"I don't want to be influenced by emotions"—Engineering students' emotional positioning in discussions about wicked sustainability problems

Johanna Lönngren
Department of Science and Mathematics Education
Umeå University
Umeå, Sweden
ORCID: 0000-0001-9667-2044

Tom Adawi
Division of Engineering Education Research
Chalmers University of Technology
Gothenburg, Sweden
ORCID: 0000-0002-4135-8784

Maria Berge
Department of Science and Mathematics Education
Umeå University
Umeå, Sweden
ORCID: 0000-0003-3614-1692

***Abstract*— This Work-in-Progress research paper describes the results from a pilot study that aims to explore the role of emotions in engineering students' discussions about a wicked sustainability problem, i.e. a problem that is characterized by a high degree of uncertainty and ambiguity and for which it is not possible to develop a perfect solution. There is strong evidence from educational research that emotions are important for learning at all levels of education and particularly in education related to sustainability and wicked problems. At the same time, dominant discourses and stereotypes in engineering and engineering education construct engineering as purely rational and unemotional. In this study, we explore how engineering students re-construct—but also challenge—this dominant discourse in interviews about a wicked problem. We use discourse analytic tools from positioning theory to analyze how the students construct and negotiate emotional subject positions for themselves and others. The results provide illustrative examples of how emotional positioning can strengthen and/or challenge the dominant discourse: examples from the dominant discourse illustrate how students position emotions as irrelevant or even detrimental for engineering work, while examples from the counter-discourse illustrate how students sometimes construct emotions as part of what it means to be an engineer and as important for engineering work.**

Keywords*— *emotions, engineering education, wicked problems, sustainability, positioning theory

I. Introduction

Engineers play a crucial role in solving complex sustainability problems, such as climate change, resource scarcity, and social injustice [1, 2]. These problems are characterized by a high degree of uncertainty, ambiguity, and conflicts of interest and are therefore often called "wicked problems" [3]. Unfortunately, most contemporary engineering education does not adequately prepare students to address wicked problems and thus to assume professional responsibility for the societal and environmental impacts of technological development [4, 5].

Emotions play a vital role in engineering education that aims to prepare students to address wicked problems [6, 7] and in ethically responsible engineering work [8, 9]. At the same time, engineering education and practice are often described as purely rational activities [10] and there is very little research on emotions in engineering education.

This study contributes to an emerging body of research on the role of emotions in engineering education. We use positioning theory [11] to explore the role of emotions in learning to address wicked problems in engineering education. More specifically, we use the concept of *emotional positioning*, which refers to the construction and negotiation of subject positions in and through emotion(al) discourse [12], i.e. *emotional subject positions* [13]. We answer the following research question:

How do engineering students construct and negotiate emotional subject positions in discussions about wicked problems?

II. Background

Almost all of the few existing studies on emotions in engineering education have focused on emotions as individual competencies or experiences, such as empathy [14], shame [15], and frustration [16]. However, research has also suggested that expressing emotions in social contexts may play an important role in explicating personal values [17] and ethical judgment [8, 10]. Such explicit discussion of values has, in turn, been described as an important precondition for constructive and collaborative discussions about wicked problems [18]. There is therefore a need for research in engineering education that studies emotions *in and as social interaction* [19], for example from discourse analytic perspectives [20, 21]. A discursive focus is particularly important for studying the role of emotions in teaching and learning processes involving controversial topics and high levels of social interaction [22], such as discussions about wicked problems.

III. Theoretical Framework

Our starting point is that addressing wicked problems is an inherently social process and therefore needs to be studied in social interaction [18, 21]. We explore this interaction through the lens of positioning theory [11]. Positioning theory is based on social constructionist perspectives of identity and learning as constructed and negotiated in and through interaction and, therefore, offers a suitable lens for exploring emotions as discursive phenomena [12].

Positioning theory provides a practical analytic tool to study discourse through triangulation of three units of analysis—storylines, positions, and speech acts—which are often illustrated in the form of a "positioning triangle" (Fig. 1) [23, 24]. *Storylines* are collaboratively constructed narratives about what is going on in the interaction. These storylines make available certain *positions* that people can relate to in different ways. Each position is characterized by a set of rights and duties to perform certain types of *speech acts* but not others. Speech acts are understood as socially constructed meanings of actions of speech, but also non-verbal

communication, such as intonation, pausing, body movement, facial expressions, and gestures [24, 25].

In this paper, we apply the positioning triangle specifically to the analysis of emotions [12]. In the remainder of this paper, we therefore use Walton et al.'s [13] term "emotional subject positions" and we talk of "emotion-acts" rather than "speech-acts". We further differentiate between two forms of emotion-acts: We use the term "emotion discourse" to denote emotion-acts that express something *about* emotions through verbal communication, for example using words that explicitly refer to emotions, such as "happy" or "frustrated" [c.f. 26]. We use the term "emotion*al* discourse" to denote emotion-acts that express emotions through non-verbal communication, for example through verbal stress or facial expressions [c.f. 27].

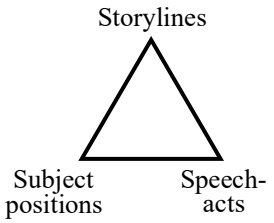

Fig. 1. The positioning triangle as described by Davies and Harré [24].

IV. Methods

We analyzed empirical material from a previous study [7] for which ten third-year engineering students were individually interviewed about how to they would address the wicked problem of water-shortage in Jordan. During the interviews, the students received a problem description and a set of solution alternatives. They were then challenged to discuss the problem from as many different perspectives as possible to fully appreciate not only the technical but also the social and environmental complexity of the problem. During the interviews, both the students and the interviewer expressed a range of emotions related to the problem and the task of addressing the problem. Each interview lasted for about one hour and was video-recorded and transcribed verbatim.

We read through the transcripts multiple times and selected all (n=26) excerpts in which students used emotion(al) discourse in talking about engineering, engineers, and/or the wicked problem. To identify these excerpts, we used Hufnagel and Kelly's [20] description of indicators of emotional expressions, which include semantics, prosody, facial expressions, gestures, and linguistic features.

In analyzing the selected excerpts, we used storylines as the primary unit of analysis because they provide the necessary narrative context within which positions and emotion-acts can be understood and described [24, 28]. Thus, we first formulated preliminary descriptions of *emotion-related storylines*. Based on these descriptions, we then developed preliminary descriptions of *emotional subject positions* in each storyline and *emotion-acts* through which the suggested storylines and positions were constructed and negotiated. If necessary, we divided excerpts into subsections with different storylines and analyzed each subsection individually. In an iterative process, we refined the descriptions by constantly comparing and triangulating across the three units of analysis [23].

V. Results

The results provide illustrative examples of how the *dominant discourse* of rationality is reconstructed, and thus perpetuated, in engineering education. The results also provide examples of how *counter-discourses* are used to construct emotions as important for engineers and engineering. In this section, we will first illustrate the in-depth analysis with one empirical extract (EXTRACT 1, TABLE II. . We then describe the overall results in terms of storylines, subject positions, and emotion-acts in dominant discourses (TABLE III. and counter-discourses (TABLE IV. and provide several empirical examples for each of the identified storylines (TABLE V. The formatting conventions for the empirical extracts are summarized in TABLE I. including both transcription conventions (e.g. for verbal stress) and analysis conventions (e.g. for indicating emotion discourse). Throughout the remainder of the paper, we use the gender-neutral singular pronoun they/them for individual students.

TABLE I. Formatting conventions for Extract 1

Formatting	Meaning
S	Student
I	Interviewer
Italics	Verbal stress
[…]	Parts of the transcript are omitted
[ ]	Text has been added for clarity or to describe non-verbal communication
Bolded	Emotion discourse (i.e. talk about emotions)
Underlined	Emotion*al* discourse (i.e. expression of emotions through, e.g., prosody or gestures)

EXTRACT 1 is taken from the end of one of the interviews. Shortly before the extract, the interviewer had asked the student to discuss the problem from the perspectives of, first, a professional engineer and, second, a local politician. The extract contains three different (but closely connected) storylines, and we have therefore divided it into three parts (lines 1-2, 3-8 and 9-15) and analyzed each part separately. In each of the three storylines, at least one emotional subject position was made available (TABLE II. . Below, we explain how emotion-acts contribute to constructing these storylines and subject positions.

EXTRACT 1:

1 S1: **How do you *want* me to** […] solve the problem? Cause *I* can say that
2 I solve it ***coldly*** [and] I can solve it ***warmly*** and I can solve it in between.
3 And since I was asked to address the problem in my professional role [as
4 an engineer] […], that's what I did. Bam! [P extends one arm and lowers
5 it in a rapid movement] And you heard me say ***exactly*** **what I was**
6 **thinking**. […] Minimize risks for human lives first. That was ***cold*** to
7 [say,] human lives **left, right, no matter, no matter, reduce lives [lost],**
8 **tap, tap, tap** [spoken quickly]. […]
9 **I don't want to be influenced [by emotions]**. I mean, everyone **turns a**
10 **deaf ear and looks away** when they see someone who's in a ***terrible***
11 situation. But the problem is also that **people who *don't* do that, they**
12 **become engrossed by […] every little *concern***. So I think that, well, I'll
13 just be this **cold**—until I'm done being **cold**. […] **I'll *take* some of my**
14 **coldness […] to solve something**. And I feel that, yeah, I **did** something,
15 **something has happened**, I **did** *something*, m*yself*.

TABLE II. Storylines and subject positions in Extract 1

Lines	Storylines (SL)	Subject positions (SP)
1-2	SL1: There are different ways of approaching a wicked problem, coldly (rationally) or warmly (emotionally).	SP1: S1 as someone who is able to do either and to consciously choose between the two approaches

Lines	Storylines (SL)	Subject positions (SP)
3-8	SL2: Engineers solve problems rationally and efficiently, using a utilitarian approach.	SP2: S1 as a rational engineer in this particular situation, but not always
9-15	SL3: A problem can be solved if you approach it rationally, but not if you approach it emotionally	SP1 (see above) SP3: "others" as people who are not able to consciously choose to approach a problem rationally and thus are unable to solve it

In lines 1-2, the words "***coldly***" and "***warmly***" are clear examples of emotion discourse. These words construct an opposition between emotional and rational approaches to problem solving in the storyline. This opposition is strengthened through the use of emotion*al* discourse: both words are spoken with verbal stress, which contributes to constructing them as belonging to a pair of opposites.

In lines 3-8, the student's use of emotion discourse constructs a focus on rationality and efficiency. For example, the expression "***exactly*** **what I was thinking**" focuses the discussion on cognition and the expressions "**cold**" and "**left, right, no matter, no matter, reduce lives [lost], tap, tap, tap**" construct a focus on rationality and efficiency. Again, emotion*al* discourse strengthens the storyline: The words "***coldly***" and "***exactly***" are spoken with verbal stress, which, respectively, constructs rationality and precision as important—and which thus strengthens the focus of the storyline on rationality. Further, the expression that starts with "**left, right, …**" is spoken in a rapid voice, which strengthens the focus on efficiency.

In lines 9-15, the student uses a lot of explicit emotion discourse to construct emotions as something that should be avoided in problem solving. They state that "**I don't want to be influenced [by emotions]**", "**people who *don't* do that [turn a deaf ear and look away], they become engrossed by (…) every little *concern***", and "**I'll *take* some of my coldness (…) to solve something**." The focus is on actions ("**solve**", "**did**") and outcomes ("**happened**") rather than emotions: the student wants to solve and do. At the same time, the expression "**turns a deaf ear and looks away**" carries negative connotations and thus constructs complete emotionlessness as undesirable. Similarly, the use of emotion(*al*) discourse in "a ***terrible*** situation" constructs empathy as generally important—if one is able to bracket this emotion during problem solving. The student constructs their own position as someone who is able to consciously choose between being empathic (i.e. recognizing that people can be in terrible situations) or rational ("**cold**").

In EXTRACT 1 as a whole, the student thus constructs an overarching storyline according to which engineers are competent problem solvers who solve problems rationally and efficiently rather than allowing themselves to be influenced by emotions. The student positions the *ideal engineer* as a highly intelligent, rational problem solver who wants to do the best for society from a utilitarian perspective. To be able to solve problems, the ideal engineer needs to bracket both their own and others' emotions and concentrate on identifying the most efficient solution for achieving a predefined aim, such as minimizing the risk of losing human lives. In contrast to the ideal engineer, the student positions *"others"* (presumably non-engineers) as reasonably intelligent, but prone to becoming overly emotional, which reduces their ability to solve problems. Finally, the student positions *themselves* by combining aspects of the two prior positions: as someone who is able to switch between acting as an engineer who is able to rationally solve problems and as an empathic and emotional human being. Thus, the student simultaneously draws on the dominant discourse—engineering as purely rational—and a counter-discourse—emotions, in this case empathy, are important for engineering work.

TABLE III. TABLE IV. summarize all storylines and subject positions for dominant and counter-discourses that were identified in the empirical material. TABLE V. provides examples of data extracts in which these storylines and subject positions are constructed in the interviews.

TABLE III. STORYLINES AND SUBJECT POSITIONS IN DOMINANT DISCOURSE (EMPIRICAL EXAMPLES IN PARENTHESIS, SEE TABLE V.)

Storylines (SL)	Subject positions (SP)
SL4: Emotions are irrelevant for engineering work. (#1, 2, 3)	SP4: Engineers as rational problem solvers (#1, 4)
SL5: Emotions are detrimental to engineering problem solving. (#1, 3)	SP5: Self as someone who, in their role as an engineer, approaches problems in a rational way (#1, 5) SP6: Others as people who are influenced by emotions (#1, 2, 4, 6, 7)

TABLE IV. STORYLINES AND SUBJECT POSITIONS IN COUNTER-DISCOURSE

Storylines (SL)	Subject positions (SP)
SL6: Emotions are important for engineering work. (#8, 9)	SP7: Self as someone who is empathetic (#9-11)
SL7: Engineers need to be able to manage others' emotions. (#6, 7)	SP6 (see above)
SL8: Certain emotions are part of what it means to be an engineer. (#12)	SP8: Self as someone who experiences these emotions (#12)

TABLE V. EMPIRICAL EXAMPLES

#	Data excerpts
1	[See Extract 1]
2	S2: "A politician experiences more "**psychological stress**" than an engineer when addressing wicked problems."
3	S7: Engineering solutions should be based on "**basic *theory***" and decisions about which solutions to implement should be based on a "***objective*** analysis of **what actually *happens***"
4	S10: Engineers' work is "**facts-based**", focusing on "cause and effect", while politicians' work involves "**a lot of *emotions***".
5	S1: Those who don't get enough water, "[without hesitation:] they'll die. […] [In a factual tone:] That's **terrible**, but it's converted into **statistics** [for the purpose of solving the problem]."
6	S7: "I *do* believe that it's possible to **calculate** what the best solution would be," but that doesn't mean it's possible to implement that solution. "You *have* to **convince** people that it [the solution] works."
7	S10: "I don't think you can simply implement such a quick change. You'd have to first test to exchange some [of the water taken from wells with water from] desalination plants […] and then you'd see that, okay, this *works*. And then people would be like, okay, **this actually doesn't seem too bad**, so now we can continue [to build more desalination plants]."

#	Data excerpts
8	S2 [Talking about engineers' responsibility in deciding between different solution alternatives]: "I'd of course try to *discuss* negative side effects [for each solution approach] **in an objective way**, but I'm sure that ***my*** **values** influence which side effects I focus on. And I don't think that's something you'd want to avoid completely. Like, if I **cared a lot about** a certain species [inaudible], then maybe I'd put some effort into highlighting [side effects that are a problem for that species] [S taps their pen on the table]."
9	S8: "***I* wouldn't want to live with** [an employee dying in an accident at a work site I'm responsible for] […]. And it doesn't matter how a ***court*** would rule, that's not the **worst** [problem]. […] The **worst** is that **you have to live your whole life knowing that someone has died** *because* I haven't made sure that all safety regulations [are followed]."
10	S3: "**It feels** a little ***harsh*** to say that *humanity* should go extinct in order to save the *climate*. […] [laughing while talking:] **I feel like** I have to defend **my** humanity, **my** people."
11	S8: "[I] ***want*** to solve the problem […], so it's **frustrating** not to be able to find a solution that doesn't have a lot of negative side effects. […] Everyone deserves **a good life** […]. I'd want to help *everyone*, [laughing while talking:] turn the world into **a better place**."
12	S4: "We [engineers] **love** to solve problems."

DISCUSSION

In this Work-in-Progress research paper, we have presented results from a pilot study that aimed to explore the role of emotions when engineering students discuss wicked problems. It should be noted that the results are preliminary and that the analysis does not cover all types of storylines and positioning that can be expected to be present in the data. Most importantly, the analysis has only focused on emotional storylines related to the student's positioning of themselves, engineers, and "others". An exhaustive treatment of the empirical material should include an analysis of how the interviewer is positioned [29]. For example, in lines 1-2, the interviewer could be said to be positioned as someone *who should tell* the student whether they should approach the given problem emotionally or rationally. Transferred to an engineering education context, such a positioning could imply that students expect instructors to specify what emotion-approach students should use for a given problem—in much the same way as instructors often are expected to specify the algorithm that students should use to solve problems in engineering education [30].

An interesting result is that students often draw on several conflicting discourses: On the one hand, they construct the ideal engineer in a way that mirrors powerful cultural stereotypes of engineers as emotionless and, sometimes, excessively rational—much like the cartoon character *Dilbert* or the Star Trek series character *Mr. Spock*. This image of the ideal engineer also matches previous descriptions in the literature, according to which engineering often is described as purely rational [8, 10]. On the other hand, the students seem to perceive these stereotypes as problematic: several students carefully position themselves as *not quite like this typical engineer*. Instead of positioning themselves as rational beings (i.e., someone who *always* is rational), they position themselves as able to choose a rational approach in order to solve a problem, but as *also* able to choose an emotional, empathetic approach. This double positioning is particularly clear in EXTRACT 1, where the student explicitly positions themselves as someone who is able to consciously *switch* between rational and emotional approaches to problem solving. As far as we know, this more nuanced emotional positioning of engineering students has not yet been reported in the literature.

Another interesting conclusion from the results is that students in this study talked about emotions in a rather *unnuanced* way. They talked about emotions as if all emotions were the same and as if they would have the same impact on problem solving. Emotions are also described in a dualistic manner as something that is either switched on or off and that can be consciously controlled. This unnuanced understanding of emotions is in stark contrast to how emotions are described in the educational research literature [31].

However, the analysis also suggests that at least some students have an intuitive understanding that emotions may be important for some aspects of engineering work, such as managing others' emotions (EXTRACTS 6, 7), deciding between different solution approaches (EXTRACT 8), encouraging professional responsibility (EXTRACT 9), and strengthening personal motivation to do good and solve problems (EXTRACTS 11, 12). These results broaden descriptions in previously literature according to which emotions are important for addressing sustainability problems [6, 7] and ethically responsible engineering work [8, 9]. -> strengthen

Some tentative implications for practice can be drawn from the results presented in this paper. First, engineering students should receive explicit teaching on the role of emotions in problem solving to allow them to develop a more nuanced understanding of emotions. To do so, engineering educators could build on the intuitive understandings that some students have of situations in which emotions are important for engineering work. Second, engineering educators should help students to develop their ability to identify and apply an appropriate emotion-approach to a given problem; students need to learn to take responsibility for how they use and communicate emotions in engineering problem solving. Third, engineering educators should involve students in discussions about common stereotypes of what an ideal engineer is; if students have a false (and slightly negative) image of the ideal engineer as someone who is unemotional, they may feel alienated from engineering and even choose to not complete their studies and/or not work as engineers after graduation.

In future research, we want to explore engineering students' emotional positioning in group discussions. Such an approach is particularly important in analyzing students' positioning in discussions about sustainability problems; addressing such problems requires discussion and collaboration among multiple stakeholders and is thus an inherently social process that should be studied in social interaction. We also expect that studying positioning in group discussions makes it possible to explore how multiple, competing storylines are constructed and negotiated, and what kinds of storylines become dominant or inferior [32].

REFERENCES

[1] Cozzens, S. and D. Thakur, *Innovation and inequality: Emerging technologies in an unequal world*. 2014: Elgar Publ.

[2] Ahmed, A. and J.A. Stein, *Science, technology and sustainable development: a world review.* World Review of Science, Technology and Sustainable Development, 2004. **1**(1): p. 5-24.

[3] Rittel, H.W. and M.W. Webber, *Dilemmas in a General Theory of Planning.* Policy Sciences, 1973. **4**: p. 155-169.

[4] Lönngren, J., *Wicked Problems in Engineering Education: Preparing Future Engineers to Work for Sustainability*. 2017, Chalmers University of Technology: Gothenburg.

[5] Seager, T., E. Selinger, and A. Wiek, *Sustainable Engineering Science for Resolving Wicked Problems.* Journal of Agricultural Environmental Ethics, 2012. **25**: p. 467-484.

[6] Lönngren, J., T. Adawi, and M. Svanström, *Scaffolding strategies in a rubric-based intervention to promote engineering students' ability to address wicked problems.* European Journal of Engineering Education, 2019. **44**(1-2): p. 196-221.

[7] Lönngren, J., Å. Ingerman, and M. Svanström, *Avoid, Control, Succumb, or Balance: Engineering Students' Approaches to a Wicked Sustainability Problem.* Research in Science Education, 2017. **47**: p. 805-831.

[8] Davis, M., *In Praise of Emotion in Engineering*, in *Philosophy and Engineering*, D. Michelfelder, B. Newberry, and Q. Zhu, Editors. 2017, Springer: Cham, CH. p. 181-194.

[9] Roeser, S., *Emotional Engineers: Toward Morally Responsible Design.* Science and Engineering Ethics, 2012. **18**: p. 103-115.

[10] Kellam, N., et al., *Exploring Emotional Trajectories of Engineering Students: A Narrative Research Approach.* International Journal of Engineering Education, 2018. **34**(6): p. 1726-1740.

[11] Harré, R. and L. van Langenhove, *Positioning Theory: Moral Contexts of Intentional Action*. 1999, Malden: Blackwell.

[12] Parrott, W.G., *Positioning and the Emotions*, in *The Self and Others: Positioning Individuals and Groups in Personal, Political, and Cultural Contexts*, R. Harré and F.M. Moghaddam, Editors. 2003, Praeger: Westport. p. 29-43.

[13] Walton, C., A. Coyle, and E. Lyons, *"There You Are Man": Men's Use of Emotion Discourses and Their Negotiation of Emotional Subject Positions*, in *The Self and Others: Positioning Individuals and Groups in Personal, Political, and Cultural Contexts*, R. Harré and F.M. Moghaddam, Editors. 2003, Praeger: Westport. p. 45-60.

[14] Walther, J., S.E. Miller, and N.W. Sochacka, *A Model of Empathy in Engineering as a Core Skill, Practice Orientation, and Professional Way of Being.* Journal of Engineering Education, 2017. **106**(1): p. 123-148.

[15] Huff, J.L., et al., *Exploring shame in engineering education*, in *2016 IEEE Frontiers in Education Conference (FIE),*. 2016: Erie, PA, USA.

[16] Estrada, T. and S.A. Atwood, *Factors that affect student frustration level in introductory laboratory experiences*, in *119th ASEE Annual Conference & Exhibition*. 2012, American Society for Engineering Education: San Antonio.

[17] Ojala, M., *Emotional Awareness: On the Importance of Including Emotional Aspects in Education for Sustainable Development (ESD).* Journal of Education for Sustainable Development, 2013. **7**(2): p. 167-182.

[18] Ison, R.L., K.B. Collins, and P.J. Wallis, *Institutionalising social learning: Towards systemic and adaptive governance.* Environmental Science and Policy, 2015. **53**: p. 105-117.

[19] Zembylas, M., *The Power and Politics of Emotions in Teaching*, in *Emotion in Education*, P.A. Schutz and R. Pekrun, Editors. 2007, Academic Press: Cambridge. p. 293-309.

[20] Hufnagel, E. and G.J. Kelly, *Examining emotional expressions in discourse: methodological considerations.* Cultural Studies of Science Education, 2018. **13**: p. 905-924.

[21] Lester, J., *Exploring the Borders of Cognitive and Discursive Psychology: A Methodological Reconceptualization of Cognition and Discourse.* Journal of Cognitive Education and Psychology, 2011. **10**(3): p. 280-293.

[22] Bossér, U. and M. Lindahl, *Students' Positioning in the Classroom: a Study of Teacher-Student Interactions in a Socioscientific Issue Context.* Research in Science Education, 2019. **49**: p. 371-390.

[23] Warren, Z. and F.M. Moghaddam, *Positioning Theory and Social Justice*, in *The Oxford Handbook of Social Psychology and Social Justice*, P.L. Hammack Jr., Editor. 2018, Oxford University Press: New York. p. 1-24.

[24] Davies, B. and R. Harré, *Positioning: The Discursive Production of Selves.* Journal for the theory of social behaviour, 1990. **20**(1): p. 43-63.

[25] Kayi-Aydar, H. and E.R. Miller, *Positioning in classroom discourse studies: a state-of-the-art review.* Classroom Discourse, 2018. **9**(2): p. 79-94.

[26] Edwards, D., *Emotion Discourse.* Culture & Psychology, 1999. **55**(3): p. 271-291.

[27] Glazer, W.P., *The Language of Emotion*, in *Graduate School of Arts and Sciences*. 2016, Georgetown University: Washington, DC.

[28] Harré, R., et al., *Recent Advances in Positioning Theory.* Theory & Psychology, 2009. **19**(1): p. 5-31.

[29] Ritchie, M. and D.L. Rigano, *Researcher–participant positioning in classroom research.* International Journal of Qualitative Studies in Education, 2001. **14**(6): p. 741-756.

[30] Wedelin, D., et al., *Investigating and developing engineering students' mathematical modelling and problem-solving skills.* European Journal of Engineering Education, 2015. **40**(5): p. 557-572.

[31] Pekrun, R. and L. Linnenbrink-Garcia, *International Handbook of Emotions in Education*. 2014, New York: Routledge.

[32] Berge, M., A. Danielsson, and M. Lidar, *Storylines in the physics teaching content of an upper secondary school classroom.* Research in Science & Technology Education, 2019. **0**(0): p. 1-22.