Emotions in software practice: presentation vs. coding

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***Abstract*— Nowadays, one of the most relevant, necessary and essential professional activities is software development. Software practitioners assume a very demanding task presenting important challenges. The aim of the present study is to find out how future software practitioners deal emotionally with two important tasks in their professional life: coding and presentation. To achieve this goal, 47 participants were asked about the emotions they experience in the selected tasks. To collect emotions, the Discrete Emotions Questionnaire was applied. The questionnaire covers eight emotions: anger, disgust, fear, anxiety, sadness, happiness, relaxation, and desire. These eight emotions are divided into four emotion words, which designate different level of intensity. All emotions are self-assessed by means of a Likert Scale. The results show differences in emotions between the two tasks, for instance: the importance of emotions like Anxiety and Nervousness in the case of presentations and Satisfaction and Enjoyment in the case of coding.**

Keywords— software engineering, software practitioners, emotions, presentation tasks, coding tasks, Discrete Emotions Questionnaire, exploratory study.

I. INTRODUCTION

Software engineering practice is highly dependent on intellectual capital, given that software work is an intellectual activity [1]. Human aspects in software practice are, as a consequence of this, of paramount importance [2]. Given that human behavior is highly influenced by emotions, these experiences also play a crucial role in software engineering. Software practitioners experience a wide range of emotions [3]. These emotions are both positive and negative in the variety of tasks software workers are facing in their everyday activities. Emotion received a panoply of definitions due to the lack of consensus on the definition of the term. In an etymological way, 'emotion' is coming from the Latin *emovere*, which means "to move away" from [4]. Merriam-Webster dictionary defines emotion as a conscious mental reaction subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body. Emotions present valence and intensity [5] that need to be assessed.

Positive and negative emotions have an influence in software artifacts produced by practitioners [6], although, according to [7], restricted research has been conducted on the role of emotions on software developers' productivity. In the last years, workshops like *SEmotion* and its side activities are influencing community to perform research in the topic producing a new set of published works in this topic.

Taking this lead, in this paper, authors present a prospective study on the different kind of emotions software engineers report in two different activities: performing presentations and coding. These two activities are just some of the panoply of tasks software professionals must face. However, the selection of these two activities is not trivial. While coding is normally linked to software engineers in the stereotyped view of their activity [8], presentations are not normally associated with software work. However, according to SWEBOK [9], the software engineer's ability to convey concepts in an effective way in a presentation positively influences product acceptance, management, and customer support. It also presents positive effects on the ability of stakeholders to comprehend and assist in the product effort. Literature reported that software practitioners generally feel nervous and anxious when performing presentations [10]. The aim of this paper is twofold. Firstly, to investigate the set of emotions that software engineers face in presentation and coding considering also their intensity. Secondly, compare results among these two activities and analyze results at large. To our knowledge, this is the first study of emotions in different tasks for software engineers. Based on the findings, initial conclusions can be drawn, yet more research is needed to fully understand the differences in emotions on these two tasks.

Given that the aim of this paper is the measurement of emotions, it is needed to adopt an artefact to measure emotions. Authors choose to use an approach based on self-reported emotions. The set of initiatives to support such way of evaluation are summarized in the next lines. Maybe the most reported and employed instrument developed in the literature is the Positive and Negative Affect Scale (PANAS) [11]. The method presents, according to literature, several caveats, including limited validity in several contexts, lack of observance of cultural differences and omission of emotions like bad or joy [7], [12], naming just some of the most reported limitations. Other newer and more elaborated approaches are the Scale of Positive and Negative Experience (SPANE) [13], the Job Emotions Scale (JES) [14] or the Discrete Emotions Questionnaire [12]. Focusing on the latter, this was published back in 2016 and validated in different scenarios. It is sensitive to eight distinct state emotions, namely, anger, disgust, fear, anxiety, sadness, happiness, relaxation, and desire. Authors chose this instrument due to its novelty and robustness, but also because it was not used before in software engineering studies.

In this paper, authors present the study conducted among students in the last course of computing studies. In the reminder of the paper, authors describe the experimental setup (Section II) including the description of the artefacts adopted, the process, the sample and the presentation of results. This section ends with the discussion of our findings

and the threats of validity. Section III wraps up the paper and proposes future work.

II. The Study

This research aims to understand the different emotions expressed by subjects in two different situations: coding and performing presentations. In this section, the design of the study is described along the data collection, data sampling and results are also outlined. The section ends with a discussion presenting results obtained comparing them with relevant literature on the topic and finally, main threats of validity are presented and analyzed.

A. Design

As stated before, the artefact used to collect emotions is the Discrete Emotions Questionnaire [12]. The questionnaire covers eight emotions: anger, disgust, fear, anxiety, sadness, happiness, relaxation, and desire. All emotions are self-assessed by means of a Likert Scale with the following values: 1: Not at all; 2: Slightly; 3: Somewhat; 4: Moderately; 5: Quite a bit; 6: Very much; 7: An extreme amount. From the set of eight high level emotions included, four different low level emotions for each high level emotion are assessed, presenting a set of emotions as presented in Table I:

TABLE I. Self Reporting Emotions

Anger	Anger	**Sadness**	Sad
	Rage		Grief
	Mad		Lonely
	Pissed Off		Empty
Disgust	Grossed out	**Relaxation**	Easygoing
	Nausea		Chilled out
	Sickened		Calm
	Revulsion		Relaxation
Fear	Terror	**Happiness**	Happy
	Scared		Satisfaction
	Panic		Enjoyment
	Fear		Liking
Anxiety	Dread	**Desire**	Wanting
	Anxiety		Desire
	Nervous		Craving
	Worry		Longing

The questionnaire presents emotions in Table 1 and asks participants to code their answers with regards to two different situations: coding and performing presentations.

Participants were assisted on site by researchers who gave them all the directives required to fill out the questionnaires. Authors underline that questionnaire was anonymous.

B. Sample

The sample consists of a set of 47 subjects. Subjects were students in their last year of studies in Computing at Østfold University College (Norway). The average age was 23.06 years old and there is a standard deviation of 2.047 years. With regards to demographic characteristics, the sample included 10 women (21.28%) and 37 men (78.72%). Literature reported traditionally a gender imbalance as a particular feature of computing students population [15], and as a consequence, in professional spheres too. The sample is coherent with the imbalance that is present in the career intentions, career choice and career persistence and advancement stages [16]. All questionnaires were considered valid.

C. Results and Discussion

In this section, authors will go through the results also considering analysis developed from the questionnaire. The authors present basic data and present statistical methods to compare emotions showed up in the two analyzed tasks.

Table II presents mean and standard deviations of the different emotions for both tasks:

TABLE II. Descriptive statistics low level emotions

	Presentation		**Coding**	
	Mean	***Std. Dev.***	***Mean***	***Std. Dev.***
Anger	1.94	1.673	2.72	1.838
Rage	1.77	1.618	2.66	1.926
Mad	1.77	1.618	2.49	1.852
Pissed Off	2.04	1.841	2.47	1.718
Grossed out	2.04	1.769	1.64	1.326
Nausea	1.57	1.118	1.60	1.296
Sickened	2.09	.928	1.49	1.266
Revulsion	1.55	1.451	1.49	1.177
Terror	1.64	1.725	1.64	1.358
Scared	2.06	1.866	1.66	1.290
Panic	2.89	2.046	2.11	1.697
Fear	2.81	1.872	1.94	1.552
Dread	2.28	1.651	1.81	1.345
Anxiety	3.43	2.061	2.09	1.692
Nervous	4.04	2.000	2.21	1.731
Worry	2.91	1.954	2.30	1.793
Sad	1.51	1.283	1.85	1.588
Grief	1.53	1.231	1.64	1.374
Lonely	1.38	.990	1.98	1.622
Empty	1.60	1.313	1.79	1.413
Easygoing	2.15	1.503	2.70	1.488
Chilled out	2.43	1.638	3.00	1.489
Calm	2.66	1.578	3.06	1.621
Relaxation	2.36	1.495	2.96	1.668
Happy	2.43	1.638	3.00	1.694
Satisfaction	2.98	1.687	3.30	1.852
Enjoyment	2.68	1.708	3.19	1.728
Liking	2.70	1.756	3.17	1.761
Wanting	2.09	1.586	2.62	1.824
Desire	2.06	1.634	2.43	1.665
Craving	1.96	1.560	2.30	1.667
Longing	1.89	1.577	2.34	1.710

A first review of the results shows differences in emotions between the two tasks. While in presentation mean higher values are Anxiety (3.43) and Nervous (4.04), when it comes to coding, higher values are Satisfaction (3.30) and Enjoyment (3.19). Lower values are in the first case for Lonely (1.38) and Revulsion (1.55) and, with regards to the second, to Revulsion and Sickened (1.49) and, finally, Nausea (1.60).

We notice that the pattern of both tasks are emotionally different: while presentation tasks are associated with negative feelings such as anxiety and nervousness experiences in higher scores; coding activities are associated with positive feelings such as satisfaction and enjoyment in higher scores. In fact, the coding activities represent an activity so positive for our students, that even the lower scores are for very negative feelings such as to be sickened or to feel revulsion. Nevertheless, it's also interesting to mention that in presentation tasks, another negative feeling

such as Anger is relatively absent with a moderate mean (1.94).

Therefore, those emotion words which illustrate better participants' feelings in both tasks are really different: our future practitioners describe presentation tasks like hard challenges in which they feel anxiety, and by contrast, they feel satisfaction when they have to deal with coding tasks.

In sum, the participants associate presentation task with negative emotions such as anxiety and nervousness, and by contrast, they associate coding activity with positive emotions such as satisfaction and enjoyment.

Overall, one can note that self-reporting emotions in coding are a bit more intense than in presentations. We also notice that coding tasks receive higher scores in eighteen of the thirty two emotion words, which represent more than fifty percent of the whole items. Probably it means that coding tasks inspire to our participants more intense feelings. But these feelings are not only intense, but also positive: for instance, some positive emotion words such as chilled out (3.00), calm (3.06) and happy (3.00) whose means are one of the highest in both tasks, illustrates again that coding tasks are described like a more positive experience than coding activities. However, it is also true that, in general, values are quite low in all cases hardly reaching 3 points in a scale of 7.

Authors wanted to investigate which emotions present statistical differences between tasks. In order to do so, authors performed a Paired Samples Student t-test to compare emotions in both tasks. Results show significant differences in a number of emotions, according to results presented in Table III:

TABLE III. STUDENT T-TEST SIGNIFICANT DIFFERENCES IN PRESENTATION AND CODING TASKS

Anger (t(46)= -2,551, p < .05)
Rage (t(46)= -3,093, p < .05)
Nausea (t(46)= 2,278, p < .05)
Scared (t(46)= 4,118, p < .05)
Panic (t(46)= 2,656, p < .05)
Fear (t(46)= 2,804, p < .05)
Dread (t(46)= 2,180, p < .05)
Anxiety (t(46)= 4,379, p < .05)
Nervous (t(46)= 5,754, p < .05)
Worry (t(46)= 2,132, p < .05)
Lonely (t(46)= -2,282, p < .05)

These tests are consistent with previous reported values showing negative results for important and higher values in the case of coding and positive results for the other case.

These differences indicate that the participants feel more anger and rage in coding activities; On the other hand, they feel more nausea, scared, panic, worry, dread and fear in presentation task, as well as feeling more anxious and nervous. Finally, they feel lonely in a coding task because in many cases it represents an individual and lonely activity.

These results are interesting because although coding tasks represent a very satisfactory challenge, participants feel more anger and rage than in presentation activities.

Once again, it can be argued that although there is no significant differences in satisfaction between both tasks (Satisfaction (t(46)=-.812, p>.05)), coding activity is less "emotionally demanding" for participants than presentation activity. This is because the emotions associated with fear in presentation tasks, such as scared or panic, anxiety or nervous, show higher scores--which represent the significant differences mentioned-- than coding tasks.

The last set of tests will be performed aggregating (averaging results of) low level emotions in higher level emotions, leading to just eight different emotions. To do so, authors coded all low level emotions as correspondent high level emotions and performed the same set of tests presented before. Table IV presents mean and standard deviations of the different high level emotions for both tasks:

TABLE IV. DESCRIPTIVE STATISTICS HIGH LEVEL EMOTIONS

	Presentation		**Coding**	
	Mean	***Std. Dev.***	***Mean***	***Std. Dev.***
Anger	1.95	1.717	2.59	1.823
Disgust	1.71	1.297	1.55	1.259
Fear	2.61	1.894	1.84	1.484
Anxiety	3.16	2.016	2.11	1.647
Sadness	1.51	1.204	1.81	1.496
Relaxation	2.40	1.553	2.93	1.562
Happiness	2.70	1.696	3.19	1.747
Desire	2.00	1.579	2.44	1.709

As happened before, a first review of the results shows differences in emotions between the two tasks in the case of high level emotions. While in presentation mean, higher values are Anxiety (3.16), Happyness (2.70) and Fear (2.61), when it comes to coding, higher values are Happiness (3.19), Relaxation (2.93) and Anger (2.59). Lower values are in the first case for Sadness (1.51) and Disgust (1.71) and, with regards to the second to Disgust (1.55) and Sadness (1.81). Overall, one can note that self-reporting emotions in coding are a bit higher than in presentations. Results are consistent with previous table.

In presentation, there is a high trend towards high level Anxiety (and its operativization in Lower Level Emotions as Anxiety or Nervous) or fear. There is a need to analyze the roots of these emotions from a general viewpoint, controlling variables like preparation and self-stem.

However, it is also true that the gathering of low level emotions into high level emotions is revealing that the second most intense emotion while performing presentations is Happiness. This aspect is showing up the fact that some of the students really enjoy presentation tasks. This finding indicates that, although doing a presentation is a task that could lead to anxiety, at the same time represents a happy experience especially when the result is positive. In fact, there is no statistical differences between both presentation and coding tasks neither in happiness nor in satisfaction (in low level emotions tests):

Happy (t 46)=-1.684, p > .05)

Satisfaction (t (46)=-.812, p > .05)

A similar phenomenon is also present in the case of coding. After emotions like happiness and relaxation, the third emotion in intensity is Anger. Previous but preliminary research [3] showed the importance of Anger feelings for Software Engineers in job settings. The intensity of this self-reported emotion leads to a call for more work on the topic. Following this reasoning, authors understand that it is necessary to deeply assess the role of intense negative

emotions in software practice such as Anger and "frustration", which is an emotion word absent in this chosen list. Frustration was the most reported negative emotion in a previous study by Wrobel [17]. In the same study, this author points at anger as the second most reported negative emotion by software practitioners. Authors underline the need to investigate the effects of the use of a specific emotion measurement scale in results and their interpretation. Given that frustration was not among the list of emotions in the Discrete Emotions Questionnaire, authors believe that, although more research is needed, there must be a connection between frustration and anger in the responses provided by subjects.

Nevertheless, it is interesting to analyze the role of anger and frustration in software engineers' job processes with more detail. A first conclusion can be that a high satisfactory activity such as coding, with high scores in happiness and relaxation, is compatible with emotions such as anger, because although we are enjoying from a certain activity, we may feel anger and frustration too.

With regards to satisfaction in the case of coding, this low level emotion is the one reported as being more intense. Recent work on satisfaction of software engineers [18] underline the need to conduct more studies on the topic and this is consistent with our result too. In [18] authors are not connecting specific tasks to practitioners' satisfaction, however, we believe there is a need to conduct research on the topic to specifically address and shed some light to this connection.

Finally, authors investigated gender differences in the perception of different emotions and their aspects. Authors want to underline the misbalance in the sample among genders presenting a Pareto distribution as described earlier in the paper. This, together with the small feminine sample along with the differences between samples lead to difficulties in the generalization of results and their overall validity. However, authors consider the study of the eventual differences worthy. Table 5 shows main descriptive statistics on low level emotions by gender:

TABLE V. DESCRIPTIVE STATISTICS ON LOW LEVEL EMOTIONS BY GENDER

	Presentation				**Coding**			
	Mean		***Std. Dev.***		***Mean***		***Std. Dev.***	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Anger	2.14	1.20	1.813	.632	2.73	2.70	1.790	2.111
Rage	1.92	1.20	1.770	.632	2.70	2.50	1.884	2.173
Mad	2.27	1.20	2.009	.422	2.59	2.10	1.817	2.025
Pissed Off	2.30	1.10	1.913	.316	2.73	1.50	1.805	.850
Grossed out	1.68	1.20	1.203	.632	1.76	1.20	1.442	.632
Nausea	2.11	2.00	1.449	2.000	1.70	1.20	1.412	.632
Sickened	1.62	1.30	.924	.949	1.62	1.00	1.401	.000
Revulsion	1.73	1.30	1.557	.949	1.62	1.00	1.299	.000
Terror	1.92	2.60	1.460	2.503	1.78	1.10	1.493	.316
Scared	2.68	2.70	1.796	2.214	1.70	1.50	1.351	1.080
Panic	2.86	3.00	1.960	2.449	2.14	2.00	1.782	1.414
Fear	2.95	2.30	1.825	2.058	1.97	1.80	1.658	1.135
Dread	2.35	2.00	1.567	2.000	1.95	1.30	1.413	.949
Anxiety	3.51	3.10	1.924	2.601	2.30	1.30	1.793	.949
Nervous	4.11	3.80	1.983	2.150	2.24	2.10	1.739	1.792
Worry	3.05	2.40	1.870	2.271	2.30	2.30	1.793	1.889
Sad	1.49	1.60	1.283	1.350	1.81	2.00	1.596	1.633
Grief	1.57	1.40	1.324	.843	1.70	1.40	1.412	1.265
Lonely	1.41	1.30	1.013	.949	2.00	1.90	1.667	1.524
Empty	1.49	2.00	.989	2.160	1.81	1.70	1.450	1.337
Easygoing	2.11	2.30	1.430	1.829	2.92	1.90	1.498	1.197
Chilled out	2.46	2.30	1.693	1.494	3.11	2.60	1.449	1.647
Calm	2.68	2.60	1.651	1.350	3.14	2.80	1.512	2.044
Relaxation	2.41	2.20	1.607	1.033	3.03	2.70	1.462	2.359
Happy	2.41	2.50	1.691	1.509	3.08	2.70	1.534	2.263
Satisfaction	2.95	3.10	1.615	2.065	3.49	2.60	1.693	2.319
Enjoyment	2.62	2.90	1.689	1.853	3.27	2.90	1.575	2.283
Liking	2.68	2.80	1.780	1.751	3.22	3.00	1.601	2.357
Wanting	2.11	2.00	1.505	1.944	2.65	2.50	1.767	2.121
Desire	2.08	2.00	1.570	1.944	2.62	1.70	1.754	1.059
Craving	1.95	2.00	1.471	1.944	2.43	1.80	1.757	1.229
Longing	1.86	2.00	1.494	1.944	2.46	1.773	1.90	1.449

At first look in both cases emotions reported by male students are, in average, higher in both cases, however, they are even more significant in coding task. In fact, in coding tasks, the male participants reported higher scores in all the emotion words, with the exception of Worry (in which both means are the same (M=2.30)), and Sad, but in this case, there is no significant differences between both genders ($t(46)=-.331$, $p>.05$). Therefore, male students reported more intense feelings than women associated with coding activities. On the other hand, in presentation tasks, male also reported higher scores in almost 60 percent of the emotion words. Therefore, a first conclusion can be that, male students feel more intense emotions in both tasks, especially in coding activities.

Regarding less intense emotions reported by male students in presentation tasks, one can find lonely (1.41), Sad (1.49) and Empty (1.49) while in coding less intense emotions are Sickened and Revulsion (1.62). On the women side and in presentations, Pissed Off (1.1) is the less intense emotion followed by Grossed out, Mad, Rage and Anger (1.2). While for coding, one can find Sickened and Revulsion (1) followed by Terror (1.1).

These results reveal that both sexes coincide, considering the task of coding as an activity that does not generate rejection, therefore, their scores in emotions such as sickened and revulsion are scanty. By contrary, in presentation tasks, while in women, this kinds of tasks are scanty associated with rage, anger or pissed off, for male participants these tasks are not considered as lonely or sad. Therefore, the emotional association in both sexes is different in presentation tasks.

In general, results are aligned with previous outcomes although different top ranked emotions are changed.

With regards to more intense emotions, in the male side and in presentations the most intense values are for Nervous (4.11) and Anxiety (3.51) while in coding one can find Satisfaction (3.49) and Enjoyment (3.27). For female students Nervous (3.8) and Satisfaction (3.1) are the top values in presentations while Liking (3), Enjoyment (2.9) and Calm (2.8) are the most intense emotions while coding.

These findings reveal that both sexes associate nervousness and anxiety with presentation tasks. In the case of women, although this represents an activity highly anxious, they feel also satisfaction. Regarding to coding activities, both sexes describe this task very positively, scoring high in emotion words such as satisfaction, enjoyment and liking.

Regarding variances in presentation, significant differences are present in a number of low level emotions according to the Student t Test. Although reliability of results in Student t Test or Welch test is reached when n=30 for each data sample [19], authors believe this test could help in the understanding of differences between genders in this

case. Given the set of variables to test in the experiment, there are different situations in the analysis of the variance of the sample. In the case of significant difference in the variances of the two groups, then an unpaired, two tailed t-test with Welch's correction was used, and in the rest of the cases, a two tailed t-test was applied. In presentation tasks significant differences between genders are present in these emotions:

Anger ($t(46)= 2.605$, $p < .05$)

Rage ($t(46)= 2.036$, $p < .05$)

Mad ($t(46)= 3.005$, $p < .05$)

Pissed Off ($t(46)= 3.628$, $p < .05$)

In all the four cases, these emotions present higher values in the case of male students, being consequent with the higher values present in the masculine side. It is also worth to note that, all emotions are negative emotions meaning that, for male students the perceptions of these negative emotions are higher than the ones by female students in a significant manner. Sample is not presenting significant differences in positive emotions in presentation tasks.

Therefore, these results demonstrate that males feel more anger, rage or piss off than women participants in presentation tasks; but regarding to the rest of the emotional states, there are not significant differences.

With regards to coding tasks, significant differences between groups can be found in these emotions:

Pissed Off ($t(46)= 3.072$, $p < .05$)

Sickened ($t(46)= 2.698$, $p < .05$)

Revulsion ($t(46)= 2.912$, $p < .05$)

Terror ($t(46)= 2.580$, $p < .05$)

Anxiety ($t(46)= 2.371$, $p < .05$)

Desire ($t(46)= 2.085$, $p < .05$)

As before, among these emotions, all of the mean values are higher in the case of men participants. In fact, all of them are negative emotions, with the exception of Desire. Does that mean that males associate coding activity with negative emotional experiences? Not in a strict sense, because in coding tasks, in the majority of items—negative and positive-- male participants score higher than women (with the exception of worry and sad). But it is true that males feel more pissed off or anxious than women in these kinds of activities. Why? Probably because these kinds of activities are emotionally quite demanding, in which emotions such as anger and frustration are very present in engineers' emotional responses. And these results reveal that probably male engineers feel these emotions more intensely than women. However this possible conclusion needs more future research.

However, it is also worth to note that, in this set of negative experiences there is a positive emotion: Desire. The connection of this emotion with coding tasks is quite surprising for authors. It is worth to note that also surprisingly, mean values of this emotion are, for both groups reaching at least 2. In the case of coding, and for men, this reaches 2.62. Authors would like to devote time to investigate the connection between desire and coding in deep. An initial hypothesis to explain these results could be the general perception of coding as a task to be done in isolate settings combined with the average age of the sample.

In this sense, authors think that such situation, that is, an isolate setting in which young people who love technology are completely free, represents a situation in which they can develop personal, creative and unique codifications, that in many cases, the results are successful. Nevertheless, it is necessary to continue investigating these hypothetical and interesting relationships between desire and coding activities.

Finally, it is interesting to mention that just one emotion is present in both tasks: Pissed off. Once again, authors argue that due to demanding nature of both tasks, an emotional consequence is to feel anger, frustrated or pissed off, but these emotional experiences are apparently higher in males. Nevertheless, to confirm this argument it is necessary to carry out more research.

To end, given that this is the first study in which the Discrete Emotions Questionnaire is used in Software Engineering scenarios, authors are unable to perform comparisons with relevant literature on the topic given the lack of clear correspondence of emotions among constructs.

D. Threats of validity

Authors concentrate in two of the most important threats to validity: namely, internal and external. With regards to the first aspect, subjects, as students present a comparable level of knowledge or expertise in the tests. However, to ensure a similar level of knowledge among participants, a previous formal study to ensure this aspect must be developed. Apart from that and as stated before, there is a general discussion in academia on the appropriateness of students as subjects in studies.

Regarding external validity, it is concerned with the generalizability of research findings to and across populations of participants and settings, where, several threats are present. The first is the limited number of subjects, which complicates generalization of the results. The second is subject representativeness, given that the sample was not taken randomly and it is not covering practitioners, just students. However, recent literature on the topic underlines the fact that students as subjects can be seen as a valid simplification of reality needed in experiments [20]. In the case reported in this paper, students are in their last year of studies, however, it was not possible to filter students with regards to their previous working experience.

Elaborating more on external validity, authors sampled participants from the Project Management course at Østfold University College. Agreeing with [21], the generalization of results to software practitioners might pose a threat of interaction of selection and treatment. So, there is a need to investigate to which extent results can be also applicable to other individuals with different characteristics, although, as stated before, the representability of students in studies have been backed up by recent literature on the topic. Moreover, regarding the Interaction of Setting and Treatment, one can question the impact of the setting of the experiment in the results. Presentation is a task connected with the course (Project Management), but coding is not directly connected, although in the same year and in the same days, students are exposed to programming tasks. Apart from that, both tasks are non-real-world tasks.

III. Conclusions and Outlook

In this paper, authors present a preliminary study on self-reported emotions among software engineering students. These emotions are reported by means of the Discrete Emotions Questionnaire with regards to two kinds of tasks: performing presentations and coding. Results show the importance of emotions like Anxiety and Nervous in the case of presentations and Satisfaction and Enjoyment in the case of coding. However, the importance of Happiness in the case of presentation and Anger in the case of coding is remarkable. These last findings reveal some aspects: firstly, both the tasks, that is, presentation and coding, are judged as important activities because they are described with intense emotion words. Secondly, although presentation task is assessed as an anxious activity, the participants emphasize the positive experience when they manage to present successfully. As a consequence, it is important to underline the importance of the development of public speaking skills in our future practitioners. In addition, authors aim to develop more studies focusing on the role of negative intense emotions such as anger, rage or frustration in software practice, to minimize its negative effects in software development.

The aim of this study is exploratory and this nature is paving the way for a set of future works on the topic. In first term, it is aimed to perform research on the impact of specific emotions on performance. Furthermore, isolating factors like working climate can be achieved. In second term, it is aimed to expand the sample in terms of volume but also with regards to its composition in order to investigate cultural and gender differences and also to alleviate threats of validity. Third, it is aimed to conduct a long-term study of the evolution of emotions in a wide timeframe covering several stages of the professional career of software workers. Authors want to investigate also the evolution of emotions throughout the working life of software professionals following the path followed by Wrobel [18]. Authors assume the threats of validity rooted in the selection of students as sample and as a consequence of that, they are willing to conduct more research including in the sample professionals in different career stages to compare their emotions. It is also aimed to study specific emotions and its connection with performance, for instance, Anger and Satisfaction. Finally, authors aim at investigating coding in more detail, particularizing studies to specific aspects inside coding like debugging, tuning, documentation, inspections, technical reviews… This specific study can lead to conclusions to underline tasks associated with negative and positive emotions.

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