands-on project that addresses a real-life situation. Akash, for instance, talked about how he learned management and people skills simply through heading the language activities club on campus. Suraj believed that skills can be picked up by immersing oneself in projects that "give back to the community". On probing further, we came to understand that for him the "community" was the campus. He also talked at length about mentoring and learning in the context of discussing the smart campus project. His learning from the entire experience was that the freshers do not learn unless there is a financial incentive. Ankit also echoed the idea that giving back to the community is an important context for acquiring skills. For him, knowing what skill sets to acquire is possible by approaching the seniors. He also believed that learning happens if there are penalties built into the learning process. It is interesting that both Ankit and Suraj held behaviourist models of learning. When probed further about how to acquire skill-sets, Suraj talked about online certified courses, asking seniors, and only finally, the faculty and coursework.

A similar disengagement with academics and coursework was true for both Ankit and Akash as well. Ankit

said that he attended classes only if he is "not occupied with something else". Yet, he believed that keeping "in touch" with professors is important, particularly when executing projects. Akash mentioned that his attendance of the courses offered by his branch (manufacturing) were low because they were repetitive and redundant and he had lost interest in them over time. Shreya, Asha and Seema also revealed a similar perception of disinterest in academic courses. Both Shreya and Seema also talked about learning things online.

All the men participants unequivocally acknowledged tremendous support from their seniors, – or *bhaiyyas* as they reverentially referred to them – in navigating their student life on campus. Akash talked at length about how supportive his seniors have been in terms of hand-holding him through the initial few semesters at college, be it advice about how to manage his CGPA or how to prepare himself for placements. Suraj mentioned the vital role that his seniors played in initiating smart-campus and how they inducted some of his friends, getting them to develop the app and the webpage. It is striking that an analogous woman senior was completely missing in the women students' narratives.

e. What does being a "good engineer" constitute?

The participants were all asked what comes to their minds when they hear the word "a good engineer". For Akash and Seema, a good engineer has good knowledge and the skill to apply it and should be able to innovate things in a way that life gets better for people For Akash, consistency and the willingness to work hard marked a good engineer while for Shreya, it is someone who "gets the job done" creatively. For Suraj, a good engineer is someone who gives back to society, while making profit ought to be a secondary thing. Ankit was unable to define a good engineer, but seemed to think his uncle was one. He believed that an engineer has to be knowledgeable in many areas and capable of systems thinking. Asha too believed that a sound knowledge of science is necessary to be a good engineer. It is interesting that both Seema and Shreya used the word "he" when referring to their conceptualisations of a good engineer.

DISCUSSION

As discussed, the nature of the privatised engineering education that students receive is by and large circumscribed by neoliberal economic processes. This is evident in the principle of self-motivated learning that the institute advocates, wherein complete autonomy is offered to the learner to drive their learning.

Building a technical culture, for the students, is a response to the increasing levels of alienation that they are witnessing on campus which is a direct result of the individualised, self-directed and competitive learning environment they are part of. For the men students, the idea of "giving back" to society or the campus through technical projects figured prominently in their articulations. They believed that engaging in these projects makes one feel rooted, connected with other individuals and their profession. However, it is important also to critically interrogate the idea of "giving back", does this concept encompass notions of social and environmental justice? Our preliminary exploration suggests otherwise. Furthermore, our preliminary investigation reveals that core of the "technical culture" is gendered and patriarchal – in the fact that it is exclusive of women and probably other minorities.

When talking about how neoliberalism has reconfigured teaching-learning, Patrick (2013) writes, "Within the new language of education, the teacher is there to meet the needs of the learner, but these needs are narrowly defined as "learning" needs within a model that reduces learning to a series of teaching inputs designed to meet pre-specified outcomes" (p.4). This view of learning is especially evident in all the students' articulations when they seemed to suggest that course work and the role of the "profs" is only required on an "as-needed" basis. This points to a deeper and graver question of whether under the new scheme of things, a teacher is needed at all.

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