Dealing with emotions – Engineering teachers' observations of students' emotional reactions to receiving feedback on their work

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Abstract— **This work in progress short paper reports on a pilot study on engineering teachers' observations of students' emotional responses to situations in which students receive feedback on their work. Academic emotions have been a less studied phenomenon compared to the cognitive and social dimensions of teaching and learning in the field of engineering education. However, the interest in academic emotions has been growing during the past decade, as researchers and educators have started to recognize the role emotions play in students' motivation, self-efficacy beliefs and academic success.**

In this qualitative study we explored engineering educators' experiences on the emotional reactions they have observed in their students at the time students receive feedback on their work. We also asked teachers to elaborate on the emotions they could remember encountering when they were students themselves and received feedback on their work. The preliminary results revealed a variety of emotions from strongly positive to extremely negative emotional responses. We classified each emotion using Pekrun's taxonomy of emotions. As we analyzed the teachers' accounts of student emotions we noted the following aspects: 1) whether the emotion was positive or negative, and 2) whether the emotion was activating or deactivating. The preliminary results showcase both activating and deactivation positive and negative emotions.

We concluded by discussing the possible practical implication of our results to engineering teachers. The role of academic emotions in a student's wellbeing and academic success poses a need to recognize the importance of cultivating the art of giving and receiving feedback skills throughout engineering degrees. We discuss what teachers can do when planning a course as well as when providing the feedback to avoid and manage at least some unnecessary detrimental student emotions. The art of receiving feedback – and handling the emotions it might trigger – are part of students' study skills that universities should promote.

Keywords—academic emotions, student wellbeing, feedback

I. BACKGROUND AND THEORETICAL FRAMEWORK

Academic emotions are affective or emotional states that relate to studying and which students experience before, during or after a learning process [1]. The role of academic emotions in learning process has been acknowledged for decades. See e.g. self-regulated learning models summarized by [2]. However, until recent years, emotions have not been studied as much as the cognitive and social aspects of learning even though the literature suggests that academic emotions are related to components of learning such as self-efficacy beliefs (students' perception of their own ability to complete the task at hand successfully [3]), the level of stress students experience in difficult situations, and academic performance [3, 2, 4].

According to Bandura [3] emotional arousal is one of the sources of a student's self-efficacy belief. Earlier studies suggested that self-efficacy affects students' resilience, the amount of effort they invest to the task, what goals students set for themselves, and the level of stress students experience in difficult situations [3]. In addition, self-efficacy beliefs also affect academic success [5]. The study by [6] indicates that students experienced emotions that have an effect on the learning strategies that students choose to employ. The study by [4] further suggests that positive emotions students have during the course have a positive effect on the end-of-course grades. Grades then again affect students' emotional reaction. The reverse effect is true with negative emotions and negative effect on grades.

Many empirical studies have highlighted the focal role of academic emotions in learning, which suggests that engineering education researchers and teachers would also benefit from learning more about students' emotions. As we put a lot of our time and effort into developing pedagogical innovations and thinking of ways to support engineering students' learning, we should base our decisions on a holistic understanding of student learning.

In this study we utilized Pekrun's taxonomy of emotions [4] as our theoretical framework to guide our choice or research questions and data analysis phase. The taxonomy contains two dimensions: positive / negative (valence) and activating / deactivating (activation) and thus this taxonomy suggest four categories to which academic emotions can be classified: 1) positive activating emotions such as pride, 2) positive deactivation

emotions such as relaxation, 3) negative activating emotions such as anxiety or anger, and 4) negative deactivating emotions such as boredom. Each of these categories of emotions can be focused either on the activity/process or the outcome.

There are limited times and situations when university teachers get to observe their students' study process as most university level studying happens outside the teachers' immediate gaze. However, the situations in which a teacher gives feedback to students either in a classroom or in a one-to-one supervising situation are times when it is possible for the teacher to observe students' reactions. In our work, we used the definition of feedback by Hattie and Timperley [7, p 81] "*feedback is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding.*" In this study we further delimited our focus of feedback and examined the students' emotional reactions to feedback that was given by a teacher in a formal learning situation.

The art and forms of giving feedback have been studied widely (see [8] for a summary] and there are several suggestions and guidelines on how to provide constructive feedback [9, 10]. However, the art of receiving feedback is a less-studied area than academic emotions in a context of receiving feedback. Nevertheless, there have been some previous studies that provide explanations why the same feedback can provide such different reactions in students. For instance, the results by [11] suggest that students with low self-esteem are more likely than high self-esteem students to encounter negative or adverse emotions to negative feedback.

We framed our initial research questions as follows: RQ1: What emotions have engineering teachers observed their students to encounter as students receive feedback? RQ2: What emotions do engineering teachers remember having encountered as a student in situations in which they received feedback on their work?

II. PILOT STUDY

A. Data collection:

Eight engineering educators at a large research-intensive university participated in this pilot study in spring 2020. All participants were enrolled in a voluntary pedagogical training unit (3/5 ECTS[1]) that was held in the 2019-2020 academic year. One theme of the training unit related to the art of giving and receiving feedback. As a pre-task before we discussed this theme at the course, we asked all participants to elaborate in writing on two questions: 1) Think back to situations when you were a graduate/undergraduate student and got feedback on your text/course work. What emotional responses did receiving feedback awake in you? 2) Think back to situations you have observed in your students receiving feedback. What emotional responses have you observed among the students? Please add a short description of the situation/context to your answers. The pre-task was not graded beyond submitted/not submitted but it was used as a prompt for a classroom discussion. Only the answers from teachers who agreed to grant permission for their answers to be used for research purposes were included to this study. In the end, eight out of ten course participants gave their permission.

The teaching experience of the eight teachers varied from being a novice teacher to being an experienced teacher with several years' university teaching experience in one or more countries. All teachers were currently supervising master's thesis students in addition to their other teaching duties and thus had experience in giving feedback in a range of teaching and supervising situations.

In summary, we had accounts from eight teachers on their experiences and observations of academic emotions in situations when feedback was received. The accounts were mostly short ones, from a few lines to approximately 2/3 of a page.

B. Data analysis

We utilized Pekrun's taxonomy [4] of achievement emotions as the theoretical framework to guide our qualitative, theory driven content analysis. The main categories in the taxonomy (positive, pleasant emotions and negative, unpleasant emotions) also became our main categories. We divided both categories further into activating and deactivating emotions. In the actual analysis phase, we first read

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[1] The European Credit Transfer and Accumulation System (ECTS). Participants can choose whether they want to do a three or five credit version of the course.

carefully the texts the teachers had written and marked all the sentences and words that mentioned an emotional reaction to receiving feedback. Then we placed each marked emotion into Pekrun's taxonomy. The choice of whether the emotion was positive or negative was easy to make in most cases. The only exception to this was the feeling of surprise. It was not clear from the account whether this was clearly a positive emotion or a negative one. However, since the background stories that led the students to feel surprised by the feedback pointed to different expectations between the teacher and the student on the quality of the work, we interpreted being surprised as a negative emotion (although perhaps not strong negative emotion).

On the second phase of the analysis, our aim was to analyze the emotional reactions further to find out whether they related to the process of learning or the outcome. Implicit clues in the text suggested that in most cases, teachers were referring to emotional reactions that related to outcomes of the study process. However, in most cases the accounts did not provide enough explicit details for us to draw conclusions on that matter, and thus we left this part of the analysis for future work.

C. Initial results:

The initial results of the content analysis revealed a wide variety of emotional reactions in a context of receiving feedback. Positive and activating emotion included feelings of pride, being excited (expressed as feeling encouraged or inspired), and feelings of confidence. An example of a positive, activating emotion and the reasons for the emotion was elaborated nicely by one of the teachers in the following quote. *"Inspiration: A result of comprehending a far-fetched piece of feedback that led to renouncing the originally ill postulated idea and setting up a new one with a much greater understanding of the relevant concept."* Positive and deactivating emotions included feeling gratitude and relief as stated by another teacher. *"Relief: A consequence of very constructive feedback on a misunderstood concept that seemed well postulated yet yielded incomprehensible results."*

Negative and activating feelings were varied. They included emotions such as anger, frustration, shame and feelings of being upset. Negative

deactivating emotions that we found in the data included disappointment, defensiveness, and feeling condescending. Some teachers noted that students' emotional responses varied from person to person, as in the following quote. *"Some people take feedback as a challenge to improve themselves. Some people take it as personal criticism and become defensive."*

The further analysis revealed that the most often observed emotional reactions among teachers' own students (RQ1) were defensiveness/feeling the need to explain or give excuses and feeling upset or surprised. When teachers reported on their own emotional responses to receiving feedback as a student (RQ2), the most oft-remembered emotion was frustration and disappointment. Many teachers also remembered the feelings of being defensive or upset as a student.

Some teachers had elaborated a bit more about the situation in which they observed or experienced the emotional reactions. Those stories reveal how differing expectations of the quality of the work may have led to strong negative emotions. Some teachers also elaborated on how it was difficult for them as a student to receive feedback and use it to improve their work and that only later when they had matured as a person and an academic it had become easier to utilize the feedback. One teacher elaborated his/her own experiences as a student as follows. *"… during my undergraduate degree, I was not ready at all to receive feedback (whether positive or negative) and honestly did not accept it most of the time and did not take it into account for future improvement. Time (maybe just growing up) and receiving a bit more detailed feedback have helped me make my work better."*

Some teachers' own take on receiving feedback had totally changed from first being defensive, or even hostile, about receiving feedback, to the current situation in which they looked forward receiving feedback.

Another notion that emerged from the teachers' accounts was the importance of culture in understanding how students react to feedback. Some teachers compared students' reactions to feedback in different countries and cultures where they had previously worked and noted that there seemed to be clear differences in how feedback was phrased in each country/culture and how students seemed to react to feedback. Whereas in some

countries, students seemed to interpret the feedback as "an attack" or criticism of them as a person and had a low threshold to defend their viewpoint, in other cultures students seemed to accepted the feedback without expressing either emotions or a verbal appraisal of the situation. There were even cases in which students tried not to show positive emotions when their work was praised but to keep up "a stiff upper lip" as expressed in the following quote. *"A somewhat typical emotional response from a [country] student receiving very positive feedback on a course assignment: keep calm, try to show no emotion. Sometimes I feel that some students find it difficult to feel proud of their achievements or at least do not want to show it."*

The results also revealed some consequences of experienced emotions. Obviously being angry or ashamed is not a productive mental state for learning, but if these emotions are short lived they are perhaps not detrimental in a long run. However, one account in our data gave an example in which the critical feedback made the student feel disappointed and to seriously think about her/his choice of degree.

III. PRACTICAL IMPLICATIONS FOR TEACHING

Receiving feedback is a skill like any other study and work life skill that engineering students need to learn. The strong negative emotions that engineering teachers have observed in their own students and remember experiencing themselves as a student suggest that learning to receive and utilize the feedback in a meaningful way may be long and a mentally taxing process. Therefore, our next question was how could teachers make this process less stressing for students. When we provide feedback to our students, what could we do to minimize students' unproductive negative emotional reactions? Our results suggest that sometimes students feel surprised by the feedback they receive and might even feel defensive and hostile. One explanation teachers gave for this reaction was that the students' own expectations or understanding of what is regarded to be high-quality work differs from the teacher's point of view. There are couple of pedagogical choices a teacher can make to create a common understanding of the expected level of quality.

First, a well-planned course through which the intended learning outcomes (ILO, what do you expect your students to learn and at what level do you expect your students to be able to perform) and assessment are in line with each other. ILOs and assessment criteria are explicitly and clearly communicated to students at the beginning of the course. Assessment criteria can be described e.g. in the form of assessment/grading rubric to inform which aspects of the work teacher will pay attention to as s/he gives feedback or grades the assignment.

Second, providing formative feedback. I.e. the student receives feedback during the learning process on smaller sub-assignments/tasks. This way student will get some idea if s/he is working towards the expected quality of the work.

Third, promoting self-assessment / feedback. Being able to reflect on one's work and to find out what the strong / weak aspects of that work are is an important skill both from the point of view of having a realistic idea of one's performance as well promoting students' life-long learning skills. In addition, the better students are at self-assessment, the less likely it is that that the feedback provided by the teacher will come as a total surprise.

The results also revealed many negative emotions students experienced as they received feedback, such as anger, upset, and disappointment. One possible reason for such strong negative emotions is students' low self-efficacy perception. Students' self-efficacy beliefs relate to their emotional reactions during the learning process. Strengthening a student's self-efficacy beliefs about their ability to do the task at hand would consequently reduce the level of stress in difficult situations and result in more positive emotions in students. The literature [e.g. 3] suggests some ways to enhance students' perceptions of their self-efficacy such as providing students with positive mastery experiences early on during the learning process. On a practical level, this could mean small, well attainable tasks at the beginning of the course so that students get the experience of being able to tackle the course-related tasks and thus building up positive self-efficacy perceptions, which in turn will help students to feel less negative if they receive criticism on their work.

IV. FUTURE WORK

This pilot study has opened up more questions than it was able to answer. In our future work, we will take a closer look at the situations in which feedback is given and received and how the situation is interpreted by both the feedback giver and the receiver and what role does academic emotions play in these interpretations.

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