MENTORING ENGINEERING STUDENTS

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Abstract. The paper outlines the importance of making necessary improvements in engineering education to keep up with the high-speed changes in the Information Era. For the instructional process to be more efficient, and to increase quality in higher education, the academic community is extensively making huge efforts to create meaningful learning opportunities. In this approach, it becomes vital for the university professor to go beyond his traditional role of the *sage on the stage* and assume a more complex one, that of a mentor, the *guide on the side*. A general framework of this transformation, surveyed in this work, serves as a window to understanding its impact on mentorship. Recent research generally confirms that mentoring relationships are tailored to facilitate personal and professional development of both student and mentor. This explains why the mentoring forms within engineering education have been provided here, so that all participants in this exercise become aware of their role and contribution in enhancing the efficiency of this process.

Keywords: *active learning, critical thinking, education, mentoring forms, personal and professional development, soft skills, teaching-learning process.*

Rezumat. Prezenta lucrare evidențiază necesitatea introducerii noilor strategii de îmbunătățire a învățământului ingineresc pentru a ține pasul cu schimbările rapide din Era Informațională. Comunitatea academică depune eforturi imense pentru a crea diverse oportunități de învățare, astfel ca procesul de instruire să devină unul mai eficient. În acest demers, la fel de important și necesar e ca profesorul universitar să își extindă activitatea sa tradițională de emițător de informații (așa-zisul *înțeleptul de pe scenă*), în una mai complexă, cea de mentor (*ghidul din preajmă*). Astfel, rolul său de actor principal în procesul educațional, devine unul mai puțin autoritar, oferind studentului, rolul central. Prin urmare, un model al acestei transformări, prezentat în acest articol, vine să faciliteze înțelegerea acestei tranziții și impactul acesteia asupra relației de mentorat. Cercetările recente afirmă că relațiile de mentorat contribuie la dezvoltarea personală și profesională atât a studentului, cât și a mentorului. În acest context, au fost furnizate și examinate diverse forme de mentorat existente în educația inginerească, astfel încât toți participanții la acest exercițiu să-și conștientizeze rolul și contribuția în sporirea eficienței procesului de instruire.

Cuvinte cheie: *învățare activă, gândire critică, educație, forme de îndrumare, dezvoltare personală și profesională, abilități soft, proces de predare-învățare.*

Introduction

"Mentoring allows the intellectual ozone layer to be preserved!"
Julie Latour

Mentoring, as a didactic function in higher education, has recently become a subject of great interest in academic environment. Actually, little investigation has been conducted to prove that mentorship has been fully explored in the university pedagogy, and especially, in the engineering one. After taking a closer look at publications from our country and foreign literature review, we inferred that researching this topic is, unquestionably, of great value for the Technical University of Moldova. As the fundamental mission of our institution is to offer quality studies to the young generation, academic staff will insist on forming strong and creative personalities to become critical thinkers. Only by combining education, research and innovation, we can build a sustainable economy and highly intelligent society.

Shifting roles: from traditional teaching to mentoring

With the rise of the European higher education standards in the context of the Bologna Process, major reforms have to be undertaken in order to improve quality in higher education. The world we are living in, is continuously supplying us with fabulous amounts of information resources and numerous interactive platforms to make our learning more accessible. In this approach, it becomes highly imperative for the teaching-learning process to be addressed differently. Even though the professors integrate modern teaching strategies and ICT tools when delivering the content, this is, still, not enough. To meet all these demands, it is crucial for the teacher to extend his activities and functions and assume the role of a *mentor*; as a consequence, the teacher-student relationship turns into a *mentoring relationship*.

Mentoring is generally accepted as an activity of people with rich experience and deep knowledge who contribute enormously to the formation of young people's personality. This relationship has already covered various areas of our social life. In Morris Zelditch's opinion, "Mentors are advisors, people with career experience willing to share their knowledge; supporters, people who give emotional and moral encouragement; tutors, people who give specific feedback on one's performance; masters, in the sense of employers to who one is apprenticed; sponsors, sources of information about and aid in obtaining opportunities; models of identity, of the kind of person one should be to be an academic [1, p. 11]. Based on the multiple roles suggested by the aforementioned author, we need to identify the instructors possibilities to carry out various activities and consider their impact on the mentees' success [2].

For the purpose of this paper, the term mentor will be taken to mean the teacher who changes his roles and switches from the traditional patterns, from the main actor of the educational process, in a less authoritarian one, leaving the central role to the student.

This paradigm shift in the university education depends on the society imperatives as today successful education is not about holding and sharing information to students, neither is efficient learning about passively processing and memorizing to be reproduced the next day.

As the 21st century seems to be very demanding with regard to the quality of engineering graduates' abilities and competences, mentors have to teach students how to face the rigors of the labour market, by offering a wide range of channels to strengthen both soft and technical skills [3].

To reiterate the importance of these efforts, instructors will have to implement active learning strategies oriented towards the creation of a learning environment that will enhance the development of skills like cooperation, teamwork, problem solving, critical thinking, leadership, decision making and others.

An indispensable component of the mentoring process is to stimulate students' growth by providing permanent and constructive feedback in order to train their high order thinking skills.

To make it clear, mentors need to align to these new requirements because they are directly responsible for raising a proficient generation of specialists.

Figure 1 depicts briefly the importance of understanding the *teacher-mentor* paradigm shift and invites the readers to thoroughly consider the activities happening around each actor involved in the educational process:
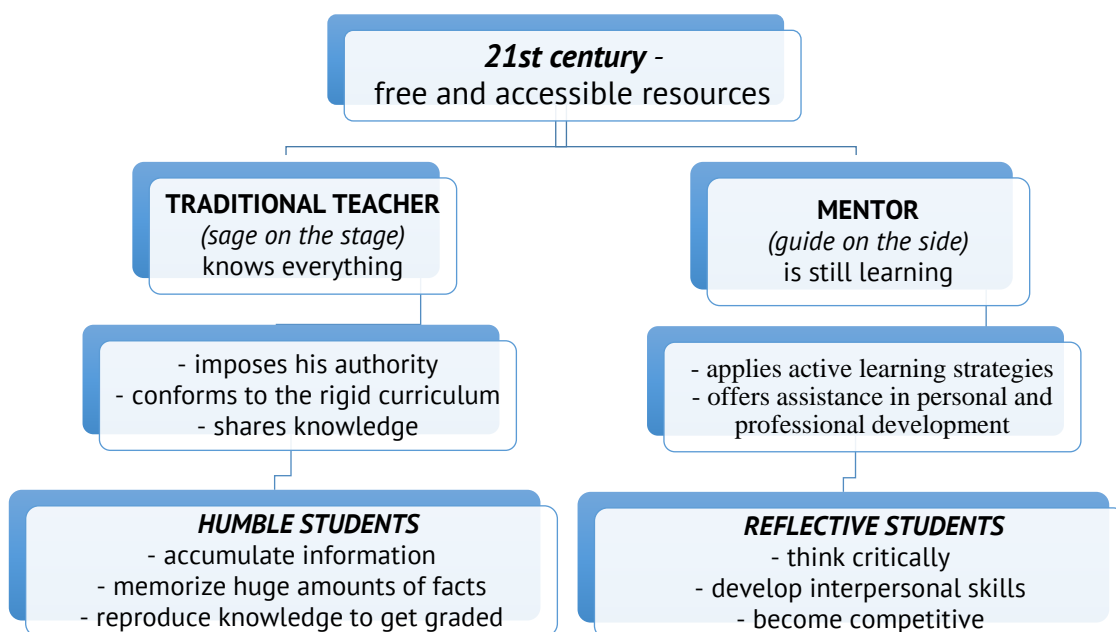
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TRADITIONAL TEACHER
(sage on the stage)
knows everything

MENTOR
(guide on the side)
is still learning

- imposes his authority
- conforms to the rigid curriculum
- shares knowledge

- applies active learning strategies
- offers assistance in personal and professional development

HUMBLE STUDENTS
- accumulate information
- memorize huge amounts of facts
- reproduce knowledge to get graded

REFLECTIVE STUDENTS
- think critically
- develop interpersonal skills
- become competitive

Figure 1. *Teacher-Mentor* paradigm shift.

To get a better understanding of this idea, the professionals in engineering education need to involve their students in different cooperative environments, create them different learning situations and monitor their progress.

Mentors, will also insist on reflecting on what they have learnt, the way they have applied their knowledge and strategies chosen to improve the activity output [4].

It is generally agreed that assisting students in their personal and professional development is a perspective that leads to competitive graduates fully equipped with all the skill set required by the labour market, engineers who know how to efficiently combine technology, how to work and grow in a cooperative environment, how to develop real life projects and identify viable solutions, demonstrating a high expertise level.

According to Nicholls, educational institutions are the place where students learn, but also the places where teachers' professional learning can also take place and mentoring is considered as a means by which teachers support their learning [In 2]. As we can see this activity offers great opportunities for teachers to grow and develop through sharing experiences and learning situations which make their endeavours visible, as the major element of the disciples' success is the mentor's ability to improve the educational process.

Mentoring networks in engineering education

Many researchers contend that mentoring describes, at first instance, a range of complex relationships among academic staff, students and institution [3, 4], oriented towards mutual enhancement of critically reflective and independent thinking [5]. At the same time, it has been stated that mentoring is also a journey mentors and mentees embark on together and help each other arrive at a destination called professional excellence and good mentoring is simply *the best way to get there* [In 2, p. 5]. It is now clear that all people involved in this constellation grow and evolve.

The following forms of mentoring are mentioned in literature as being the most popular ones: dyad, triad, e-Mentoring, group or team mentoring, multiple mentoring, peer mentoring, reverse mentoring etc.

Further, we are going to approach mentorship forms explaining the way these relationships develop at different levels within faculty: mentor-student, student-student and mentor-mentor interactions [6].

1. <u>Mentor-student level</u>
   a) Group mentoring:

- *Mentoring first year students* is meant to facilitate the adaptation of newcomers to a new environment and to monitor their academic progress through the designation of an official group mentor/ tutor/supervisor [7].

- *Internship mentors* initiate the sophomore students into the internship process as well as acquaint them with the outcomes and outputs to be achieved [8]. Mentoring, at this level, also implies activities such as: organizing, monitoring and assessing this activity. Moreover, university mentors are always in tight contact with the company mentor, the one who, after introducing students to the company culture, guides them along four weeks by providing constant feedback.

- *The mentor in charge of the faculty internationalisation* assists the foreign students during their adaptation period and facilitates the process of solving the issues of cultural, social and academic level. He will also monitor the students' integration into the new environment.

- *Mentoring small teams in Cooperative Learning (Problem-Based Learning)* requires a mentor's guidance when students, organised in teams, have to solve real life problems by developing semester projects [9]. As it is one of the latest strategies implemented at our university, further research needs to be conducted to find how these types of interactions impact the success of future specialists.

   b) One-to-one mentoring (Dyad)
- *Supervising* students in the elaboration of the bachelor, master or PhD thesis and
- *Counselling* disciples in private, on request, involves discussions, guidance and help.

2. <u>Student-Student (Peer Mentoring) level</u>
- *Guiding newcomers* on the first days at university comes from the initiative of various students from different years and study programs who are open to support and facilitate freshmen's transition to a higher stage. Orientation sessions are meant to welcome peers and bring them into contact with the academic community and the new environment.

- *Providing subject-specific lectures,* in an informal format, is another way of more experienced peers or graduates to help those who encounter difficulties when studying a specific matter or discipline[10].

- *Mentoring younger students in different competitions* like 24-hour Hackathons or Start-ups just bring students closer. These events are supposed to teach young students develop IT projects under the guidance of peers and alumni who have already reached a particular level of expertise in the related field.

3. Mentor-Mentor level

- *The academic staff formation* within the Center for Continuing Education, TUM delivers training through the Psycho-Pedagogy module by providing modern teaching strategies, methods and tools, all used to streamline mentor's activities to reinforce interaction at different levels in an educational setting.

As illustrated above, group mentoring is one of the most popular types of activities. Our legal framework does not offer yet the possibility to carry out the one-to-one mentoring, the one that assumes that each newcomer to the university is paired with a mentor who will guide him throughout his studies, a model widely spread in western universities. That is why our efforts are enormous, when we have to manage, supervise and counsel large groups of students.

Following mentoring subject, several scholars have argued that "The goal of mentoring is not teaching the system, but to change it to become more flexible and responsive to the needs and pathways of its members-mentors and protégés [In 6, p. 58]," that is exactly why all these perspectives intend to prepare the learners to face the rigors of the information society.

Conclusions

Many scholars claim that mentorship goes beyond knowledge sharing and becomes a relationship of mutual learning as it has been proved to favour the efficiency of the instructional process. Observations from our educational activity allow us to conclude that it becomes essential to develop and promote mentoring activities in the engineering education. We all target to streamline the process of forming future specialists able to easily integrate in the labour market and quickly adapt to new environments. Adopting the *learning by doing* strategy will definitely lead to the increase of our graduates' level of competitiveness and employment opportunities. The entire academic environment is aware of the fact that this success can be reached only through the joint efforts of all participants: mentor, student and educational institution. Since the entire academic community strives to ensure efficiency in engineering education, then each of us has to contribute to make it happen. For this endeavour to be achieved, mentoring becomes a fundamental activity meant to model people committed to changing the world and making our life easier, because *Engineers Create the Future!*

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