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WORKSHOP: WHEN EMOTIONS ARE *NOT* OUTLAWED: USING EMOTIONAL SCAFFOLDING TO ENHANCE STUDENT LEARNING

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1 WORKSHOP AIMS

The aim of this workshop was three-fold: (1) to introduce participants to educational emotion research and the notion of “emotional scaffolding”, (2) to provide examples of emotional scaffolding, with a special focus on engineering education for sustainable development, and (3) to let participants collaboratively develop strategies for emotional scaffolding they can use in their own teaching.

2 BACKGROUND

According to socio-cultural theories of learning, scaffolding is a form of support that teachers (or peers) provide to students, allowing students to perform tasks they would not otherwise be able to do [1]. Scaffolding can, for example, consist of hints, explanations, modelling behavior, or guiding questions. Three forms of scaffolding are described in the educational literature: cognitive, meta-cognitive, and affective/emotional. While cognitive and meta-cognitive scaffolding have been studied extensively, affective/emotional scaffolding has received scant attention [2], [3]. Yet, a sizable body of research shows that emotions profoundly affect teaching and learning [4]—and there is some research to suggest that emotional scaffolding

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can be used to influence students' emotional reactions in ways that can enhance learning [5], [6]. Also, emotional scaffolding seems to be particularly important in the context of dealing with sustainability issues, due to their seriousness, high levels of complexity, and the need to navigate conflicting values and interests [7], [8]. Emotional scaffolding can, for example, aim to help students regulate emotional experiences when they encounter difficult tasks, cognitive conflict, or confrontation with others. It can also aim to build positive social relationships or to create opportunities for students to express emotions in constructive ways, for example in group work or in giving/receiving feedback [2], [3], [5], [7], [9]–[11].

3 WORKSHOP DESCRIPTION

We started the workshop providing a short overview over educational emotion research, including the widely used *typology of academic emotions*. This typology distinguishes between *topic emotions* (emotional responses to subject matter), *achievement emotions* (emotions related to students' perception of their academic performance), *epistemic emotions* (emotions related to the process of learning, such as grappling with uncertainty and ambiguity), *social emotions* (emotions related to interaction and social relationships in the classroom), and *incidental emotions* (emotions related to events and relationships outside the classroom) [4].

We also introduced the notion of emotional scaffolding, tentatively defined as "teachers' pedagogical use of emotive tools and strategies to influence students' emotional experiences and expressions related to subject matter, learning processes, performance, and social relationships in a way that promotes transgressive learning for all students." We provided the following examples of *emotive tools and strategies* from the literature on emotional scaffolding and sustainability education: instructors can acknowledge and validate expression of emotions [8]; create safe spaces for emotional expression and failure [12]; model constructive emotional responses [8], [12]; provide encouragement and reassurance in the face of unconstructive emotional experiences [5], [7]; adjust subject content and/or pedagogical presentation to match students' interests, cultural backgrounds, and competencies [6]; or build positive relationships in the classroom [5].

Next, we asked participants to join virtual break-out groups. In these groups, participants shared and discussed their own experiences of situations in which students' emotional reactions may have impacted learning, taking notes on a shared electronic platform. In total, participants created around 30 posts on the platform, covering a wide range of situations and themes. In a short midway plenary session, we asked participants to vote which of the themes they would like to discuss further. The following four themes were chosen: (1) Fear of making mistakes and being humiliated, (2) Fear of feeling stupid, (3) Emotions in learning about inequalities, and (4) Joy of feeling competence increase – empowerment.

We then created four new virtual break-out rooms, one for each of the above themes. Participants self-selected to one of the rooms, where they then worked together to develop strategies for emotional scaffolding that could enhance student

learning in similar situations. Participants again took notes on the shared electronic platform.

Finally, in a concluding plenary session, participants shared their experiences and results from the discussions. We also discussed more general questions related to emotional scaffolding and how it could be implemented in engineering education.

4 WORKSHOP RESULTS

The participants developed a rich set of emotional scaffolding strategies for different situations that can arise in engineering education. Below, we have organized the main results using the above-mentioned typology of academic emotions.

4.1 Emotional scaffolding strategies directed at social and achievement emotions

Theme (4) relates primarily to achievement emotions, and themes (1) and (2) each relates to achievement emotions *and* social emotions. Therefore, participants' descriptions of emotional scaffolding directed at these emotions overlapped to some degree. For example, participants suggested that instructors could reduce students' fear of feeling stupid by providing a safe learning environment, characterized by mutual trust and an acceptance of vulnerability and failure as important aspects of learning. Participants also suggested that instructors could add more formative assessment to help students build confidence and thus reduce anxiety related to exams and oral presentations. Finally, participants suggested that instructors could focus more on re-explaining challenging content, providing access to resources for self-directed learning, or experiment with different pedagogical approaches that could be more aligned with students' needs and thus help them build trust in their own learning and competence.

4.2 Emotional scaffolding strategies directed at epistemic emotions

With regard to epistemic emotions, participants particularly focused on how to provide emotional scaffolding to help students realize that failing is part of learning. Participants suggested that instructors should explicitly encourage processes in which students can test, fail, and learn from failure. Instructors should put more emphasis on validating students' learning *processes* and less on whether or not the students arrive at correct *results*. In fact, participants suggested that instructors should tell students to be "proud of [making] mistakes and learning from them".

Participants also discussed the need for emotional scaffolding when students are confronted with contrasting values and worldviews. These situations can challenge students' views of knowledge—which in turn can challenge their ideas of engineering as a profession and their own identities as future engineers.

4.3 Emotional scaffolding strategies directed at topic emotions

Theme (3) focused primarily on topic emotions and how instructors can help students deal with negative emotions triggered by learning about inequality, suffering, or environmental degradation. Participants suggested that instructors

should not only acknowledge and validate students' emotions, but also create opportunities for students to (anonymously) share their emotions. Instructors can also act as role models, demonstrating how one can deal with challenging topic emotions. For example, they can demonstrate how one can express emotions in constructive and respectful ways, and how one can use them as resources in ethical decision making.

Further, participants suggested that institutions and instructors should create curricula that allow students to use their learning for a good cause. Such curricula could empower students to use their topic emotions (such as anger about inequality) as *productive resources for learning and societal transformation*.

5 WHERE DO WE GO FROM HERE?

The large interest in this workshop and participants' vivid discussions suggest that *emotional scaffolding is a topic that should be further explored in engineering education research*. During the workshop, participants developed and shared many concrete ideas on how engineering instructors could provide emotional scaffolding to support student learning. However, participants also raised more fundamental questions and concerns regarding the (often neglected) role of emotions in engineering education. They suggested that students' emotions and their impact on learning should be explored further, as should *instructors'* emotions and how students' and instructors' emotions are closely interrelated [13]. For example, participants suggested that instructors may need to engage in *for themselves*, that is, they need to take care of themselves and their own emotions in order to avoid transferring insecurities and emotional challenges to their students. Especially in teaching about controversial or uncomfortable topics, instructors need to be prepared both with regard to content and potential lines of conflict (for example, understand the historical backgrounds of racism from different perspectives) and emotions (for example, practice speaking about the topic and monitor one's own emotional reactions). In light of the high incidence of teacher burn-out in higher education [14] and education focused on emotionally challenging topics [15], participants' call to exploring how instructors can take care of themselves (and their colleages) is very timely and important.

Another important point raised during the workshop is that instructors need time and resources to develop and provide meaningful emotional scaffolding that to all students, especially since emotional reactions differ between individuals, which means that instructors may need to provide several forms of emotional scaffolding simultaneously. One possible approach to addressing these challenges could be to provide students with resources and encouragement to develop and provide emotional scaffolding strategies themselves—with and for each other. Just like we can train students to provide high-quality *cognitive peer-feedback* on problem sets and essays, we should also be able to train them to provide supportive, respectful, and stimulating *emotional peer-scaffolding*. This is another important area for future engineering education research to explore.

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