

Freshmen Protégé Perspectives on Mentoring in Engineering Education-A Qualitative Study

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Abstract— Mentoring in engineering education is a critical aspect of success for all student population. Undergraduate mentors can provide young engineers invaluable guidance and support early in their career. Enhancing undergraduate engineering institutes' perspectives on mentoring at well-established levels is necessary to ensure the engineers they provide to the industry are capable, both academically and professionally. By qualitatively analyzing student perceptions, the study investigates how freshmen engineering students perceive mentorship in engineering institutes. A questionnaire with open-ended questions was created and given to 26 first-year engineering students in an autonomous institution HITAM (Hyderabad Institute of Technology and Management) in South India. The analysis of students' responses revealed the following themes: Mentoring in engineering education, mentor focus towards physical and mental health, short-term and long-term goal setting, skill development and trust and confidentiality in mentor-mentee relationship. The analysis focused on how responses of the students varied depending on their discipline and gender. Comparatively more thorough experiences and views were provided by participants in computer sciences and its applied discipline than by participants in other engineering disciplines. The results of this study will help engineering institutions to better understand mentorship for freshmen protégés and serve as a reference for implementing better and advanced goal-based mentoring practices.

Keywords— Mentoring, Mentee, Physical and Mental health, Roles of mentoring, Skill development, Trust and confidentiality

JEET Category— Research

I. INTRODUCTION

entoring is a multifaceted perception that lacks a common explanation, and its execution is governed by the organisational context, aspirations and contributors. Through internalisation and socialisation, mentoring is an informal process of knowledge transmission inside an organisation. One of the earliest methods of learning through experience is mentoring, which has a long history. However, in recent years, there have been a lot of articles on novel forms of mentoring under various names, such as tutoring, coaching, facilitation, shadowing, etc. coaching, facilitating, and shadowing (Jenkins, S. 2013, Mueller, S.

2004)

Mentoring programmes became a part of employment and human resource growth in corporate, industry, and governmental organisations with the framework of the mentoring program that started in the 1970s. Generally speaking, their objective was "to make certain that potentially higher-ranking people always had a key figure to advise them and monitor their career (Jenkins, S. 2013). After mentoring programmes showed to be effective at finding candidates for high and executive positions, mentoring was expanded to help women and underrepresented groups overcome the infamous "glass ceiling" and advance into positions of leadership (Mueller, S. 2004, Clutterbuck et.al 2002)

A career advancement mentoring strategy places an emphasis on the mentor's function as a counsellor who is sympathetic to the needs of the mentee personally (Israel, M. et. al 2014), helping them to resolve personal issues and feel at ease with academics (Ganser, T 1998). Even the mentor's emotional support is crucial in aiding the mentee in reducing stress and resolving internal conflicts related to transitioning to the work (Hastings, L. J. et.al 2020, Orland-Barak, L. et.al 2021). Mentor instructions could help engage mentees in assessing fundamental teaching methods by receiving adequate and targeted training (Hennissen, P et.al 2010, Crisp, G et.al 2009) and in supporting mentees to reach their goals. This learning takes into account of becoming aware of one's strengths and limitations to the extent that a mentor is able to suggest and assist the mentee along a course of action that interacts and capitalises on the protégé's strengths, while offering opportunities to develop their recognised weaknesses for personal growth and the successful accomplishment of academic and/or career aspirations.

Earlier research has generally focused on the evaluation of group mentorship programmes, attempting to identify programming faults rather than identifying what students want (Santucci, J. 2004). These practices need assessments in the form of systematic reviews that examine needs before making essential decisions regarding mentoring practices (Campbell, T. A. et.al 2007).

This helps in reaching agreement and meeting students' requirements. The lack of a needs assessment prior to

designing mentoring practices is concerning because institutions are making investments to groom and train risk obliging to certain demographics while excluding others, as participant views can be critical in effective development and implementation of mentoring practices.

Successful mentoring may and should involve the mentee's and mentors' personal values (Campbell, T. A. et.al 2007). Values-based mentoring, for example, offers the chance for individualised mentoring with the aim of promoting better outcomes for specific mentees, but it also acknowledges the fact that different values can lead to a conflict or differences in preconceptions that can obstruct or disrupt mentoring exchanges. Since one identifies and considers the full person, effective mentoring places a strong emphasis on personal growth. It also aims to encourage a person's values-based personal success in a certain field. Numerous studies have demonstrated the benefits of mentoring in all its forms, including improvements in productivity, professional and academic persistence, identity development, job placement, self-assurance, and other results (Crisp, G. et.al 2009 ,Pfund, C. et.al 2016, Gershenfeld, S. 2014).

Some academic institutions have formed numerous mentoring programmes for freshman students in order to increase freshman retention rates, a frequent issue faced by engineering programmes. The common objective of these programs is to assist students in dealing with the challenges of switching from high school to university environments, as well as the pressures involved with pursuing the strenuous engineering courses (Matthew, S. et.al 2006)

Even National Educational Policy 2020 (NEP 2020) has mentioned that the mentors play an important role towards producing responsible, committed and persistent graduates. A National Mission for Mentoring should be put forward to provide short and long-term mentoring support to faculties in institutes. (14.4.2 and 15.11 in NEP 2020).

The significance of mentoring in education resides in the fact that a mentor may impart information about his or her career path as well as serve as a source of guidance, inspiration, emotional support, and role modelling to a mentee (FISH, C. 1993). In this paper the study mainly focuses on understanding freshman mentees' perspective on role of mentor in engineering education, how they motivate and guide to enhance their skills, develop physical and mental connect, guide them for career development in long and short term goals by maintaining trust and confidentiality.

II. LITERATURE

The study's supporting literature covers a mentor's responsibilities to a mentee in a variety of contexts. The goal of mentoring is to help the protégé advance in their professional, personal, and intellectual lives. As a result, their students while not having adequate evidence to back up the need, usefulness, and efficacy of those programmes.

Furthermore, without an awareness of student opinions on peermentoring programmes, institutions the nature of the connection between mentor and protégé changes based on both their respective abilities and moral character. The majority of mentor-mentee relationships go through at least three phases: getting to know each other, action plan for achieving goals and closure. Mentorship is about building a relationship who's been in your shoes, and it takes time to get better

The foundation of mentoring is also mutual respect and trust between the mentor and the mentee, which enables open and honest discussion about topics like how to learn from failures and chances for improvement. The relationship is built on confidentiality, which provides the mentor and protégé peace of mind that what they discuss will remain private. Some mentoring programmes require participants to sign non-disclosure agreements in order to maintain confidentiality. Since the mentor is not in a position to fully evaluate the protégé, many mentoring programmes advise that mentoring should take place "offline" instead, such as with an immediate supervisor, professor, manager or academic advisor (FISH, C. 1993).

In a mentor and mentee relationship, a mentor typically assumes a variety of responsibilities based on the specific needs of the protege. A mentor in general performs each of the following three major roles: teaching, providing psychosocial

support, and serving as an example, per research. A mentor ought to have sufficient technical knowledge and professional experience to be capable of providing in-depth responses on performance-related issues (such as successful project briefings and resumés for internships). Mentors should have good listening skills because they also provide ongoing moral and emotional support (Greco, L. M. et.al 2020).

The University of Arkansas mentions the factors credited for the success of their mentoring programmes. The factors mentioned are: choice of mentors on the basic need of protégés (seniors & juniors), training mentors, provision of training to freshman protégés, matching mentors and mentees properly, setting up targeted one-on-one meetings between mentor and protégé, timed information and support provided to the mentee, social activities, and mandatory development of mentor handbook. (Greco, L. M. et.al 2020, Binani, S. et.al 2018)

E-mentoring is another type of mentorship, which enables mentors to respond to mentee e-mails at their comfort and with the least amount of interruption to their daily regimen. Due to Face to face mentoring occurring at set times; this allows mentors a great deal of adaptability that is not feasible. The lack of non-verbal cues during online communications is closely linked to the concept of text-based conversation.

Many people in academia mistakenly believe that a person's faculty advisor is a mentor, but this is not always the case. Students may struggle to establish a friendly association with faculty advisors, particularly when working in settings like big enterprises and laboratories (Binani, S. 2022). They might search elsewhere for a mentor, a classmate, another professor, a friend, or a professional from the industry who can offer on-going advice and support. Mentors from business and government organisations can raise students' knowledge and understanding of postgraduate potentials by sharing their own career advancement with the protégé and by giving them useful insight on how coursework can be applied in the workplace. By establishing goals and acting as seasoned professionals who give newcomers specific guidelines and framework that aids in the analysis and understanding of their career aspirations, career mentoring promotes protégé advancement within a corporation or in their career (Binani, S. 2022).

Few studies reported an ethical dilemma in freshman engineering students for taking decisions in achieving their proximal and distal future goals with required skill set which indirectly depends on the relationship they share and maintain trust and confidentiality with their mentor. Mentees self- efficacy, preparedness and challenges in ethics will also help mentor in understanding how confident they are to respond to ethical dilemmas in their four years of engineering. Improper mentoring can lead to unethical decisions which will directly affect their future prospects. Therefore, it is crucial for mentors to make their protégés ethically rooted in their profession. (Schunk, D. H. et.al 2022).

Mentoring goals establish criteria for task completion and act as a guide for other processes supporting self-regulation, such as making plans, strategy development, supervising, and

evaluation (Bozionelos, N. 2004). There isn't much research on career aspirations, despite the fact that many authors who write about career management emphasise the benefits of goal setting (Ragins, B. R. et.al 2007). Proximal tasks and people's longer-term development need to be driven by educational objectives. When establishing and achieving their learning objectives, professionals heavily rely on their mentors, colleagues, and supervisors (Mullen, C. A. et.al 2012).

The importance of considering mentoring as a mutualistic developmental relationship that fosters learning, development, and progress for both mentors and protégés is highlighted by recent theoretical approaches on mentoring. This hypothesis is supported by existing research, which demonstrates that mentors can gain from mentoring relationships in terms of both proximal advantages (i.e., benefits directly attributed to the relationship) and distal results (i.e., more peripheral career outcomes and work attitudes) There exists a lack of research that looks at the connections between mentors'

reports of the direct benefits of their mentorship programs and more long- term results related to career achievement and positive job involvement. Existing studies offer important information on the types of short-term gains and long-term results that may contribute from mentoring. In fact, few studies have examined the factors that influence the benefits of mentoring for mentors. (Cellini, M. M. et.al 2017) revealed that, after adjusting for a number of relationship characteristics (e.g., relationship duration) and mentor variables (e.g., gender), perceived similarity among mentor and protégé was associated with mentors' assessments of their training and relationship quality.

Since serving as a mentor sharpens one's skill set and raises one's visibility in the organisation, several authors who centred on more long-term mentor advantages discovered a significant correlation between mentors' opinions of their professional success and both the mentoring they offered to their protégés in addition to the mentoring they gained can result in objective professional success for the mentor (Allen, T. D. et.al ,2021). Even mentoring can help people develop the interpersonal skills and abilities that improve career outcomes like advancement, satisfaction, and career effectiveness both for mentors and protégés.

Despite the advancements of mentoring in varied areas, the study attempts to examine the views of first year engineering students' perceptions by open-ended survey questions on roles of mentoring in engineering, in terms of physical and mental support, goal settings, skill development, trust and confidentiality the mentor provides in his/her career path.

III. METHODS

For the purpose of this study, an open-ended survey was created to gather data. Knowing the steps, we needed to take to arrive at the right interpretation was crucial for completing this survey. In order to have a wider demographic variety, the researcher chose participants out from various disciplines. After the data was gathered, the statements were evaluated in order to determine how freshmen students felt about engineering mentoring and to think of ways to encourage

institutions to adopt effective mentoring practices that will ultimately aid mentees in their future careers. The information was assessed.

IV. PROCEDURE

Firstly, a one-hour online session on roles of a mentor was conducted among the freshmen engineering students. Survey questions were designed based on 5 constructs namely: Mentoring in Engineering Education; Focus towards physical and mental health of students; Goal setting (short and long term); Skill development; Trust and confidentiality. Out of the 27 volunteers, 15 participants were selected from nine disciplines to provide feedback on the wording and the

phrasing of the questions. The survey instrument was designed in Google form and was administered via WhatsApp to the students. Students were asked to complete the survey in less than 48 hours and a reminder was sent after 24 hours.

V. PARTICIPANTS

The 15 chosen participants are represented in tabular form below. answers with pseudo names, sexual identity, and engineering branch targeted first-year students at the autonomous engineering institution.

TABLE I.
 DEMOGRAPHIC INFORMATION OF
 PARTICIPANTS

#	Pseudo Name	Gender	Discipline
1	Shrayan	Male	AI/ML
2	Dhruv	Male	EEE
3	Myra	Female	IOT
4	Junaid	Male	Data Science
5	Prisha	Female	CyberSecurity
6	Pahel	Female	IOT
7	Kiansh	Male	Mechanical
8	Arpita	Female	IOT
9	Yuvraj	Male	AI/ML
10	Yash	Male	CyberSecurity
11	Pravallika	Male	Mechanical
12	Aachman	Female	Data Science
13	Mihir	Male	AI/ML
14	Varshita	Female	Data Science
15	Naseer	Male	IOT

VI. RESULTS AND ANALYSIS

THEME 1: MENTORING IN EDUCATION ENGINEERING

Question. *What are the qualities you expect a mentor must possess? Justify.*

If there is good understanding between mentor and student, the student can share their problems and struggles which they are facing and can get a better solution for it. An important point is that the mentor should be worthy of trusting and should be able to build trust among his/her mentees easily. One such incident was when I was selected for an SSG interview on the day I had my end-semester exam. I asked my mentor for help and they suggested me to go for interview as it was one in a lifetime chance (Shrayan)

A mentor should guide the students in all perspectives like he/she should know the student's interest in a domain and

have to encourage them in that particular domain. (Myra) A mentor must be empathetic, patient, knowledgeable, trustworthy, optimistic, understanding and should have good obstacle tackling skills or problem-solving skills as being a mentor holds the responsibility of a student and their future. Therefore, the mentor should be capable of listening patiently and understand the issues a student could be facing. They should be good at giving proper advice to the students and guide them to a better future. (Dhruv)

Participants Shrayan, Myra, and Dhruv exhibited a positive attitude toward the roles of mentors in engineering education because they agree that mentor value the mentee as a person and encourage them in the right direction, listen to what is said as well as how it is said, they even assist them in solving his or her own problems rather than providing direction, and aim to develop the mentee into a nice individual for their professional life.

The above findings are lined up by the role of mentor in engineering institutes who helps to grow skills, make better decisions and gain new perspectives in life and career. As said being questioned by someone is just not easy to handle, but to enhance your abilities and advance in your career, mentors are individuals who expect the best from you. They will help expand your network and provide guidelines that will accelerate your career (Mullen, C. A. et.al 2012).

THEME 2: FOCUS TOWARDS PHYSICAL AND MENTAL HEALTH OF STUDENTS

Question: *Did you come across any situation where a mentor looked after your physical and mental health? Explain.*

Yes. I was in a situation in my 1st semester where I was sitting in a corner and crying about the things that have happened in the past. I still remember feeling weak in my knees and I was not in a position to talk to anybody. My friend spoke to our mentor. Even though I did not feel like talking to my mentor, she made me feel comfortable and talked me out of it..... And coming to my current semester, even though she was not our mentor anymore. She used to come to our class

and interact with the students. And I don't think we had a proper session with our current mentor yet. (Junaid)

When I was suffering from viral fever, my mentor gave me good suggestions like what kind of food to be taken during the fever, that helped me a lot. (Prisha)

Till date I haven't come across any situation where my mentor had to look after my mental and physical health. But I think a mentor should know the status of physical and mental health of a mentee, because health is considered as the first priority. Because now-a-days, students are much prone to depression because of the pressure they have. A mentor should counsel the mentee when needed. (Pahel)

According to the responses mentioned above and quoted by Junaid, Prisha, and Pahel, the majority of the target

classmates interviewed showed an improvement in their physical and mental health after being mentored. It's been proven that mentoring is an effective solution; having a support system in the form of a mentoring programme for those who have lived experience with mental health can have a significant impact. Mentoring is one of those techniques that has been proven to reduce anxiety, particularly around social situations.

The results agree with the authors' conclusion that, without a mentor to provide guidance, pupils' physical health gradually deteriorated. The same group of students later displayed improved mental health after receiving extensive mentoring. The tension and anxiety levels among the kids decreased in response. Even research from Cambridge Judge Business School shows that mentoring helps mentees experience less anxiety. Overall, having a mentor around had a good effect on the students' physical and emotional wellbeing [Glazzard, J. et.al (2021)].

THEME 3: GOAL SETTING (SHORT TERM AND LONG TERM)

Question. *Does your mentor help in achieving your career goals (short term and long term)? Justify.*

Yes. My mentor has spent a lot of time asking me about my long-term goals, but he/she never asked me regarding the progress of my long-term goal. Because I expressed my aspirations to my mentor in the first year, I expect him/her to ask for an update in my second year. (Arpita)

Yes. They do help us to achieve our short-term and long-term goals. As in they keep the track of the particular student and mentor him/her to get into the correct path. Mentor always corrects us. (Kiaansh).

Yes, she used to encourage us in achieving our career goals and dream both short and long term irrespective of the goals she used to boost us up. (Yuvraj)

Goal setting is essential in any mentoring process, as evidenced by the responses of participants Arpita, Kiaansh, and Yuvraj. The mentor in the institute analyses and takes into account both short- and long-term goals. The mentor keeps track of the progress of the mentee and defines methods to

map out the route to success by setting the right timelines. Goal setting enables the mentor and mentee to have a clear focus and enables priorities to be set.

The aforementioned comments are consistent with research showing that engineering students who have a mentor provide them with help are more likely to succeed in their short-term goals. Few scholars even came to the conclusion that mentoring can guarantee a favourable impact on students in terms of creating long-term goals with instant benefits mentioned by mentees. These advantages are linked favourably to their dedication to the organisation and job happiness. (Fletcher, J. K. et.al 2007).

THEME 4: SKILL DEVELOPMENT

Question. *Does your mentor understand and improve your personal development skills which maximize your potential both personally and professionally? Justify.*

Yes, as most of us in our class we listen to the lectures of the faculty. But during presentation we used to face a lot of problems like expressing ourselves or voice modulation. Later on, it was observed by our mentor so they gave us tips about how to give a presentation which helped us to improve our quality personally and professionally. (Yash)

The more I show or express my skills, the mentor will try in every way to improve my skills and helps for development. We have a separate class dedicated to soft skills, in which we are told to improve and learn new skills which are important both personally and professionally. (Ankit)

My mentor doesn't show any interest towards our personal development skills. They wanted us to get good marks and do well. (Varshita)

The eventual aim of mentoring in engineering, according to participants Yash and Ankit, is to ensure that they first pursue the career they desire and then maximise their potential in their workplaces. The latter depends on the mentor's sustained focus on the mentees personality development, whereas the former heavily depends on the mentor's attention to the mentee's skill development. Similar circumstances that a mentee encounters have already been experienced by a mentor. As a result, the mentor can help their mentee by inspiring them to acquire the necessary skills for their desired careers.

Varshita, however, exhibits a nuanced mindset towards the mentor for skill development because they believe the mentor is primarily focused on academic tasks and that the advancement of their skills is neglected or not given much attention, which is in line with the findings that assistance of technical mentors helps to enhance skills required for their professional development in support to academic mentors. Technical mentors assist mentees in developing their technical understanding in a variety of aspects by preparing them for hackathons, social media tech groups, professional networking events etc. (Ragins, B. R. et.al 2017).

THEME 5: TRUST AND CONFIDENTIALITY

Question. *Does your mentor maintain confidentiality and trust in your personal life? What is your opinion?*

No, the mentor didn't maintain confidentiality, in fact he scolds and taunts students in front of everyone which makes that person feel humiliated. (Pravllika)

Yes, my mentor maintains confidentiality. When I was in a particular situation and not sure how to react to it. I explained my situation to my mentor and I am pretty satisfied with what I got. Till date, it's just between the two of us. (Mihir)

In a class environment, I tend not to share my personal life with my class mentor due to professionalism. But I make sure I keep sharing my personal life matters to my mentor, who always maintains confidentiality and helps me go through the process of solving the problem I'm facing. He tells me to understand the problem and its cause and solve it effectively and critically. (Naseer)

In the relationship between a mentor and mentee, confidentiality is sacred. The aforementioned responses from Mihir, Naseer, and Pravallika indicated that the majority of students interviewed had a mixed opinion of their mentors in terms of trust and confidentiality. A confidentiality breach has the ability to irreparably end the mentee-mentor relationship. Confidentiality must always be upheld between a mentor and mentee. Confidentiality is an element of ethical conduct and one of the best practices for ethics in mentoring guidelines. Keeping confidences was found to have an impact on perceptions of integrity (Leck, J. et.al 2013).

Another factor that determined the mentees trust in the mentor was gender of mentor. These results coincided with the finding that female mentors share a comparatively fragile relationship with their male protégés and vice versa. Moreover, protégés being mentored by the same gender apparently involve more trust and confidentiality. Overall, the gender of the protégé and the mentor appears to reinforce or adversely affect the trust relationship between them (Orser, B. et.al 2010).

It was observed that open-ended survey questions helped students to understand the role of mentoring in engineering education by maintaining guidance, trust and confidentiality. For author it created awareness to both mentor-mentee relationship and had a direct impact on establishing relevance to research work by identifying gap in mentoring procedures in the research topic by maintaining guidance, trust and confidentiality.

VII. CONCLUSION

In this study the author concludes that mentoring in engineering education is a very crucial aspect to create competent and socially responsible engineers, who adhere to moral and ethical values in service to society and industry. The survey analysis played an integral role in understanding freshman students' perspectives on mentoring in engineering

education. With responses retrieved from mentee, a mentorship model could be improvised in a well organised way which will increase the student engagement in academics, co-curricular, extracurricular activities to a larger extent and role of gender to be considered in having trust and confidentiality among mentee. This mentoring strategy will serve as a model that can be adapted to be followed in the subsequent years. However, the success of the strategic model can be measured by periodically tracking the students' progress over a few years. Where best practice of mentoring in four years of engineering is introduced to

support students to help them build a better professional workplace. Moreover, freshman engineering students need to be taught how to work side by side with a mentor. It helps them to observe their thinking process and gives them hands-on experience that improves their skills and builds mentor-mentee relationships.

VIII. FUTURE WORK

Future studies will concentrate on a deeper analysis of perceptions of participants from various autonomous and deemed colleges and how mentoring effectively through all years of engineering improves them to achieve their future goals. The current study offers a broad perspective of how first-year engineering protégés perceive mentorship. Further studies may even include quantitative surveys of mentees to gather information about their perspectives on engineering mentoring from those enrolled in all four years of engineering [Kittur, J. (2018)]. This will help to raise the standard of mentoring practices provided by these institutions by achieving a measurable and goal oriented mentoring process. Lastly, qualitative research could also be carried out to explore the perspectives on mentoring held by faculty members [Kittur, J. et.al (2021)].

IX. LIMITATIONS AND RECOMMENDATIONS

A limitation of our study is small sample size, duration of mentoring received by mentees (only for one year) and the limited data collection i.e., from exclusively freshmen engineering students in just one institute. Future research in this area should include a larger group of participants, more in-depth ethnographic methods, from all four years of engineering students and multiple data sources that could be triangulated. This would help generate more holistic data, identify more robust patterns and enhanced mentoring models. With support of technical mentors along with academic mentors, the overall mentoring process can be streamlined to ensure the proteges achieve their long term and short-term goals with regular improvement of their skills, ultimately making their position better in their profession.

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