

Who is a Role Model? An Open Discussion on the Role of Role Modeling in Engineering Education

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Abstract—While role models are frequently mentioned in literature to broaden participation in engineering education, there are diverse ways of understanding what role modeling is, what it entails and what theory we can use to support our own reflections as professionals and students in engineering who can act as role models for others in the discipline. In this special session we invite participants to discuss their own conceptions of role modeling, in terms of what can be modeled, the intention and awareness of it, and how this may be perceived by others. To support the discussions we introduce Grande’s framework of role modeling, which builds on role modeling theory. The format of the session will be that of a World Café, where participants will alternate their participation in discussions at five different tables, each table with a theme related to the framework. With these conversations we expect participants to go back to their own contexts in academia and industry to continue the discussion with their colleagues. We also invite them to connect with facilitators and others at the session to continue research efforts in the area of role modeling in engineering education.

Index Terms—role model, engineering education, framework, reflection

I. INTRODUCTION AND BACKGROUND

One of the grand challenges in engineering education is broadening the diversity of ways to participate in engineering: who gets to be an engineer? Who is recognized by others as such? There are many initiatives to address this problem, with the use of role models being commonly used by the community (see for example [1]–[6]). In this special session we invite participants of all backgrounds to get together and reflect on different questions about role modeling. What is a role model in engineering education? What kinds of role modeling do we need in the contexts that we belong to? Who gets to be perceived as a role model? What barriers are there for others? We will facilitate discussions around the topics that the participants are most drawn to, supporting this with research on role modeling. In particular, we will present a framework for role modeling developed by the first author [7] and used in our previous similar special sessions (see [8], [9]).

Role model is a loosely defined term [10]–[12]. We use it often and think we share an understanding of it with others. And yet, we may not have stopped to reflect on how are views are different, what role modeling is, what it entails, who it involves, external influences (such as limitations on who gets to be perceived as a potential role model due to beliefs), etc. The main goal of this special session is to spark these con-

versations and reflections as structured discussions supported by theory. This includes not only Grande’s framework [7] but also its connection to identity, professional competencies, and other aspects and achievements that can be modeled by the participants and those around them.

Dictionary definitions of role modeling vary, with aspects such as admiration [13] or age [14] being lifted. The different approaches can lead to misunderstandings, as experienced in other studies [15]. In our chosen framework, role models are described as individuals who embody an aspect (something inherent to the role model) or an achievement (something external to the role model). This means that the role model is a concrete representation of something abstract. This abstract concept can be related to a) their competencies (e.g. programming skills), character attribute (e.g. kindness), attitudes and behaviors (e.g. aggressiveness), and/or b) connected to goals they have achieved from an objective perspective (e.g. a job position) or subjective one (e.g. success). Figure 1 shows this classification. The person who observes the role model is referred to as the emulator, who will either emulate or avoid becoming the role model as a way to achieve the emulator’s goal [10]. If the role model represents how to reach the emulator’s goal in some manner, they are a positive role model; whereas the representation of how to miss the goal is attributed to negative role models [16]. In mainstream discourse, the focus tends to be on positive role models. In this special session we will use both positive and negative definitions to explore what participants aim to (avoid) embodying and what they value in others. More nuance in these two definitions will be given during the session following to the framework. The overall definition of a role model in engineering that we thus use is “a person who embodies a seemingly attainable achievement and/or an aspect (competency, character attribute, or behaviour) which, through its imitation or avoidance, may help another individual achieve a goal” [7].

We will also explore the awareness and intention of role modeling, and the combination of both concepts, as in the following examples:

- 1) Aware and intentional, e.g. aware of modeling honesty and intending for others to emulate this honesty;
- 2) Aware and not intentional, e.g. aware of modeling a cheerful attitude but not necessarily intending for others to act in the same way;

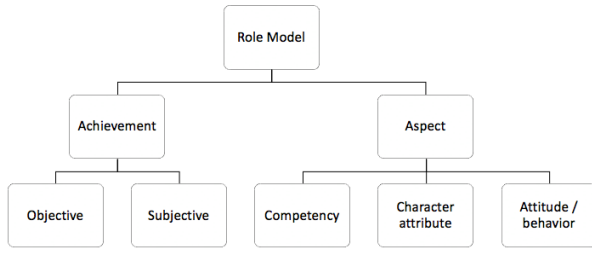


Fig. 1. From [7]: types of role modeling based on what a role model can embody: an achievement (external to the role model) or an aspect (inherent to the role model).

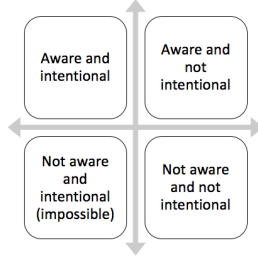


Fig. 2. From [7]: types of role modeling based on level of awareness and intention.

- 3) Not aware and not intentional, e.g. not aware of acting aggressively, no intention for emulators to become aggressive too;
- 4) Not aware and intentional: this combination is not possible, as to have intention one needs to be aware of the modeling first.

Other factors to consider are whether the role model's success is perceived as attainable [16] and how the emulator's self-esteem affects the motivation the role model can contribute to, current career stage [10], whether one is aware of the modeling and has the intention for it to be emulated [7], and how social contexts can hinder or prevent role modeling from happening [17]. In the context of education, a student who has a role model may have higher self-esteem [18], academic achievement [19], and motivation [20] especially if there is a match between ethnicity/gender of the role model and the student. Teachers in higher education can experience their own role modeling as being someone who knows the subject, transmits passion for it, shows traits that may be perceived as positive or negative, and influences not only the students as a heterogeneous group but also partly the profession and society [21].

The pool of participants at FIE is unique because it encompasses individuals from very diverse backgrounds (from many branches of engineering, academia and industry, etc.). This allows us to explore the grand challenges in engineering from the participants' perspective connected to role modeling. This includes but is not limited to modeling for others how we deal with heavy workloads, climate anxiety resulting from tech evolution, and other ethical implications that affect how

we perceive ourselves as role models. The participants are in positions of power that affect others, e.g. teachers being role models for students and/or (not) giving visibility to other role models; students transmitting to their peers what is valued as an engineer; principal investigators (PIs) who act as leaders in their team, managers in industry in a similar role, etc.

We propose a creative approach of running this special session in the form of an interactive world café ¹. This allows us to maximize the participation of the disparate FIE community, collect diverse opinions and experiences with respect to role modeling, and spark rich informative follow up discussions addressing and challenging the ideas and assumptions expressed by the participants instead of only informing them of the theories around role modeling.

II. FORMAT AND AGENDA FOR THE SESSION

The special session will be organised using the World Café methodology ². A world café is a structured conversational approach that engages participants in meaningful dialogue in small groups around tables similar to what takes place in a café. Each table will contain a written set of topical questions belonging to a theme on an A1 paper sheet. Participants will write down their own responses using the writing material provided, and read how others approached the same questions with the objective of sharing knowledge and experiences. This novel interactive process allows for creating discourse over the topic in an engaging and interactive manner whilst giving every participant an opportunity to express their viewpoints. A nearby facilitator will visit the tables and prompt and monitor the discussions if necessary. Once all the participants have sufficiently contributed to the topic, they are free to move to another table and repeat the process making the panel format flexible and inclusive. Adaptations can be made to allow for hybrid participation by replicating the physical space online using a visual collaboration platform (e.g. Miro board ³) and recording the responses there.

For the purpose of this session, the conversation will center over five “tables” or themes that will discuss. The themes have been selected based on the different sections described in Grande's framework [7], related to 1) how the concept of role model is defined, 2) main actors (role model and emulator), 3) what is modeled (achievement/aspect) and how (4)awareness, intention, and 5) perception by others). As such, the questions will be formatted as follows:

Table 1: Role Model Definition *Think of the term “role model”*

- How would you define it?
- What traits would you associate with a role model within the context of engineering education?
 - External (e.g. objective achievements such as becoming a professor).

¹<http://www.theworldcafe.com/>

²<http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/>

³<https://miro.com/>

- Internal (e.g. beliefs and values).
- What behaviours and competencies would you associate with a role model within the context of engineering education?

Table 2: Main Actors in Role Modeling *Think about yourself in the context of “role model”*

- Do you see yourself as a positive role model? Why/why not? And a negative one?
- Who are your role models?
- Who are your role models in education?
- Has anyone expressed in a professional context that you are their role model?
 - Yes
 - * Tell us more... What did they say? How comfortable do you feel about that?
 - No
 - * What would you think the reasons may be? E.g. that they do not perceived you as a role model, that they do but have not considered communicating it (or feel comfortable doing so).

Table 3: Embodiment by the Model *Think about yourself as a potential role model:*

- What are barriers or challenges related to your own role modeling?
- What are ways in which you feel supported in your role modeling?

Table 4: Awareness and Intention of the Modeling *Think about who/what are you trying to embody when you are in a position of influence*

- Which statement is more applicable to you?
 - I am aware and intentional of my potential role modeling effect on others around me?
 - I am aware and not intentional my potential role modeling effect on others around me?
 - I am not aware and not intentional of my potential role modeling effect on others around me?
- Could you please elaborate? E.g. you may not have been aware of a trait that you model and others have brought to your attention.

Table 5: Perception by Others *Think about your role models*

- Do you reflect on who you perceive as a role model? If yes, why and how? If not, why?
- How attainable does what these role models represent seem to you?
- Can you give examples of negative role models for you?
- Can you give examples of undesirable behavior embodied by role models?

The panel session is estimated to last 80 minutes and is structured as follows:

- Introductions by the facilitators with the aims and agenda of the session (5 minutes).
- Brief introduction to theory of role modeling, including framework (15 minutes)
- World café discussions (50 minutes)
- Wrap up with recommendations on the applications for role modeling (10 minutes).

The session leaders will facilitate channels for communication after the session, especially to share the outcomes of discussions taking place at different tables and to promote further collaboration (in, for example, discussions about the participants’ practice and/or research) among those who give their consent.

The invitation to participate is open to everyone to benefit from a diverse set of experiences and enrich the dialogue. The expected audience will mainly consist of people from the engineering and computing communities: academics (including early career researchers), students of all levels, and industry professionals who are often perceived as role models by their peers or their juniors.

III. FACILITATORS

Virginia Grande’s framework [7] for role modeling in engineering education can be used for contexts such as teaching and conference organization. In their work they have also explored ethics [22] and identity [17] related to role modeling in engineering. Virginia has ample experience organizing this type of session in research communities and events for members of the Association for Computing Machinery (ACM).

Dr Bedour Alshaigy (FHEA) is an established researcher and educator in Computing and Mathematics with experience in outreach activities in STEM. Their research interests include Computer Science Education, diversity, and inclusion. Bedour has previously facilitated successful panels and world cafes at different computing conferences.

Dr Anne-Kathrin Peters’s research suggests that disciplinary values and norms in education affect what role models are accessible to students and in which ways students perceive they can participate in computing [23]. Peters will contribute with theoretical underpinnings on disciplinary culture and identity. She currently works with the integration of sustainability, including equality and social justice, in computing and engineering education.

Professor Mats Daniels’s research includes how development and attitudes towards the development of professional competencies are connected to role modeling. His research interests comprise a variety of aspects related to understanding and developing educational settings intended to promote development of professional competencies in higher computing and engineering education.

IV. EXPECTED OUTCOMES OF THE SESSION

The objective of this special session is to explore and examine the definition of role model from the engineering community’s lens. By having these discussions and reflections

participants can go back to their own social contexts (teaching, research, industry work, etc.) and be cognizant of their behavior and its influence on the broader population. It is worth noting that the role model notion is not confined to industry professionals or educators; but can also include peers, such as other students, and individuals outside of the professional context.

One of the conceptions of role modeling we aim to break is the perception of a role model as “perfect”, as someone to be emulated as a whole. Rather, we hope participants discuss role modeling as emulating an aspect and/or achievement of an admired or respected individual, not necessarily everything that this person represents. Complementing this view, reflections can include how desirable traits change depending on cultural trends and other factors, and how participants should be attentive to their social contexts and how they can positively impact them to promote diversity of thoughts, ideas, and positive behaviour.

Furthermore, interested participants are welcome to further explore research or networking opportunities with the facilitators and others in the engineering community. Examples of this kind of future work are data collection on role modeling in engineering education, conference organization (see for example [24]), and other contexts. This also means that participants can disseminate the lessons learned among their colleagues and the greater public, and improve on the body of research in the area of role modeling.

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