



Adapting Emotional Support in Teams: Emotional Stability and Productivity

Isabella Saccardi
i.saccardi@uu.nl
Utrecht University
Netherlands

Judith Masthoff
j.f.m.masthoff@uu.nl
Utrecht University
Netherlands

ABSTRACT

Emotional support is a fundamental social construct for human beings, closely tied to mental and physical wellbeing. In the context of a classroom, teachers' emotional support has been linked to students' increased motivation, better learning outcomes, and decreased stress, ultimately representing a protective factor against the development of mental illness. Students often work on projects in teams, and many experience issues with teammates, leading to stress and frustration. However, teachers' limited time and resources represent a challenge to the provision of effective support to such students. Technology is a possible mediator between teachers and students. By means of online interventions, a conversational agent may collect students' teamwork experiences and deliver support messages at the same time, providing not only a monitoring tool for teachers but also a source of support to students. This intervention requires conversational agents with a validated framework of effective emotional support messages, adapted to the students' personalities and experiences. In this paper, the first steps for this intervention are presented. First, a corpus of emotional support statements provided by teachers for students working in teams is collected. Second, these statements are validated in emotional support categories. Third, participants are presented with a situation where they have to provide support to a student rating another one on one aspect of group work: Productivity. We investigate the adaptation of such messages to students' Emotional Stability and the given rating. Two versions of an algorithm are created based on the results.

CCS CONCEPTS

• **Human-centered computing** → HCI theory, concepts and models; • **Applied computing** → Collaborative learning.

KEYWORDS

emotional support, groups, personalization

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1 INTRODUCTION

Technology experienced unprecedented developments in the past years, quickly changing our society by seamlessly improving industry, health, and everyday life. The benefits arising from this are undeniable. However, there is still a side of society where technology *could* contribute to further welfare, but is still far from being able to do so: mental health. Mental health is worsening worldwide, as reflected by a global increase in mental health conditions [55]. This is especially true for young adults such as college students [36, 39], who face a crucial moment of change in their lives. Finding new ways to support them is now a necessity. Technology represents a great, new opportunity for delivering support available anytime and anywhere. However, we are still far from understanding how it can offer effective social and emotional support. Recent attempts in this direction include apps for mental and physical health, companion robots, and chatbots able to talk "empathetically". Many proposed interventions involve models of Natural Language Generation, equipped with the possibility of simulating emotional conversation. Unfortunately, these conversations are often intrinsically stochastic. They are typically generated from a set of possible empathetic answers, often not equipped with a broad variety of support types other than simple empathy, or not tailored to the individual and situational variables of the recipient. Tailoring supportive communication to the recipient is something entirely human, and it is something that technology should aim to achieve to offer effective support. In the present work, we attempt to pursue this goal. We target a specific situation, namely a student facing trouble with a teammate. Assuming the perspective of a teaching assistant, the input on which we base our emotional support algorithm is the student's personality (i.e. Emotional Stability) and the score that the student gives to the teammate on one aspect of teamwork (i.e. Productivity). This work is a first investigation into how to create a framework of personalized emotional support messages, bringing us one step closer to a technology able to support students in need.

2 RELATED WORK

2.1 Emotional support

People routinely seek support from their social circle, especially when facing difficult situations. Social support is a fundamental aspect of human relationships, and it represents a critical resource for managing stressful situations [13, 80]. Social support presents many facets, according to the type of support provided [15]. Among those, *emotional support* can be defined as any form of communicative

behaviour directed to help another cope with negative emotions [6]. It is specifically directed to the emotional coping of stressful situations, and it includes feelings of appreciation, encouragement and care for the other [8, 82], which leads the individual to believe that there's someone who appreciates them and cares for them [12]. The reception of effective emotional support promotes the individual's self-esteem, sense of identity [6], coping skills [78], and it is linked to numerous health benefits [33, 35, 62, 87].

Emotional support is often provided by close friends, family, or partners [82], but can also be effective when provided by acquaintances, colleagues, or teachers [6, 68]. Teachers' emotional support, in particular, has been found to increase motivation [69] and decrease emotional and behavioural issues [88] in middle and high school students. Similarly, college students' perception of teachers' emotional support has been positively related to students' motivation, positive affect, and learning outcomes [84]. In this context, emotional support is intended as the perceived availability of a teacher to talk and deliver emotional support about school topics, but also to provide a positive and warm communication style that promotes emotional health, decreases stress levels, and encourages positive relationships in the class [83, 84].

The presence of support for students becomes especially important during college years when students face several life changes; new social contexts, pressure to form new relationships, and academic demands can result in increased stress and mental health issues [36, 39, 52, 67]. In the past decade, a marked worsening of students' mental health has been reported [26, 70], exposing the need for new ways to support students in this crucial period of their lives.

2.2 Supporting students' group work

A possible target for supporting students is represented by group projects. Group projects are common in higher education: they serve as an incentive for learning [34] and to foster interpersonal and communication skills [14]. However, working in groups may also result in negative experiences causing stress and frustrations [4, 5]. These negative experiences can affect individuals' mental health and attitudes regarding future group projects [5], adding frustrations and difficulties to the challenges that students are already facing. When looking at the type of issues that may arise, problems can be numerous and of different kinds [66].

Some of these issues are a result of the mindsets with which the students approach group work. Expectations about group work and desired grades may influence the attitude with which one approaches the project, determining participation and motivation [3]. It is not uncommon for group members with clashing expectations to result in conflicts [50]. Similarly, diversity arising from visible demographic (e.g. culture, gender, age) or less visible aspects (e.g. education, political preferences, social influence on others) may prompt the creation of sub-groups within the group, undermining cohesion and ultimately hindering the working process [31, 38, 85]. The difference in culture or in the previous experience with group work may also hamper effective communication, which is known to be another issue lowering the overall group performance [9, 48, 49]. Lastly, social loafing may occur: the tendency of an individual to work less when in a group, lowering one's own

productivity [40, 65, 72]. Social loafing can interfere with group motivation, resulting in morale damage and undesired marks [42, 44]. These issues are closely related and may often occur together, or one may cause the other: for this reason, it is especially important to target them as soon as they occur and prevent the worsening of the situation [66].

However, the accurate detection of group issues as they arise is not straightforward. While some issues may be partially prevented by an informed group composition (e.g. diversity), most arise or become evident only after a period of time - and even then, not all are immediately brought to the teachers' attention by the students. On the other hand, teachers often lack enough time and resources to monitor and individually support every single student. A possible solution is using software to monitor and detect issues as they arise. Several software tools have been developed with this objective [1, 29, 54]. In this paper, we base our work on the approach in [86], where issues are detected via peer assessment of five group work aspects: Quality of Contribution, Productivity, Quality of Cooperation, Friendliness, and Reliability. This paper's main study focuses on Productivity, which expresses the amount of work that an individual contributes in a certain time frame [86]. In [86], support messages were embedded in the peer assessment survey via a virtual character providing feedback, providing the possibility of not only monitoring group work but also immediately supporting the student in completing the survey via a simple form of emotional support.

2.3 The need for adaptation of support messages

Using a peer assessment tool during group work opens a new way to deliver support to students, who can receive supporting messages as they fill out the survey. However, this also opens a new challenge: ensuring that the emotional support is effective for the recipient. Well-meaning but inept attempts at support may cause opposite effects in the recipient, increasing negative emotions, inhibiting problem-solving abilities, and increasing stress levels [2, 16, 18, 46, 64]. The definition of effective emotional support itself is not universally established. There are a few aspects of emotional support messages that have been generally identified as helpful; for instance recognizing, legitimizing, and elaborating on the recipient's feelings and perspective is defined as *person-centered* communication, and is typically considered a decisive aspect of such messages [7]. However, research on emotional support provision suggests that people naturally tailor support messages to the recipient and to the source of stress, suggesting that its effectiveness may strongly rely on the possibility of adapting it to the receiver's situation and personality [23, 75]. Each individual is characterized by a set of qualities and dispositions that may determine the type of support one may prefer in a stressful situation: some may need a practical and pragmatic opinion, whilst others may feel more supported by expressions of empathy and reassurance. Therefore, personality must be considered when creating a support message framework. Several frameworks exist to describe and comprehend personality [63]. Among those, the Five Factor Model [32] has gained consensus among researchers, because it provides a taxonomy of personality traits that can easily be integrated with previous

personality models [25, 41]. In this model, personality is mapped onto five *traits*: each represents a stable pattern of thoughts, feelings and behaviours that guides one's response to the environment [81]. This taxonomy is considered robust by most psychologists [25, 51], and the five traits are known to be relatively stable across one's lifespan [77]. The traits have been defined differently among researchers; here, the terms and definitions from [41] are adopted:

- (1) **Extraversion**: the degree to which one is talkative, assertive, and energetic.
- (2) **Agreeableness**: the degree to which one is good-natured, cooperative, and trustful.
- (3) **Conscientiousness**: the degree to which one is orderly, responsible, and dependable.
- (4) **Emotional Stability** (opposed to *Neuroticism*): the degree to which one is calm, not neurotic, and imperturbable.
- (5) **Openness to Experience**: the degree to which one is intellectual, imaginative, and independent-minded.

Among those, Emotional Stability is known to be tightly connected to students' academic behaviour, with students high in Emotional Stability who tend to obtain better academic achievements compared to the ones low in Emotional Stability [10, 56]. Students low in Emotional Stability tend to be more anxious and focused on their emotional state [58]. This internal focus diverts their attention from academic tasks, and the increased anxiety and stress that they experience under academic evaluation further impair their academic performance [11, 19, 58].

2.4 Emotional support by computers

Many digital mental health interventions have been proposed in recent years, often based on therapeutic intervention; examples include Tess [30], Woebot [28] and many others [27, 45]. These virtual agents, similarly to the ones conceived for behavioural change intervention [47], typically include empathic communication. Empathic communication is also part of chatbots whose main function is simply to engage the user [59, 60, 79]. These attempts at supportive communication belong to the Natural Language Generation realm, and do not present a fine distinction between different types of support. They typically focus on expressing empathy; however, support may take many different forms. One person may feel supported by empathy, another by practical advice about the situation; one may appreciate a different point of view, and one may desire simply to feel like there is someone there for them.

Some researchers have investigated how emotional support messages can be adapted by a computer, studying how people adapt emotional support to individuals and contexts, in order to create a framework that reflects human-to-human communication. It has been shown that personality determines the type and quantity of emotional support messages, with different personality traits affecting the delivery and the reception of support messages [21, 23, 75]. Furthermore, people adapt support feedback to the recipient's culture [71]. The recipient's context and situation also impact the support messages provided: previous research explored how to support community first responders [20, 43], informal carers [75], and learners [23, 24]. These studies show how individual and situational factors impact the type and quantity of emotional support messages

received, with every situation resulting in a different set of emotional support. This paper extends the work of [24] by studying how to support students facing problems in group work.

2.5 Problem statement

This paper investigates how a computer can adapt emotional support to a student working in a team. In Study 1, a corpus of emotional support statements is collected for five aspects of teamwork. In Studies 2a and b, the emotional support statements are validated into emotional support categories. In Study 3, it is investigated how people adapt the use of these categories to students with different levels of Emotional Stability (high, low) and different reported teammate Productivity (from 1=awful to 5=great). Lastly, two algorithm variants are created based on the results. All studies presented in this paper were allowed to progress based on an Institutional Ethics Quick Scan.

3 STUDY 1: COLLECTION OF EMOTIONAL SUPPORT MESSAGES

3.1 Method

The survey was created using the University's Qualtrics environment. Participants were asked to write response statements to a student who has rated a teammate on teamwork attributes, namely Quality of Contribution, Productivity, Cooperation, Friendliness and Reliability. Participants could select with which attribute they wanted to start, and they could fill out the survey for as many attributes as they wanted. For each attribute, they were presented with five different pairs of students. For each pair, they received a story such as:

Adam and Daniel are two students working on a ten-week project together. After two weeks, Adam rates Daniel's productivity 2 out of 5 (1=awful, 5=great). Assume you are the teaching assistant who reads Adam's rating. What would you say to Adam? Write as many alternative messages as you like.

A pair was presented for each score from 1 to 5 in increasing order, resulting in 5 different situations per attribute.

3.2 Results and Discussion

23 university teachers were recruited by means of convenience sampling. 143 statements were collected. These statements were processed by 1) removing duplicates; 2) excluding ones that were too specific or inappropriate for a survey; 3) rephrasing open questions into advice where possible; 4) rephrasing the sentence with gender-neutral names, Alex (the student giving the rating) and Robin (the student receiving the rating). Two researchers performed this process together. This resulted in 118 statements. Each statement was then assigned to an emotional support category during a brainstorming session. The proposed categories were derived from the statements' content and the literature on previous work [20, 23, 24, 43, 74], as follows:

- **Celebration**: 21 statements were assigned to this category that are intended to support the student by celebrating positive experiences. In the literature, there has been a renewed interest in studying so-called *positive empathy*, also defined

as *empathic joy* [53, 76]. Positive empathy is defined as the ability to share, celebrate, and enjoy others' positive emotions [53]. Statements belonging to this category overlap with these psychological concepts and aim to share Alex's positive experience by expressing congratulations and positive feedback.

- **Emotional Reflection:** 19 sentences were assigned to this category that elaborate on the recipient's emotions, acknowledging how they are feeling. This is a way of expressing interest in their perspective, often mentioned as a crucial feature in emotional support [7].
- **Empathy:** 20 sentences were assigned to this category. Empathy is defined here as expressing regrets for Alex's negative experience. In psychology, empathy is typically defined as a multi-dimensional construct, composed of a cognitive aspect (e.g., understanding others' emotions) and an affective aspect, namely the degree to which other's emotions affect oneself [17, 37]. The chosen category overlaps with the affective component of empathy: by communicating regret about Alex's experiences, the statements aim to express that Alex's feelings are recognized and affect the sender of the messages.
- **Reassurance:** 17 sentences were assigned to this category that reassure Alex that things may get better soon and that sometimes it is normal to experience troubles in a group. This category aims to legitimize the recipient's feelings, which is another fundamental aspect of support [7].
- **Advice:** 33 sentences were assigned to this category that encourage Alex to take action to solve or improve the situation. Providing advice is a positive aspect of emotional support when presented in a supportive fashion [6].
- **Supported:** 8 statements were assigned to this category that suggest involving the teacher to improve the situation. As defined by [12], social support is "*information that leads individuals to believe they have someone who cares for them*". Statements in this category remind Alex that the teachers are there to help if needed.

4 STUDY 2: VALIDATION OF EMOTIONAL SUPPORT CATEGORIES

In Study 1, 118 emotional support statements were collected and emotional support categories identified based on their content and the literature. Study 2 validates the categorization of statements.

4.1 Method

The university's Qualtrics environment was used to create the survey. Participants were recruited via Prolific (prolific.co), a crowdsourcing platform in which participants complete online studies in exchange for a monetary reward [57]. For this survey, participants had to be fluent in English and pass two attention checks. Each statement was introduced as: "*Alex and Robin are two students working on a ten-week project together. After two weeks, Alex rated their collaboration with Robin on multiple aspects. In response to these ratings, a teaching assistant reacts to Alex with the following statement:*" (see example in Fig 1). The statements were presented one by one in random order. Participants categorized each statement into the best

category from the ones shown, and could choose "Other" if it did not fit any. The *Free-Marginal Kappa* (κ) [61] was used to establish how well each statement belonged to each category. The κ value shows the agreement between participants: 1 indicates complete agreement, 0.7 is excellent and 0.4 is moderate agreement. Two rounds of the study were run. In Study 2a, 118 statements from Study 1 were categorized, with categories defined as in Table 1. In Study 2b, 27 validated Advice statements from Study 2a were categorized into subcategories, defined as in Table 3.

4.2 Results

Study 2a had 41 participants (19 female, 22 male; aged 21-66, $M = 28$, $SD = 11.2$) and Study 2b 40 (20 female, 20 male; aged 19-54, $M = 22.5$, $SD = 5.9$). Table 2 shows the validated statements for both studies excluding 4 Advice statements that were validated in Study 2a with $0.4 \leq \kappa < 0.6$ and not used in Study 2b. In Study 2a, of the 118 statements, 69 were categorized with $\kappa \geq 0.4$: 14 in Celebration (C), 17 in Empathy (E), 31 in Advice (A) of which 27 with $\kappa \geq 0.6$, 7 in Supported (S), and none in Emotional Reflection, Reassurance, and Other. Given the many validated A statements, we decided to use four subcategories based on the statement content (see Table 3) and performed Study 2b to validate these. In Study 2b, of the 27 A statements 10 were categorized with $\kappa \geq 0.4$: 3 in A: Expectations (A-Exp), 4 in A: Feedback (A-Feed), and 3 in A: Improvement (A-Impr).

5 STUDY 3: ADAPTATION OF SUPPORT MESSAGES

5.1 Method

A 2x5 between-subjects design was used. Participants were shown a story conveying the Emotional Stability (ES) of Alex, a fictional student, and Alex's rating of a teammate Robin's Productivity (from 1 (awful) to 5 (great)). This resulted in 10 conditions. Participants took the part of a teaching assistant and chose the best feedback (see Fig. 2). They could add multiple sentences if they wished to produce longer feedback. The statements were presented in random order. The university's Qualtrics environment was used to create the survey and participants were recruited on Prolific.

5.2 Materials

The ES personality stories were adapted from [24], who created validated short stories which describe one personality trait at a polarized level (the development and validation of the stories are described in [22, 73]). The stories were adapted to be gender-neutral (see Table 4). The statements used are shown in Table 8. Based on the validation in Studies 2a and 2b, for each category, we selected 6 statements applicable to Productivity (where needed, another group work aspect was replaced with Productivity in the statement). For the Advice category, 2 sentences per sub-category (A-Exp, A-Feed, and A-Impr) were selected.

5.3 Results and Algorithm Creation

200 participants took part, 20 per condition (10 male and 10 female per condition; aged 19-64, $M = 25$, $SD = 7.13$). Figures 3 and 4 show the different emotional support categories used per Productivity

Table 1: Categories and definitions inspired by the emotional support statements from Study 1 and the literature.

Category	Definition	Example
Celebration	The statement expresses joy for Alex’s positive experience.	<i>Well done, keep on the good work.</i>
Emotional Reflection	The statement acknowledges how Alex is feeling.	<i>It sounds like a difficult situation.</i>
Empathy	The statement expresses regret for Alex’s negative experience.	<i>Sorry to hear Robin has not been very productive.</i>
Reassurance	The statement reassures Alex.	<i>Many people experience problems with their teammates.</i>
Advice	The statement suggests to Alex what to do.	<i>Robin may perform better if you gave them some feedback.</i>
Supported	The statement is about the teaching staff taking action.	<i>I will raise this with the teacher.</i>

Alex and Robin are two students working on a ten-week project together. After two weeks, Alex rated their collaboration with Robin on multiple aspects. In response to these ratings, a teaching assistant reacts to Alex with the following statement:

"Really sorry to hear."

Which category do you think the statement belongs to?

Figure 1: Example of a statement presentation from Study 2a.

Alex and Robin are two students working on a ten-week project together. After two weeks, Alex rated Robin on several aspects. On Productivity, Alex rated Robin **1 out of 5** (1=awful, 5=great).

Productivity is the **quantity of work** provided for the project.

Select from the dropdown below your feedback to Alex. You can add as many statements as you like, in case you want to give feedback that consists of multiple sentences.

Your feedback: ▼

Write any comments below:

Figure 2: Study 3 example. In response to Alex’s rating, participants were asked to select feedback from the dropdown box.

score, for each level of ES (high or low). A 2-way MANOVA was used to test the effect of the score and ES on the number of emotional support statements used for each category (A, C, E, S). There was a significant effect of Score ($F(4, 571.943) = 10.962, p < .001$), but not of ES ($F(1, 187) = .456, p = .768$). A post hoc Tukey HSD pairwise comparison produced homogeneous subsets of scores on

the number of emotional support statements used per category for each level of ES (see Table 5).

Selection of statement categories. The statistical analysis resulted in a series of recommendations which can be seen in Tables 5, 6, and 7, columns labelled "Decision". These recommendations indicate which emotional support categories to use for each ES level and

Table 2: Study 2A: Emotional support statement categorization.

Statement	Study 2A		Study 2B	
	κ	CAT	κ	CAT
Congratulations.	0.94	C		
Congratulations on having a reliable teammate.	0.94	C		
Good to see the collaboration is going well!	0.83	C		
Delighted to hear this.	0.83	C		
Good for you, I am happy that the collaboration runs this well.	0.78	C		
Great to hear that you get along so well with Robin.	0.73	C		
Delighted that you are so happy with the quality of Robin’s work.	0.73	C		
Well done, keep on the good work.	0.64	C		
Glad to hear Robin is quite reliable.	0.56	C		
Glad you get along well with Robin.	0.55	C		
Glad to hear the quality of Robin’s work is quite good.	0.55	C		
Happy to see that you and Robin are getting along well.	0.48	C		
Glad to see Robin is contributing good work.	0.48	C		
Glad to see cooperation with Robin is going ok.	0.47	C		
Really sorry to hear that you felt Robin was so unfriendly.	0.84	E		
I’m sorry you’re having some difficulties.	0.84	E		
I’m sorry you are having a tough time.	0.84	E		
I am sorry to hear that Robin was a bit unfriendly.	0.83	E		
Really sorry to hear.	0.79	E		
Sorry to hear the quality of Robin’s work has not been very good.	0.79	E		
Sorry to hear it’s been hard.	0.74	E		
Sorry to hear that Robin did not contribute so well.	0.73	E		
Sorry that Robin did not do so much.	0.69	E		
Sorry to hear you’re experiencing some troubles.	0.65	E		
Really sorry that Robin is not pulling their weight.	0.65	E		
Sorry to hear Robin has not been very friendly.	0.64	E		
Really sorry to hear that Robin’s productivity did not meet your standards.	0.64	E		
Sad to hear Robin’s reliability could be better.	0.61	E		
Very sad to hear cooperation is not going well.	0.58	E		
I’m sorry you feel this way.	0.54	E		
I understand it must have been hard for you with Robin doing so little.	0.43	E		
You might want to discuss with Robin where your expectations might differ.	0.94	A		
Perhaps you can talk with Robin on how to become more reliable.	0.89	A		
I suggest you talk to Robin about what you would like to change.	0.89	A		
Perhaps you can talk with Robin on how to become even more cooperative.	0.89	A		
Perhaps you can talk with Robin on how to improve the quality of their work even more.	0.89	A	0.56	A-Impr
I recommend you discuss with Robin about how to improve their cooperation.	0.89	A	0.43	A-Impr
I suggest you tell Robin you are not happy with their reliability.	0.83	A	0.43	A-Feed
You could talk with Robin about how to make this cooperation even better.	0.83	A		
I think you need to discuss with Robin the types of expectations you both have on productivity, and come to some agreement.	0.83	A	0.57	A-Exp
You might want to discuss with Robin whether your expectations and ambitions are sufficiently aligned ¹ .	0.83	A	0.57	A-Exp
Consider speaking with Robin to find out whether there was a reason for their lack of work.	0.83	A		
If you have not already done so, give Robin very specific subtasks to do for the next weeks.	0.83	A		
Perhaps you can talk with Robin on how to improve the quality of their work.	0.83	A	0.61	A-Impr
If you have not yet done so, agree clear expectations with Robin on cooperation.	0.79	A	0.56	A-Exp
Ensure you give Robin sufficient opportunities to contribute.	0.79	A		
My suggestion is to try to get to know Robin better.	0.78	A		
I recommend you try to find out what is going on with Robin.	0.78	A		
Sometimes having well defined tasks helps.	0.78	A		

Table 2: continue

Statement	Study 2A		Study 2B	
	κ	CAT	κ	CAT
Try to stay as friendly as you can be with Robin.	0.78	A		
I suggest you have a discussion on expectations about reliability.	0.78	A		
Talk to Robin about how to improve their reliability.	0.69	A		
Try to help Robin out as much as you can if they are going through personal problems.	0.68	A		
Talk to Robin about what you dislike about the collaboration.	0.68	A	0.42	A-Feed
Make sure you make concrete agreements with one another.	0.65	A		
Tell Robin how you feel about them not having been so reliable.	0.64	A	0.44	A-Feed
I recommend you tell Robin you are quite happy with their contribution. They will be happy to hear so.	0.64	A	0.71	A-Feed
Robin may perform better if you gave them some feedback.	0.64	A		
I will raise this with the teacher.	0.74	S		
I will let the teacher know so that they can help you.	0.74	S		
I will tell the teacher.	0.73	S		
Please let me know if you would like me to raise this with the teacher.	0.69	S		
The teacher will talk to Robin.	0.68	S		
Please let me know if you would like the teacher to talk with Robin.	0.47	S		
Teachers are there to help you.	0.42	S		

Table 3: Study 2: Advice statements categories from Study 2a used in Study 2b

Category	Definition	Example
Advice: Expectations	The statement suggests to Alex to clarify expectations with Robin.	<i>Make sure you make concrete agreements with one another.</i>
Advice: Feedback	The statement suggests to Alex to tell Robin their opinion/feelings on how things have gone.	<i>Robin may perform better if you gave them some feedback.</i>
Advice: Improvement	The statement suggests to Alex to discuss with Robin how Robin can improve in future.	<i>Perhaps you can talk with Robin on how to improve the quality of their work.</i>
Advice: Other	The statement suggests to Alex other things Alex can do to improve the situation.	<i>My suggestion is to try to get to know Robin better.</i>

Table 4: Study 3: Stories used to describe high and low Emotional Stability. Adapted from [24].

High Emotional Stability	Low Emotional Stability
Alex seldom feels sad and is comfortable with themselves. Alex rarely gets irritated, is not easily bothered by things and they are relaxed most of the time. Alex is not easily frustrated and seldom gets angry with themselves. They remain calm under pressure and rarely lose their composure.	Alex often feels sad, and dislikes the way they are. Alex is often down in the dumps and suffers from frequent mood swings. Alex is often filled with doubts about things and is easily threatened. They get stressed out easily, fearing the worst. They panic easily and worry about things. Alex is quite a nice person who tends to enjoy talking with people and tends to do their work.

Productivity score. For each combination of ES level, category of emotional support statement, and score, decisions were made in two different ways:

- (1) Based on the homogeneous subsets in Table 5:
 - When the average in the subset (SubAvg) was <0.5 then no statement of that emotional support category was included; when $0.5 \leq \text{SubAvg} < 1.5$ then one was included; when $\text{SubAvg} \geq 1.5$ then two were included.

- When a score is part of multiple subsets that would lead to different decisions, then the average was calculated for the combination of those subsets, and the decision based on that.
- (2) Based on the medians in Tables 6 and 7:
 - When the median in Table 6 was 0 then no statement of that emotional support category was included; when 1 then one was included; when 2 then two were included.
 - When the median in Table 6 was 0.5 or 1.5 and the emotional support category was Advice, the medians for the subcategories of Advice in Table 7 were considered:

¹Study 2A used a longer version that started with "It looks like you get along well enough, but".

Table 5: Study 3: Per ES level and emotional support category (Cat): homogeneous subsets of Productivity scores, subset means (SubAvg), and decisions made per score based on the subsets and medians (with Cat to use ordered from top to bottom).

ES	Cat	Subsets	SubAvg	Subset Decision					Median Decision						
				1	2	3	4	5	1	2	3	4	5		
Low	C	1,2,3	0,15	-	-	-	-	-	-	-	-	-	-	-	-
		3,4	0,75	-	-	-	C	-	-	-	C	C	-	-	-
		5	2,10	-	-	-	-	2C	-	-	-	-	-	-	-
	A	1,2,3,4,5	1,10	A	A	A	A	A	A	A	A	A	A	A	A
	E	3,4,5	0,13	-	-	-	-	-	-	-	-	-	-	-	-
		1,3,4	0,32	-	-	-	-	-	-	E	-	-	-	-	-
S	1,2,3	0,53	-	E	-	-	-	-	-	-	-	-	-	-	
	1,2,4,5	0,21	-	-	-	-	-	-	-	-	-	-	-	-	
High	C	1,2,3	0,05	-	-	-	-	-	-	-	-	-	-	-	
		4,5	1,63	-	-	-	2C	2C	-	-	-	C	C		
	A	4,5	0,68	-	-	-	-	-	A	A	2A	2A	A	-	-
		3,4	1,15	2A	2A	A	-	-	-	-	-	-	-	-	
	E	3,4,5	0,13	E	E	-	-	-	E	E	-	-	-	-	
		1,2,3	0,58	-	-	-	-	-	-	-	-	-	-	-	
S	1,3,4,5	0,24	-	-	-	-	-	-	S	-	-	-	-		
	1,2,3	0,43	-	-	-	-	-	-	-	-	-	-	-		

Table 6: Study 3: Emotional support types used (N=Number; Avg=Average, M=Median, SD=Standard deviation) for different scores (Sc) and ES level, and decisions based on medians.

Sc	ES	C				E				S				A				Median Decision
		N	Avg	M	SD	N	Avg	M	SD	N	Avg	M	SD	N	Avg	M	SD	
1	Low	1	0,05	0,00	0,22	12	0,60	0,00	0,82	7	0,35	0,00	0,49	27	1,35	1,00	0,99	A
	High	1	0,05	0,00	0,22	16	0,80	1,00	0,95	8	0,40	0,00	0,60	35	1,75	1,50	1,16	2A-E
2	Low	1	0,05	0,00	0,22	15	0,75	1,00	0,72	7	0,35	0,00	0,59	27	1,35	1,50	0,99	A-E
	High	0	0,00	0,00	0,00	12	0,60	1,00	0,60	12	0,60	1,00	0,60	34	1,70	2,00	0,73	2A-E-S
3	Low	7	0,35	0,00	0,75	5	0,25	0,00	0,55	11	0,55	0,50	0,60	25	1,25	1,00	0,79	A
	High	2	0,10	0,00	0,31	7	0,35	0,00	0,49	6	0,30	0,00	0,57	29	1,45	1,00	1,10	A
4	Low	23	1,15	1,00	1,23	2	0,10	0,00	0,45	1	0,05	0,00	0,22	16	0,80	1,00	0,62	C-A
	High	32	1,60	1,00	1,23	1	0,05	0,00	0,22	2	0,10	0,00	0,31	17	0,85	0,50	0,99	C
5	Low	42	2,10	1,50	1,77	1	0,05	0,00	0,22	2	0,10	0,00	0,45	15	0,75	1,00	0,44	C-A
	High	33	1,65	1,00	1,23	0	0,00	0,00	0,00	3	0,15	0,00	0,37	10	0,50	0,00	0,69	C

Table 7: Study 3: Advice types used (N=Number; Avg=Average, M=Median, SD=Standard deviation) for different scores (Sc) and ES level, and decisions based on medians.

Sc	ES	A-Exp				A-Feed				A-Impr				Decision
		N	Avg	M	SD	N	Avg	M	SD	N	Avg	M	SD	
1	Low	13	0,65	1,00	0,67	4	0,20	0,00	0,41	10	0,50	0,50	0,51	A-Exp
	High	15	0,75	1,00	0,72	4	0,20	0,00	0,41	16	0,80	1,00	0,52	A-Impr - A-Exp
2	Low	11	0,55	0,00	0,69	7	0,35	0,00	0,49	9	0,45	0,00	0,69	A-Exp
	High	14	0,70	1,00	0,66	5	0,25	0,00	0,44	15	0,75	1,00	0,44	A-Impr - A-Exp
3	Low	13	0,65	1,00	0,67	2	0,10	0,00	0,31	10	0,50	0,50	0,51	A-Exp
	High	14	0,70	1,00	0,57	3	0,15	0,00	0,37	12	0,60	0,50	0,68	A-Exp
4	Low	1	0,05	0,00	0,22	10	0,50	0,50	0,51	5	0,25	0,00	0,44	A-Feed
	High	6	0,30	0,00	0,57	6	0,30	0,00	0,47	5	0,25	0,00	0,44	-
5	Low	0	0,00	0,00	0,00	14	0,70	1,00	0,47	1	0,05	0,00	0,22	A-Feed
	High	2	0,10	0,00	0,31	7	0,35	0,00	0,49	1	0,05	0,00	0,22	-

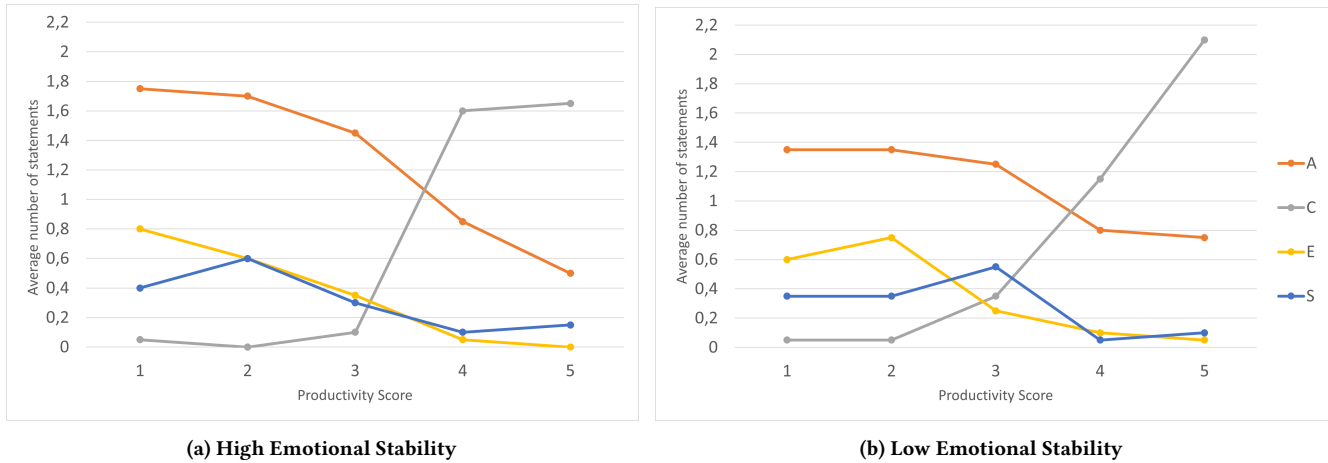


Figure 3: Study 3: Average number of emotional support statements used, for high (3a) and low (3b) ES, for each Productivity score.

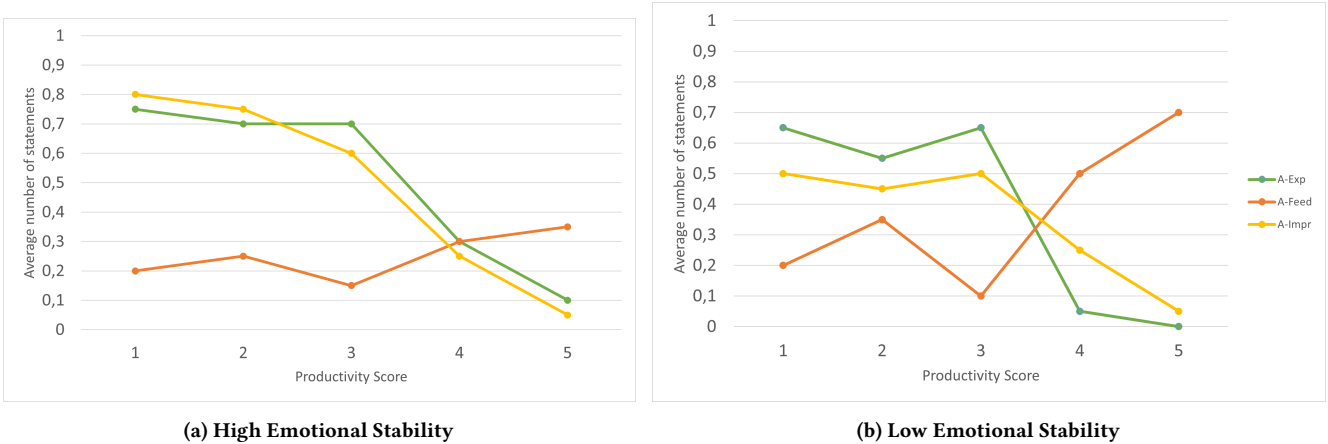


Figure 4: Study 3: Average number of Advice statements used in each subcategory, for high and low ES, for each Productivity score.

- High ES, score 4: Category median of 0.5; all subcategory medians of 0, so no A used.
- High ES, score 1: Category median of 1.5; two subcategory medians of 1, so 2A used.
- Low ES, score 2: Category median of 1.5; all subcategory medians of 0; so decided to use one A only (A-Exp as this had the highest average).
- When the median in Table 6 was 0.5 or 1.5 for other categories, these cases were considered as follows:
 - Category C, Low ES, score 5: Median is 1.5. Decided on one C, to mimic the high ES decision.
 - Category S, Low ES, score 3: Median is 0.5. Decided on no S, to mimic the high ES decision.

We observe the following, which shows ES is considered in many cases:

- *Score 1.* People provide A and E for high ES. A includes discussing expectations and improvements. People recommend discussing expectations also for low ES, but it is noteworthy that people avoid E messages. This may reflect an attempt

to avoid stressing the negative emotion that Alex must be feeling, given that they tend to stress easily, or avoid over-involvement in Alex’s feelings (an unhelpful aspect of attempts at support [7]).

- *Score 2.* People provide A and E. When the student has high ES, according to the median they recommend involving the teacher. The absence of S for low ES may suggest that people assume the low ES student is too distressed to discuss the issue with a teacher, which could also explain the absence of S for a score of 1.
- *Score 3.* Regardless of ES, discussing expectations is preferred. A possible interpretation is that the expectations for the project may profoundly influence the evaluation of a middle score and as such the preferred recommendation is to discuss them together. We did not observe significant differences between low and high ES, though one participant in the low ES condition noted: “3 out of 5 is mediocre, it could be because Alex is avoiding conflict, considering how they worry too much and often feel anxious. Maybe Robin deserves less.”

Table 8: Study 3: Statements used and occurrences per score and ES level (L=low, H=high) where relevant for the algorithms.

CAT	#	Statement	1		2		3		4		5	
			L	H	L	H	L	H	L	H	L	H
Exp	1	If you have not yet done so, agree clear expectations with Robin on productivity.	5	5	2	6	3	5				
	2	I think you need to discuss with Robin the types of expectations you both have on productivity, and come to some agreement.	8	10	9	8	10	9				
A	Feed	1 Tell Robin how you feel about them not having been so productive.							0	0	0	0
	2	I recommend you tell Robin you are quite happy with their productivity. They will be happy to hear so.							10	6	14	7
Impr	1	Perhaps you can talk with Robin on how to improve their productivity.	8	8	6	10						
	2	Perhaps you can talk with Robin on how to improve their productivity even more	2	8	3	5						
C	1	Delighted that you are so happy with Robin’s productivity.							10	3	8	5
	2	Good to see the collaboration is going well!							3	7	11	12
	3	Delighted to hear this.							2	4	8	4
	4	Congratulations.							1	1	2	1
	5	Well done, keep on the good work.							2	10	7	6
	6	Congratulations on having a productive teammate.							5	7	6	5
E	1	I’m sorry you are having some difficulties.			7	2	2					
	2	I’m sorry you are having a tough time.			2	3	2					
	3	Really sorry to hear that Robin’s productivity did not meet your standards.			3	4	3					
	4	Really sorry that Robin is not pulling their weight.			3	3	3					
	5	Really sorry to hear.			0	0	1					
	6	Sorry that Robin did not do so much.			1	3	1					
S	1	The teacher will talk to Robin.					0					
	2	Please let me know if you would like me to raise this with the teacher.					7					
	3	I will tell the teacher.					0					
	4	I will raise this with the teacher.					0					
	5	I will let the teacher know so that they can help you.					0					
	6	Please let me know if you would like the teacher to talk with Robin.					5					

- Scores 4 and 5. C is the preferred category for high scores, followed by A-Feed. Although providing A for high scores may seem counterintuitive, in most cases (37 of 58 A statements) the chosen sentence was "I recommend you tell Robin you are quite happy with their productivity. They will be happy to hear so." which consists of positive feedback. As seen in Fig. 4, this is especially true for low ES, possibly arising from the wish to communicate and acknowledge even better results, as a participant in the low ES- Score 4 condition noted: "Considering that Alex is a person who is easily stressed and tends to panic, giving Robin a 4 out of 5 is pretty good."

Order of statement categories. For many combinations of ES and score, multiple support categories were decided upon. For example, for low ES and a score of 2, we decided to provide A and E. For those cases, we need to decide which order to provide them in, so, in this case, A followed by E (A-E), or E followed by A (E-A). We considered the order in which participants put them, for those who used both. We first considered this per combination of ES and score, but as the same patterns occurred across combinations, we combined them. When using A and E, in 53% A-E was used. When using A and C, in 67% C-A was used. When using E and S, in 75%

E-S was used. When using two A (A-Exp and A-Impr) there is a slight preference for A-Impr - A-Exp (53%). We have reflected these orders in Tables 5, 6, and 7.

Selection of individual statements. C, E, S each contain six statements, and A-Exp, A-Impr, and A-Feed two, so we needed to decide which one(s) to use. Table 8 indicates for each combination of score and ES level for which the (sub)category was used in the algorithms, how often each statement was used. A-Exp2, A-Feed2, and A-Impr1 are clear winners¹ In S, the highly similar S2 and S6 are the only ones used; S2 is chosen as it is used slightly more. In E, E1 is chosen for score 1 and E3 for score 2. In C, for score 4, there is a clear preference for C1 for ES=Low; for ES=high, C2 is selected when one is needed², C2-C5 when 2 are needed. For a score of 5, C2 is selected when one is needed; C1-C2 when 2 are needed.

Algorithms. Combined, this lead to two algorithms: Algorithm 1 is based on the subsets and Algorithm 2 on the medians.

¹For ES=High, Score=1, A-Impr1 and A-Impr2 are used as often, but given A-Impr1 is used the most in all other cases, it is chosen also for this case.

²To be in line with the decision for score 5.

Algorithm 1 Based on Subsets

```

switch Score do
  case 1: if ES = Low then A-Exp2 else A-Impr1; A-Exp2; E1
end if
  case 2: if ES = High then A-Impr1 end if; A-Exp2; E3
  case 3: A-Exp2
  case 4: if ES = High then C2 C5 else C1 end if; A-Feed2
  case 5: C1; C2; A-Feed2
end switch

```

Algorithm 2 Based on Medians

```

switch Score do
  case 1: if ES = Low then A-Exp2 else A-Impr1; A-Exp2; E1
end if
  case 2: if ES = Low then A-Exp2; E3 else A-Impr1; A-Exp2;
E3; S2 end if
  case 3: A-Exp2
  case 4: if ES = Low then C1 A-Feed2 else C2 end if
  case 5: C2 if ES = Low then A-Feed2 end if
end switch

```

6 CONCLUSION AND FUTURE WORK

This paper investigated the adaptation of emotional support to a student who rated a teammate. In Study 1, a corpus of emotional support messages was collected from teachers for 5 teamwork aspects and 5 scores per aspect. In Studies 2a and b, these statements were validated into categories. Study 3 investigated the adaptation of statement selection to a student with different ES levels (high and low) who reported a certain score (from 1 to 5) for a teammate's Productivity.

Our study shows that people adapt emotional support messages to score. Low scores (1, 2) encourage the provision of A, E, S. A student reporting a low score on the teammate's Productivity is generally considered to have an issue, and people encourage talking about expectations, improvements, and involving the teacher. They also tend to express empathy. For a score of 3, the main suggestion is to talk about each teammate's expectations in order to align them. Higher scores (4, 5) encourage congratulations, and people often suggest giving positive feedback to the teammate.

We did not find a statistically significant main effect of ES, but observed differences in the homogeneous subsets and on a descriptive level: the high ES condition received more E on a score of 1, and the low ES more A on high scores (4, 5). This result may appear contradictory: when facing a student with low ES, people avoid providing empathy on low scores, and on high scores, they suggest the student to tell the other they are happy with the productivity. A possibility is that given that Alex is presented as a person who tends to get stressed easily, people avoid hyper-focusing on negative emotions at low scores and instead encourage focusing on positives at higher scores.

We generated two algorithm variants expressing such adaptations. The next step is to evaluate these algorithms, testing whether the feedback is deemed appropriate by teachers and students, and

whether it is effective for students' well-being. Additionally, as Study 3 investigated only ES and Productivity, we will extend this to other personality traits and teamwork aspects. We will also investigate how to combine support for multiple dimensions, and how to adapt support when a teammate is rated on multiple occasions.

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