

Sentiment Analysis of a Student Q&A Board for Computer Science

Jihie KIM, Erin SHAW, Saul WYNER, and Taehwan KIM
University Of Southern California/ Information Sciences Institute
4676 Admiralty Way, Marina del Rey, CA 90292 USA

Abstract. Students' emotions and attitudes are discernible in messages posted to online question and answer boards. Understanding student sentiment may help instructors identify students with low confidence or high frustration, optimize help-seeking, and potentially improve performance. Towards this end, we present a set emotion speech acts that were used by students in a university-level computer science course to express certainty and uncertainty, frustration, tension, and politeness in an online Q&A board. An analysis of the dataset by gender and roles is given.

Keywords. Sentiment Analysis, Emotion Annotation, Online Discussion

Introduction

Online discussion boards are widely used in higher education, extending the availability of instructors, assistants, and materials to students beyond the traditional classroom. Students use discussion forums to collaborate, exchange information, and seek answers to problems from their instructors and classmates. Discussion board use is generally associated with improved academic performance and greater student satisfaction [2,3]

In this paper we present a set of dialogue features, or *emotion acts*, that characterize student sentiment with respect to 1) tension and frustration, 2) certainty/confidence and 3) politeness. These sentiments were exhibited by students using a question and answer board in an undergraduate computer science course. A discussion corpus consisting of almost 1,179 student messages was labeled with the new emotion acts.

Our previous work on analyzing student discussions has been based on rhetorical speech acts, course topics, and problem tasks [1,5], and classification systems for these features enable us to automatically identify student problems. Similarly, understanding student sentiment may help instructors identify students with low confidence or high frustration, optimize help-seeking, and potentially improve performance. In subsequent analysis of the corpus, we look for interesting patterns in both student-student and instructor-student interactions. E.g., we found that female students use more polite expressions and show less 'tension' toward instructors than male students.

1. Emotion annotation

It is extremely difficult to devise a category of emotion labels given the gradations and subtlety of the way emotion is expressed in language. It is not surprising then that there is no general agreement on how to label emotional content and that instead there exist a number of different labeling schemes for different domains [4].

Emotion coding is an iterative process. We began with the desire to identify students' self-efficacy and attitudes. Confidence, interest and mastery begot urgency, understanding and technicality as an approach to measuring academically pertinent characteristics of messages. We were interested in the orthogonal dimensions of humor and politeness as well. Our most recent survey focuses on certainty/confidence, frustration, with respect to *something*, and tension, with respect to *someone*.

2. Emotion acts (EAs)

Two annotators worked together with four other project members for over two months to define the final emotion acts, and to label a dataset of 1,179 messages in 240 threads. Table 1 describes the set of emotion labels for coding student messages.

Table 1. Types and examples of emotion acts (EAs).

Tension	Examples
Instructor Judgments: Possible student issues with class attendance, judgment or choices	If you really want to do this; I stated in class on at least 2 occasions
Student Judgments: Possible student issues with questioner or target	Result of this sucks; Wow... That was..
Frustration	Examples
Repetitious Actions, Continual Actions: Descriptions of continuous actions without real progress	A lot (15+ times); Never seems to end; High rate of redundancy; Another can of worms
Large Quantities: Descriptions of overwhelming amounts of work and other material	Zillions of references; Super-huge; Simply gargantuan; Monstrous, super-verbose
Difficulty/Impassability, Material Denigration: Statements of explicit difficulty in either solution or understanding of issues, as well as frustration about the material itself	Serious disk quota problems; Severe annoyances; A pain to fix; Makes it really hard
Self-Denigration/Lack of Confidence: Declarations of a personal belief in a lack of ability on the part of the poster	I have spent FAR too long; ...I'm stumped; Longer than they should have
High Certainty	Examples
Specificity of Question/Answer: Specific phrasing that concisely explains through examples and pre-conditions	The only way; I found the answer; It only appears
Ease of Understanding/Completeness: Emphasis of the simplicity or completeness of a solution or question	The trick is; Just wait till; Will be simple; All you need to do is
Necessity: Specifically stating that the presented solution is required, or in the case of a question, its importance	Must be able to; Vitally important task; Must have something; You will
Logical Presentation: A method of presenting a proposition, solution, or question that makes it a logical proposal	I assume that; Granted.; Likewise.; On the other hand,
Low Certainty	Examples
Vagueness in Question/Answer: Statements that imply only general or surface understanding of the material at hand by stating personal understandings over factual presentation	What is wrong?; If I understand; Seems to me; Read it somewhere
Lack of Understanding: Statements that clearly state a lack of understanding; differs from other Speech Acts as it implies a continuing lack, rather than an individual issue	I am still confused; Not sure if I understand; I follow most; I'm not sure
Optional Nature: Statements indicating a not strongly recommended or vital issue, solution, or question	Should be compiled from the network directory with gmake; You might try; ...maybe I'll try making; What is wrong?
Weakened Presentation: Phrases that weaken or justify logical proposal statements	Correct me if I am wrong; Apparently; I am guessing that is the way; As far I know
Politeness	Examples
Positive: Language strategies used according to formal cultural rules to avoid losing face. The methods themselves are commonly identified as typical polite speech	Thanks; Okay thanks; Good luck with your project
Negative: Dealing with a face-threatening act, by lightening the request or response into a less pressing, informal status.	I was wondering if; Thought I'd throw this out there; Get this cleared up early; Just a head's up,
Bald on record: Dealing with a face-threatening situation by ignoring or emphasizing the consequences of the threat	I question the; I don't bzero anything; Change it to this.; Do we?
Off record: Attempting to change the request or response into a non-face-threatening statement, i.e., by generalizing a query to a rather than asking for direct help	Has anyone else had this problem; What would do; Asking for answers directly is way easier

3. Assessing student discussion analysis with EAs

The frequency distribution of the EAs within the dataset is shown in Table 2, for all students and also by gender and instructor. Of interest are the high occurrences of low confidence and the relatively high frequency of frustration. There were 3 female students and 45 male students. As expected, the instructor presents more Certainty_High. Female students seem to present more positive politeness than male peers. On the other hand messages from male students show more Polite_Neg.

Table 2. Distribution of EAs

Emotion Act	%EAs in all messages (N=1179)	%EAs in male student msgs (N=782)	%EAs in female student msgs (N=62)	%EAs in instructor msgs (N=300)
Tension_St	2% (28)	1% (9)	0% (0)	6% (19)
Frustr	14% (170)	19% (151)	9% (6)	2% (7)
Certnty_H	32% (386)	31% (249)	36% (22)	35% (107)
Certnty_L	20% (241)	26% (206)	27% (17)	4% (12)
Polite_Pos	13% (159)	15% (119)	55% (34)	0% (1)
Polite_Neg	13% (163)	18% (147)	3% (2)	3% (11)
Polite_Off	5% (60)	6% (53)	11% (7)	0% (0)
Polite_BOR	10% (12)	8% (63)	11% (7)	16% (49)

Table 3 shows the distribution of EAs in successful vs. non-successful threads in a subset of 165 threads. Successful threads include more answers than questions and do not end with a question. We first found that successful threads have less instructor posts. On the other hand, in unsuccessful threads, the instructor shows brusque commanding messages (with more Polite_BOR) and students show higher frustration. Trends like these can be used in future research to determine the most effective approaches to instruction and student discourse.

Table 3. Percent of expressed EAs from Successful and Unsuccessful threads.

EA %From Each Group	Successful Threads 79 Threads w/354 Answer Posts			Unsuccessful Threads 86 Threads w/137 Answer Posts		
	All Answers (354 Posts)	Student (249 Posts)	Instructor (105 Posts)	All Answers (137 Posts)	Student (76 Posts)	Instructor (61 Posts)
Certnty_H	57.5%	52.2%	71.1%	54.2%	52.6%	56.5%
Certnty_L	11.2%	15.3%	1.9%	7.8%	13.2%	1.6%
Polite_BOR	22.4%	17.8%	33.7%	27.5%	17.1%	41.9%
Polite_Pos	12.1%	18.1%	1.9%	8.5%	11.8%	1.6%
Polite_Neg	21.8%	28.5%	5.6%	21.1%	30.3%	8.1%
Polite_Off	2.8%	3.6%	0.1%	2.8%	5.3%	0.0%
Frustr	20.4%	25.3%	7.5%	17.6%	30.3%	20.4%

4. Conclusion

We have described an important first step towards the semi-automatic identification of emotion speech acts: We have identified common emotion acts used by students in a computer course who interact within a question and answer board and have shown that these acts are significant within the corpus, and that even with a dataset of only 1,179 labelled messages, there are many research avenues to explore. In combination with existing metrics based on rhetorical speech acts, contribution quantity and technical depth, the new measures will assist instructors and researchers in understanding how students learn. This study complements previous work on analyzing student discussions using rhetorical speech acts, course topics, and problem tasks.

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