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ARTICLE

Teacher empathy messages: The role of teacher enthusiasm and student outcomes

Elisa Santana-Monagas[1] | **Juan L. Núñez**[1] | **Jaime León**[2]

[1]Department of Psychology, Sociology, and Social Work, University of Las Palmas de Gran Canaria, Research Institute of Text Analysis and Applications, Las Palmas, Spain

[2]Department of Education, University of Las Palmas de Gran Canaria, Research Institute of Text Analysis and Applications, Las Palmas, Spain

Correspondence
Jaime León, Department of Education, University of Las Palmas de Gran Canaria, Research Institute of Text Analysis and Applications, C/. de Pérez del Toro, 1, 35001 Las Palmas, Spain.
Email: jaime.leon@ulpgc.es

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Abstract

Background: Recent research has increasingly focused on the role of teachers' empathy in classrooms. However, due to the inconsistencies observed in its conceptualization and assessment, whether this competence is key for effective teaching remains unknown. Grounding empathy research on previous approaches to the understanding of emotions, such as the control-value theory, could be the key to assess teachers' empathy messages, understood as their demonstration of an understanding students' context, appraisals and emotions. Moreover, reaching an understanding on how teacher motivation might shape their instructional practices (i.e., messages) and these student outcomes is also crucial.

Aim: This study aimed to develop a framework of teachers' empathy messages, examined their use of across the academic year, and how contextual classroom characteristics, teachers' enthusiasm and students' grades related to their usage.

Sample: Participants included 45 teachers and 1370 students distributed in 66 classrooms across 24 high schools.

Methods: Teacher empathy messages were assessed through audio recording of teachers' speech during lessons. Messages were extracted from transcriptions with the help of large language models. Teacher enthusiasm was assessed on T1 and T3. Student's grades were collected from academic records at the end of the course (T3).

Results: Overall, the number of students per class increased the number of emotion empathy messages used by the teacher. Teachers' enthusiasm was associated with the number of messages used whereas no significant relation was observed between messages and students' grades.

Conclusions: This study presents a practical framework to assess teacher empathy messages. Findings also highlight how teacher motivation (i.e., enthusiasm) can shape their teaching practices.

KEYWORDS
artificial intelligence, empathy, enthusiasm, students' performance, teacher messages

INTRODUCTION

Teachers' Social and Emotional Competencies (SEC) have been under the lens of research and policies for years (OECD, 2015, 2018; Schonert-Reichl, 2019), demonstrating their essential role in students' development and academic performance (Guo et al., 2023; Liu et al., 2021; Ren et al., 2022; Zyberaj, 2022). Amidst SEC, teachers' capacity to take the students' perspective (Gehlbach et al., 2023) and discern their feelings, namely, their empathy (Aldrup et al., 2022), emerges as an essential prosocial behaviour for occupations such as teaching (Cuff et al., 2016; Eisenberg et al., 2010; Goroshit & Hen, 2016; Preston & Waal, 2002). In essence, empathy goes beyond simple awareness of another person's viewpoint; it involves a deeper understanding and appreciation of their experiences, thoughts or emotions and a sensitive reaction to them. However, despite the interest of empathy among researchers (Meng & Dai, 2021; Wampold & Flückiger, 2023; Weisz et al., 2021; Winter et al., 2020), systematic reviews show inconsistent findings regarding its impact (Aldrup et al., 2022). Three main reasons could explain these findings: (a) inconsistencies regarding the conceptualization and definition of empathy (Cuff et al., 2016), (b) challenges in assessment, as empathy has so far been measured through self-reports and (c) the lack of specificity of these self-reports to educational settings, limiting their applicability and relevance in such contexts. Furthermore, while the relation between teaching practices and student outcomes is well-known and explored (Collie et al., 2019; Haerens et al., 2015; Pianta & Hamre, 2009), the 'inner side' of teachers, such as their enthusiasm for teaching, and the relation with their instructional practices is still lacking. In other words, the motivational characteristics that make a teacher exhibit empathy with their students are yet to be fully explored (Aldrup et al., 2022). Addressing this issue is crucial to clarify the mixed evidence, suggesting that the underlying processes in teaching and teacher–student interactions may be more complex than previously thought. Moreover, without a precise theoretical definition within educational contexts and a reliable assessment measure based on real-life teaching scenarios; the field fails to provide actionable insights that can elevate students' success in education.

Within classroom settings, teachers' messages are central to all interactions with students and have been repeatedly found to impact their outcomes (Belcher et al., 2021; Caldarella et al., 2020; Putwain et al., 2021). Since language is the main way teachers can show their caring for students (Tausczik & Pennebaker, 2010), their messages could serve as an excellent indicator of teachers' empathy. Understanding the antecedents of such messages (e.g., teacher enthusiasm) could help uncover why some teachers excel in supporting students, while others may not. Hence, to address the aforementioned issues, the present study aims were as follows: first, to introduce a conceptual and methodological framework to assess teachers' empathy messages reliably. This was done by integrating the propositions from the control-value theory (Pekrun, 2006) with several approaches to teacher empathy. Moreover, the present work also relies on a similar methodology to that used by Falcon et al. (2023) employed, examining audio recordings of lessons to analyse teacher messages. Second, to examine whether classroom characteristics and teachers' enthusiasm are related to the usage of empathy messages throughout the year, and whether these, in turn, relate to students' final grades.

Theoretical approaches to empathy across education

Across diverse theoretical frameworks, empathy has been assessed under a plethora of terms contributing to its ambiguity within the field (Olderbak & Wilhelm, 2020). For instance, cognitive empathy, understood as "a person's ability to understand how other people feel by taking their

perspective and reading their non-verbal signals" (Aldrup et al., 2022, p. 1179), aligns with the principles of the theory of mind defined as 'being able to conceive of mental states: that is, knowing that other people know, want, feel, or believe (Baron-Cohen et al., 1985, p. 38). This concept is also reflected in the definition of social awareness within the Collaborative for Academic, Social and Emotional Learning (CASEL) model, encompassing the abilities to understand and empathize with others (Gueldner et al., 2020). Moreover, within the framework of the Self-Determination Theory, there is also a perspective-taking approach involving an understanding of students' viewpoints before proposing alternative ways of approaching tasks (Ahmadi et al., 2023). All these terms contribute to the jingle-jangle fallacy, where the same label is used for different constructs, and different labels are used for the same construct measured (Olderbak & Wilhelm, 2020). This prevents the accurate evaluation of teachers' empathy, making the connection between theory and practice difficult to find (Olderbak & Wilhelm, 2020).

Altogether, addressing the issue of taxonomic incommensurability is crucial for choosing suitable measures to describe, predict and modify teachers' behaviour (Norris et al., 2019). Upon closer examination, all these terms share a common theme of recognizing others' viewpoints. In this research, we go beyond understanding empathy as simple awareness of another person's viewpoint, to explicitly focus on the nuanced exploration of empathy as involving a profound comprehension and appreciation of students' experiences, thoughts or emotions, along with a thoughtful and sensitive response (Aldrup et al., 2022; Gehlbach et al., 2023), in this case, through their messages.

Besides struggling with various definitions and measurements of teachers' empathy, the field faces several issues such as the excessive use of teacher self-report measures. Given that teachers are expected to consider students' perspectives, acknowledging their emotions and care for them (Haerens et al., 2015; Johnston et al., 2022; Reeve et al., 1999), it is likely that teachers respond with a self-report bias (O'Connor, 2008; Shepperd et al., 2008). This added to the already existing criticisms of self-report measures (Paulhus & Vazire, 2007; Spooren et al., 2013), and the specific lack of consistency of empathy scales (Baldner & McGinley, 2020) hinders the predictive power of these assessments. Furthermore, the scales employed are not specifically designed for educational settings but rather encompass life situations (Aldrup et al., 2022) which may not match classroom realities. These issues highlight the need for assessment methods that faithfully capture real-life teaching contexts to advance the field of teaching quality.

One potential solution could be to assess teachers' actual behaviour during lessons, particularly focusing on their verbal behaviour (Falcon et al., 2023), which serves as teachers' most available, straightforward and fundamental resource. By utilizing audio recordings of lessons, we can gain a direct insight into the messages employed by teachers that demonstrate they are taking the students' perspective. This direct method of teacher messages addresses two of the main assessment limitations. First, it provides an objective indicator of empathy without the bias of self-report measures, as it draws from teachers' real-life verbalizations, thus avoiding the issue of a teacher rating high in empathy without necessarily displaying it. Secondly, such messages are specific to educational settings. Given that educational strategies that take students perspectives into account are more likely to create engaging and effective learning experiences (Ahmadi et al., 2023; Deci & Ryan, 2016; Linnenbrink-Garcia & Pekrun, 2011; Liu et al., 2018), assessing and understanding how teachers can demonstrate their empathy through their messages is essential.

Although examining teacher messages within audio recordings during lessons presents many advantages (Harris & Lahey, 1982), one of its main drawbacks is the time-consuming nature of qualitative data coding along with the need to rely on several trained coders. Fortunately, over the last few years, advancements in natural language processing have greatly facilitated the seamless incorporation of language analysis (Demszky et al., 2023; Falcon & Leon, 2024). Hence, taking advantage of the growing popularity of large language models (LLMs), a branch of artificial intelligence (AI), the present research relied on such tools to transcribe teachers' speech, extract the target messages and code them (see Figure 2 in the method section). This process mitigates the arduous task of extracting messages manually, by performing this task automatically, efficiently and objectively (Falcon et al., 2024; Rathje

et al., 2024). Ultimately, this approach advances and addresses the issues in the field of teacher empathy by providing a framework for the study of such messages.

Teacher empathy messages

Throughout research, teachers' messages have proven to be a key component of teachers' forms of communication within classroom settings (Putwain et al., 2019, 2021; Santana-Monagas et al., 2022; Symes & Putwain, 2016). Supporting students emotionally and offering them understanding greatly reduces stress and discomfort (Aldrup et al., 2019) while shaping high-quality classrooms environments (Pianta & Hamre, 2009). Hence, understanding their feelings and emotions is crucial for a teacher to display empathy. Attending to Pekrun's (2006) control-value theory (CVT), emotions can be triggered by both students' appraisals and the context itself. Thus, through their messages, teachers can express and show their understanding of the students' perspective by either targeting one or another of these three CVT domains: students' emotions, students' appraisals and the students' context (see Figure 1). Aligning with the three CVT constructs that highlight emotions and their antecedents, which teacher messages can target (emotions, appraisals and context), and building upon previous research on messages and emotions (Falcon et al., 2023; Putwain & Symes, 2011, 2016; Santana-Monagas & Núñez, 2022), teachers' empathy messages could be divided into three types of messages: emotion, appraisal and context empathy messages.

Emotion empathy messages show understanding of what students' might be feeling in terms of negatively valenced emotions. These messages are aimed at reducing students' fear of failure (Putwain & Roberts, 2012) and hence target their physiological arousal (Pekrun et al., 2023), but do not necessarily refer to an individual's ability to reach a goal or outcome. These messages often display optimism, hope and provide emotional support (Alqassab & Leon, 2024). For example, messages such as: 'Don't be afraid, I'll explain it step by step'. On the other hand, messages such as 'There is no one here who can't get a good grade' exemplify an appraisal empathy message, targeting students' control and value appraisals. These messages reinforce how capable a student is to reach a goal or outcome (Putwain et al., 2021) intending to boost students' confidence by providing positive teacher expectations for student success in a valued activity outcome. As Ahmadi et al. (2023) argue, these messages stimulate students' perceived ability to achieve an outcome. Finally, context empathy messages target students' classroom context. For example, messages, such as 'Do you have a test now? Okay, we'll leave it here then' reflect teachers' understanding and knowledge of events students have experienced, are experiencing, or will experience that can impact their control and value appraisals and hence their educational outcomes. These messages imply teachers' knowledge gained through immediate sensory perception as well as stored episodic knowledge acquired through experience working in classrooms and with students (Wolff et al., 2021). Using such messages would demonstrate a genuine interest in and understanding of students' perspectives, ultimately fostering deep connections and positive relationships, a fundamental aspect of teaching quality (Marshik et al., 2017; Santana-Monagas et al., 2023). Altogether, such messages highlight teacher

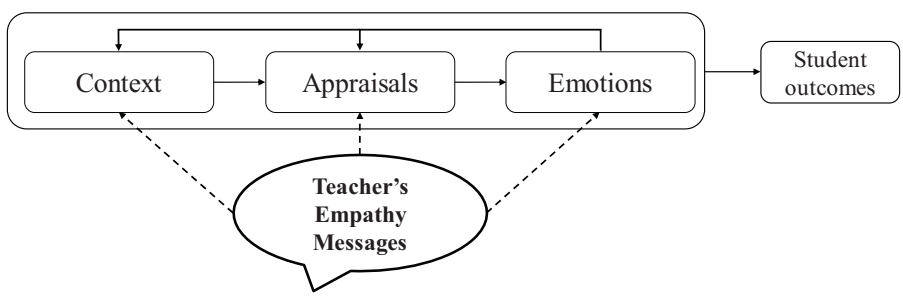

FIGURE 1 Dimensions teacher empathy messages can target.

behaviours that aim to support students in developing adaptative control and value appraisals for the learning context.

Exploring teacher empathy: classroom characteristics, enthusiasm and student outcomes

Although empathy has been an essential prosocial behaviour within teaching contexts, some authors have argued that teachers are not always motivated to display empathy (Aldrup et al., 2020). Given that there is variation with respect to when, where and with whom we are empathetic (Spaulding, 2024), recent studies understand empathy as a motivated behaviour (Weisz et al., 2021). Indeed, in situations where empathizing might result in suffering, people often choose to avoid it, highlighting its context-dependent nature (Zaki, 2014). Hence, displaying empathy can be understood as a choice that can be activated in several ways (Ferguson et al., 2020). In the context of teaching, this suggests that teachers' motivation to express empathy may depend on factors such as the characteristics of the students they work with or the dynamics of the classroom environment. In fact, previous research has shown that teacher emotions are shaped by student traits and, in turn, influence teachers' emotional support for students (Burić & Frenzel, 2023; Frenzel et al., 2015). Thus, the display of empathy may similarly vary across different classroom contexts, reflecting its adaptive and situation-specific nature. Yet, the specific classroom factors that influence a teacher's capacity to display empathy remain insufficiently understood (Aldrup et al., 2020).

One factor that is still under debate is class size, as relatively few studies have focused on class size and teaching, and the insights derived from research remain limited (Blatchford & Russell, 2020). On the one hand, research has shown that smaller classes often allow for more individualized attention and improved classroom management (Blatchford, 2011). Indeed, some research has shown how smaller classes relate to better outcomes (Blatchford et al., 2011; Pedder, 2006; Wright et al., 2019). Nonetheless, on the other hand, research has also suggested that teaching and class size are not directly related (Brühwiler & Blatchford, 2011), and effective teaching can occur regardless of class size (Hattie, 2005). What is clear is that there is a need for more research, specifically in the field of teacher messages, to better understand how class size can influence the way teachers tailor their messages to students. For instance, although smaller classes enable teachers to better recognize and respond to student needs, larger classes translate into a greater diversity regarding students' needs. As a result, teachers might be more inclined to rely more often on empathy messages with larger classes to address this diversity more effectively.

In addition to class size, students' gender may also influence the way teachers deliver empathy messages in the classroom. Social norms often associate women with greater emotional attunement and empathy, as reflected in the 'women are wonderful' effect (Hodges & Klein, 2001; Krys et al., 2018). These stereotypes may unconsciously influence teachers to use more empathy messages with female students, reinforcing gendered patterns in classroom interactions. Such practices could have long-term implications, particularly given research indicating that gender-biased expectations can negatively affect female students' performance in areas like mathematics and science (Carlana, 2019).

Beyond classroom characteristics, individual teacher characteristics can also influence how they display empathy. One key characteristic is teacher enthusiasm, which plays a pivotal role in instruction (Keller et al., 2016; Kunter et al., 2013). Defined as enjoyment in teaching, interest in the subject matter, motivation to teach and the expression of positive emotions (Kunter et al., 2008, 2011), teacher enthusiasm has been consistently linked to better teaching practices. These include providing emotional support, managing classrooms effectively and promoting positive student outcomes (Lazarides et al., 2019; Pianta & Hamre, 2009). While the direct relation between teacher enthusiasm and empathy messages is still an emerging area of research, the broaden-and-build theory (Fredrickson, 2001) offers a useful framework to explore this connection. According to this theory, positive emotional states, such as enthusiasm, broaden an individual's thought—action repertoire, enhancing cognitive flexibility

and awareness, processes closely tied to empathy (de Vignemont & Singer, 2006). This suggests that enthusiastic teachers, who enjoy their work and experience positive emotions, may be more intrinsically motivated to engage in prosocial behaviours (Akın, 2012).

Nonetheless, recent research suggests this link might be more complex. Falcon et al. (2023) examined the interplay between teachers' engaging messages (e.g., messages directed towards students with the purpose of engaging them in their school tasks) and their enthusiasm. Their research suggests that, in some cases, enthusiasm might reduce the reliance on explicit messages aimed at engaging students, as an enthusiastic teaching style itself can foster a positive classroom environment that could mitigate students' off-task behaviours (Frenzel et al., 2024; Keller et al., 2016). These findings underscore the need to further investigate how teacher enthusiasm interacts with the use of empathy messages, particularly in relation to creating supportive and adaptive classroom climates.

Finally, it is still uncertain how teachers' empathy messages relate to students' academic performance. While some studies have found a positive relation among such variables (Franklin, 2013; Latchaw, 2016), others have not (Aldrup et al., 2020; Curci et al., 2014). Given that empathy improves many student outcomes and teaching practices that are further related to academic performance (Fauth et al., 2014; Jerrim, 2023; Kunter et al., 2013), it is plausible to expect a positive relation among teacher's empathy and grades. For instance, Cai et al. (2023) found that teacher empathy is related to students' sense of school belonging, which, in turn, was positively related to their learning achievement. Similarly, a teacher who understands their students is more likely to display good classroom management and instructional support (Bieg et al., 2017; Nett et al., 2010) which would, in turn relate, with students' performance (Kunter et al., 2013; Ruzek et al., 2016).

The present study

As mentioned throughout the previous paragraphs, research on teacher empathy encounters many issues, beginning with the struggle to correctly discern and measure teachers' empathy. The inconsistent conceptualization and reliance on self-reports limit the accuracy of evaluating empathy in educational contexts, making it difficult to identify its impact on teaching practices and to establish a unified understanding of what empathy entails within educational contexts. Hence, to address this gap the present study first aim is to describe teachers' use of the different types of empathy messages through audio recordings during lesson and classify them as proposed.

Additionally, despite recent research highlighting empathy as a context-dependent motivated behaviour (Burić & Frenzel, 2023; Ferguson et al., 2020; Bayram Özdemir & Özdemir, 2019), how classroom factors like student demographics or class size shape teachers' propensity to display empathy messages has yet to be explored. Hence, the study's second aim is to examine how classroom characteristics (gender and number of students per class) relate to the use of empathy messages. According to previous works, we hypothesized the following:

> **Hypothesis 1.** We expected classroom characteristics (gender and number of students per class) to be related to the frequency of empathy messages used, as teachers may adapt their behaviour accordingly (Collie & Martin, 2017; Parsons et al., 2018).

As research shows, motivated and enthusiastic teachers are better equipped to create supportive and engaging classroom environments (Bieg et al., 2022; Lazarides et al., 2019; Moè et al., 2021). However, while teaching practices and student outcomes are well explored, the impact of teachers' intrinsic characteristics, such as enthusiasm, on empathy is less understood and recent studies suggest a complex relation between enthusiasm and teaching practices (Falcon et al., 2023). Thus, the third objective of this study is to examine the relation between teachers' enthusiasm and the use of empathy messages. In line with previous works and the broaden-and-build theory, we hypothesized the following:

Hypothesis 2. We expected that higher enthusiasm (both initial and increasing over the academic year) would make teachers rely less often on empathy messages.

Lastly, the final aim of the present study is to explore whether the use of empathy messages relates to students' grades. Previous studies have shown inconsistent results regarding the relation between teacher empathy and student outcomes but suggest these inconsistencies may arise from differences in how empathy is measured. Aldrup et al. (2020) highlight that positive relations are more commonly found when the instruments used are profession-specific or situation-specific, rather than relying on teachers' self-reports of general empathy. Hence, context-sensitive measures could capture critical aspects of teacher empathy that might otherwise go unnoticed. Given that our study adopts a profession-specific approach, focusing on empathy messages tailored to the classroom context we hypothesized the following:

Hypothesis 3. We expected to find differences in students' academic performance, with higher achievement associated with teachers who use empathy messages.

METHOD

Participants

A total of 45 teachers (M age = 44.27; SD = 8.99; 56% women) from various subjects (including integrated Physics and Chemistry, Language and Literature, Mathematics, Biology, specialized Physics, History and specialized Chemistry) participated in the study along with 1370 students (M age = 16.2, SD = 2.21, 54% women) from 9th to 12th grade distributed in 66 groups. The study was conducted over a whole academic year. Participants were recruited from 24 secondary high schools in the Canary Islands, Spain, both from rural and urban areas. Most of the surveyed students came from middle-class families and displayed no significant ethnic differences. In Spain, education in the 9th and 10th grades is compulsory and uniform for all students. However, the 11th and 12th grades are not mandatory, and students have the option to choose specialized tracks such as sciences, humanities or arts.

Procedure

Initial contact with the schools by the research team was established to invite them to participate in the study. We informed them via phone calls and in-person meetings about the study's general objectives, specifically the assessment of teachers' messages, without disclosing the exact types we intended to evaluate. The voluntary and confidential nature of the study was emphasized. All volunteers were informed that AI would be used for data analysis and provided explicit consent through a document detailing the data storage procedure. To participate, we asked teachers to record their voices during eight classes per term (T1, T2 and T3) and to report their enthusiasm at the first term (T1) and at the end (T3) of the academic year, in the third term. A small recorder was used for this purpose, which teachers could clip to their clothes. Each recording was approximately 50 min in length, corresponding to the duration of a typical class session. To ensure representativeness, we requested eight recordings per teacher, taken near the end of each academic term. Some teachers recorded more lessons; we used all of the recordings for model fine-tuned and reliability testing, while for data analysis, we used eight lessons per teacher. For those teachers who recorded more than eight lessons, we selected the middle lessons for analysis to ensure a balanced representation of the teaching period. After receiving teachers' audio lessons, we transcribed them with OpenAI Whisper (Radford et al., 2022). Missing data was not an issue as each teacher provided eight recordings and information about their enthusiasm and their student's grades. The study and all data gathered followed the ethical guidelines of the Declaration of Helsinki and had the approval of the University Human Research Ethics Committee (CEIH-2024-11).

Measures

The descriptive characteristics of the study's measures, including the assessment of empathy messages, teacher enthusiasm and student grades, are summarized in Table 1. This table provides an overview of each measure, indicating the time points at which data was collected and the number of participants for each.

Teachers' empathy messages

To assess teachers' empathy messages, we followed a six-step approach: a. we conceptualized empathy dimensions following the aforementioned framework, b. we developed example messages based on the previous step, c. we refined until reach an adequate agreement, d. we then used an LLM to identify messages within the data on teachers transcribed lessons, e. We refined these results until reach an adequate agreement, and f. we finetuned a final LLM based on the selected messages were used to (See Figure 2 for a view of these steps).

In the identification step, to automatically extract messages from the transcriptions, we relied on OpenAI Services (OpenAI, 2024). For each empathy message category (*emotion*, *appraisal* and *context*), a model based on GPT-3.5 was trained to identify the target messages, resulting in a separate model for each category. These models were trained using datasets previously gathered by the research team. The training data consisted of 150 empathy messages and 2850 non-empathy messages extracted manually from transcriptions, maintaining a 5:95 ratio of messages versus non-messages. In some instances, when the available real examples were limited, as in Demszky et al. (2023), artificial examples were created through authors' interactions with GPT-4 and used as empathy messages to train the model (see Section B of the Supporting Information). To assess the model's reliability, 10% of the training data (comprising 15 messages and 285 non-messages) were randomly selected and withheld from the training process. Finally, this 10% dataset was provided to the already trained AI Model to evaluate its ability to accurately detect and discard messages.

In the classification step, the GPT-4 API was employed to refine the data from the identification step and discard false positives. In this phase, precise instructions and definitions were provided to the tool for it to conduct the classification (see Section C of the Supporting Information for an example of the instructions given to GPT-4). To test the reliability of the classification procedure, a researcher

TABLE 1 Overview of measures, time points and participant counts.

Teacher enthusiasm	T1, T3 (ΔT3−T1)	45 teachers
Empathy messages	T1, T2, T3 A total of 24 lessons (8 lessons recorded per term)	66 classrooms (24 high schools)
Students' grades	T1, T2, T3	1370 students

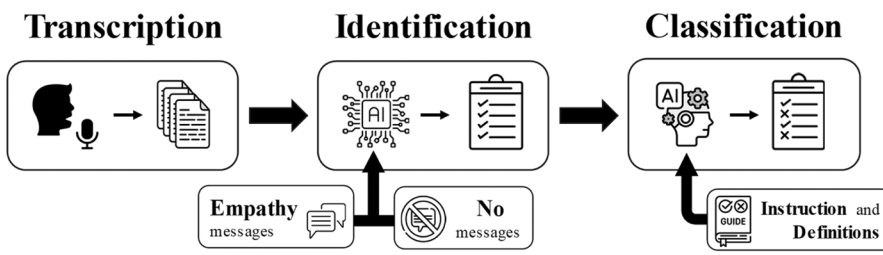

FIGURE 2 Procedure to extract messages.

independently coded a randomly selected 10% subset of the data. The results showed a high inter-coder agreement (see Table S1).

Teachers teaching enthusiasm

To assess teachers' enthusiasm for teaching, we used the Teacher Enthusiasm Scale (Kunter et al., 2011), specifically the subscale that measured enthusiasm for teaching. This subscale is comprised of five items (e.g., 'I always enjoy teaching students new things') that were preceded by: 'In this class'. Items were answered following a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Finally, to ensure the reliability of the scale, McDonald's Omega was estimated using factor loadings from a congeneric CFA with the following fit indices: $\chi^2(5) = 20.1$, $p < .001$, CFI = .97, TLI = .94, SRMR = .02, showing a satisfactory reliability ($\omega = .94$).

Students' grades

Students' grades were obtained from the school's official records. In Spain, academic courses are divided into three terms, with students receiving a mark at the end of each. However, the grade awarded in the third term (T3) represents the overall evaluation of the entire academic year, encompassing the assessments from both the first (T1) and second (T2) terms. Teachers assess individual students based on a rubric provided by the government that considers the academic content and competencies of the subject at the course level. Grades range on a scale of 0 to 10 points, with being 10 the highest mark (León et al., 2017).

Data analysis

The following steps were conducted to address our goals. First, we performed a descriptive analysis to inform about the number of messages categorized by type of empathy message: emotion, appraisal and context messages. Next, to account for the longitudinal data we tested a growth model with each of the 24 lessons recorded as time points (eight lessons in three terms). In the growth model, the intercept indicates the average number of empathy messages at the beginning of the series of lessons (T1). The slope represents how the number of empathy messages changes from one lesson to the next. A positive slope indicates there is an increase in these messages over time, while a negative slope suggests a decrease. If the slope is zero, indicating no change over time, the intercept still provides information about the average number of messages across all lessons. Because messages are count data and, in many lessons, teachers did not say any message, we used the zero-inflated binomial model.

To explore whether the use of messages relate with contextual classroom characteristics (percentage of boys/girls and number of students per class) we analysed the association with the growth model intercept. Next, to examine if teachers' enthusiasm relates to the use of such messages, we explored the association between teachers' enthusiasm and the growth model intercept. As an indicator of teacher enthusiasm, we use the measure of T1 and the difference between T3 minus T1. The former informed us whether enthusiasm at the beginning of the academic year was related to the number of messages said in the year, and the latter helped understand whether variations in enthusiasm were related to variations in the number of messages. Finally, to test the association between grades and empathy messages, we analysed a parallel growth model. In this model, the intercept for grades represents the average grade at the beginning of the academic year, and the slope reflects changes in grades across terms. We explored correlations between the intercept and slope of grades and those of empathy messages to determine whether initial levels or changes in grades were associated with initial levels or changes in empathy messages. This parallel growth model allowed us to evaluate how changes in teacher empathy messages

might correspond with students' academic performance trajectories. All data analyses were conducted using Mplus 8.9 (Muthén & Muthén, 2024).

RESULTS

Descriptive analysis

Table 2 presents the descriptive statistics of teacher empathy messages categorized by type: emotion, appraisals and context, and segmented by terms and grades. In the first term, there is a total of 84 messages, with emotions being the predominant category, followed by minimal instances of appraisals and context messages. The second term shows a slight decrease in overall messages to 64, with emotions still leading. Finally, the third term presents the lowest total with 55 messages, still dominated by emotional messages.

Analysing by grade, Grade 9 exhibits a distribution of 47 total messages, with emotions and appraisals as major contributors. Grade 10 records 39 messages. Grade 11 has the fewest messages, totalling 44, with nearly all being emotional. Grade 12 stands out with 71 messages, which is the highest total among the grades, characterized by a significant number of emotion and context messages. Considering that the average number of messages per teacher is 3 (203 messages recorded in 66 groups), Grade 11 stands out as the grade with the most frequent use of messages, while Grade 9 has the least. This suggests that teachers in Grade 11 are utilizing empathy messages more frequently compared to other grades, whereas those in Grade 9 are doing so less frequently.

Results of growth model

As shown above, the number of appraisals and context messages was marginal; thus, the study focused only on emotion empathy messages. First, we will present the distribution of the data. The proportion of zeroes in the 24 time points ranged from .50 (T24) to .93 (T9), providing evidence that empathy messages are occasionally said in class. Among the teachers who did produce a message, the maximum number in one class was 4.

Regarding the results of the growth model, the intercept mean estimate was −1.30 (SE = .23); this indicates that the average number of messages teachers convey is low (negative intercept, log-odds, corresponds to a probability less than .5). The variance of the intercept was .35, indicating variability in initial values. The slope mean was −.01 (SE = .00). This suggests no significant linear trend over

TABLE 2 Descriptive statistics of messages detected.

		N	Emotion	Appraisals	Context	Total
Term	1		81	2	1	84
	2		51	5	8	64
	3		49	1	5	55
Total			181	8	14	203
Grade	9	20	37	4	6	47
	10	12	35	3	1	39
	11	9	43	0	1	44
	12	25	64	1	6	71
Total		66	181	8	14	203

Note: *N* = number of groups per grade.

time. The variance of the slope was .00, indicating no variability in growth rates. The covariance between intercept and slope was −.00 (SE = .00), suggesting no significant relation between initial levels and growth rates.

Classroom characteristics

The results indicated a significant positive relation between the number of students per class and the intercept ($r = .45$), suggesting that larger class sizes are associated with higher emotion-related empathy messages (see Table 3). The correlation between the percentage of boys/girls in the class and the intercept was not statistically significant ($r = -.21$). This indicates that the gender composition of the class does not significantly affect the average number of emotion-related empathy messages across lessons.

Teacher enthusiasm

As shown in Table 3, there is no significant correlation between teacher enthusiasm at T1 and the intercept ($r = .21$). This suggests that initial enthusiasm levels do not predict the emotion empathy messages used by teachers.

The change in teacher enthusiasm from T1 to T3 shows a negative correlation with the intercept ($r = -.36$). This implies that increases in enthusiasm over time are linked to a reduction in the average number of emotion empathy messages, suggesting that as teachers become more enthusiastic, the use of these messages decreases (see Table 3). It could also mean that teachers with less variation in their enthusiasm scores over time used fewer empathy messages.

Grades

In the growth model examining the relation between teacher empathy messages and student grades, the intercept of grades ($M_{\text{Grades Intercept}} = 4.03$, $2 = 6.22$) showed no significant correlation with the intercept of messages ($M_{\text{Messages Intercept}} = -1.37$, $2 = .37$; $r = -.21$, SE =.28, $p = .45$), indicating that initial levels of empathy messages were not predictive of initial student grades. However, there was a significant positive correlation between the intercept of grades and the slope of messages ($r = .75$, SE = .23, < .001), suggesting that higher initial grades were associated with an increase in empathy messages over time. Additionally, the slope of grades and the slope of messages showed a non-significant but moderate correlation ($r = -.45$, SE = .25, = .07) suggesting that there is no significant relation between how teacher's emotion empathy messages evolves and how students' grades change over the same period. Altogether, these findings suggest that teacher empathy messaging may adjust dynamically in response to students' academic progress, potentially decreasing as students achieve higher performance levels.

TABLE 3 Correlation between variables and intercept.

	r	SE	*p*
Number of students per class	.45	.17	.01
Percentage of boys/girls	−.21	.24	.40
Teacher enthusiasm (T1)	.21	.21	.32
Teacher enthusiasm ($\Delta T3 - T_1$)	−.36	.17	.03

DISCUSSION

The influence of teachers' SECs, such as empathy, on students is unquestionable. However, the scientific literature shows inconclusive findings regarding their impact, mainly due to an ambiguous conceptualization and unspecific evaluation methods. This study, therefore, aimed to present a conceptual and methodological framework for reliably assessing teachers' empathy messages, as well as to examine their relation to various contextual classroom characteristics, teachers' enthusiasm and students' grades over an academic year. Drawing on Pekrun's (2006) CVT and previous research on messages and emotions, this study examined three types of empathic messages: emotion, appraisal and context. Additionally, we provide a reliable method for assessing teachers' empathetic messages using audio recordings.

Regarding the first of the established objectives, the results show that, in general, the teachers convey the three types of empathic messages established. The most frequently detected type of empathic message used by teachers is the emotion message (89.16%) followed at a considerable distance by context and appraisal messages. In this sense, it might be easier for teachers to understand students' emotional cues than their thoughts or context factors, as emotions are observable in facial expressions and behaviour, whereas understanding thoughts and situations surrounding people requires a higher effort and level of inference (Lange et al., 2022). Teachers predominantly use emotional empathic messages to convey their understanding towards students, foster a climate of trust, optimism and support, while trying to minimize their students' fear of failure. Consequently, the emotional aspect prevails when teachers' approaches to students, leading to more desirable and adaptive consequences (e.g., reducing ill-being) as suggested by Aldrup et al. (2019).

This pattern is further reflected in the distribution of messages across terms and grade levels. Emotional messages were the most common across terms, with the first term showing the highest number ($N = 84$), followed by a gradual decrease in the second and third terms. This trend suggests that teachers initially prioritize empathy messages to build rapport and establish a positive classroom climate early in the academic year. As relationships solidify and routines are established, the need for such messages may diminish slightly. When examining message types by grade, we observe that Grade 12 teachers use empathy messages more frequently ($N = 71$), especially emotional messages, compared to lower grades with Grade 9 showing the fewest total messages ($N = 47$). This aligns with previous research (Flitcroft et al., 2017; Putwain et al., 2021) highlighting how teachers adapt their messages to their students. Given that older students often face heightened academic and social pressures as they approach the end of their secondary education, teachers might respond by providing more emotional support through their empathy messages. This added to the fact that as students get older their relationship with teachers is likely to improve suggests that teachers could be more motivated to display such messages with upper-secondary students (Bayram Özdemir & Özdemir, 2020). Interestingly, prior research in teacher messages (Santana-Monagas et al., 2023) has shown that as students get older, teachers rely less often on messages that try to engage students in the school task. This, together with the present findings, suggests that teachers might gradually shift from providing academic support to offering emotional support. Additionally, older students are often better able to articulate their concerns, making it easier for teachers to respond with empathy and explicit emotional support. Together, these findings underscore the nuanced ways in which teachers tailor their support to meet the evolving needs of students throughout their secondary education journey.

Regarding the second objective, which explores the relation between the use of emotion empathy messages and classroom contextual characteristics (gender and number of students per class). Although a positive relation is observed, significant findings emerge only with class size: in larger classes, teachers are more likely to convey emotion empathy messages. No significant relation is found between the percentage of boys/girls and the use of emotion empathy messages. The heterogeneity and diversity of larger classes likely result in a higher number of students in need of emotional support and understanding, making it more understandable that teachers rely on emotional empathetic messages to a greater

extent. Similarly, managing large classes is more challenging, so teachers may use emotion empathy messages to foster a positive and trusting climate (Jennings & Greenberg, 2009; Mainhard et al., 2011; Morin, 2020).

Enthusiasm and grades

The third and fourth objectives of the study were to examine whether teacher enthusiasm relates to the use of emotion empathy messages and, subsequently, whether these messages are related to students' grades. Our results showed a lack of a significant relation between teachers' initial enthusiasm and their emotion empathy messages. This suggests that the level of enthusiasm at the beginning of the year does not predict how empathetic a teacher will be in their communication. Empathy, as expressed through teachers' messages is not solely dependent on enthusiasm as a static trait at the start of the year, instead it may be more influenced by dynamic changes in teachers' enthusiasm. In fact, results showed a negative relation between the change in enthusiasm ($\Delta T3 - T1$) and emotion empathy messages. This suggests that as teachers' enthusiasm increases, their use of emotion empat messages tends to decrease. Conversely, as enthusiasm decreases, the use of emotion empathy messages tends to increase. These findings line up with Falcon et al. (2023) study that showed how the more enthusiastic teachers are, the less they tend to rely on messages to engage students in tasks. Considering that teachers who display greater enthusiasm often exhibit positive emotions (Kunter et al., 2008, 2011), it is likely that, through emotional contagion, students may adopt similar feelings (Frenzel et al., 2024), leaving the teacher with less need to engage in messages to encourage or reassure students. Building on the broaden-and-build theory, positive emotions like enthusiasm would help the teacher build and sustain long-term empathetic practices that benefit the classroom environment. When such classroom climates are established, teachers may feel there is no need to rely on these messages as students may not demonstrate a need for them. In other words, a teacher's natural enthusiasm might serve as an indirect form of emotional support, reducing the necessity for explicit empathy messages to motivate or comfort students. This aligns with the concept of emotional contagion, whereby students may mirror their teacher's positive affect, fostering a classroom environment that is inherently supportive and less reliant on specific verbal cues for engagement and reassurance (Frenzel et al., 2024). Another possible explanation is that teachers with lower enthusiasm might try to compensate such motivational state by communicating more empathetically with their students to maintain a positive environment. This decrease in enthusiasm could relate with teachers that face greater challenges, such as classroom conflicts or students with higher needs, prompting them to rely on such messages. This would explain an adaptive response of teachers to the contexts' demands. Finally, it could also be possible that the enthusiastic teacher maintains an internal attentional focus, concentrating heavily on the subject matter and, as a result, neglecting the emotional needs of their students (i.e., failing to take the students' perspectives).

Finally, results could also be interpreted as teachers who used more emotion empathy messages initially having smaller changes in their enthusiasm over time. This would suggest that employing these messages early on may help establish a supportive and positive classroom environment, which could contribute to greater emotional stability for the teacher. This aligns with previous research showing how teaching practices and students' behaviour relate reciprocally (Frenzel et al., 2018, 2024; Goetz et al., 2021). By addressing students' emotional needs from the start, teachers may reduce potential sources of stress or conflict, creating a smoother teaching experience and maintaining their motivation. Hence, displaying empathy messages early in the course might serve as a protective factor for sustaining teachers' emotional and motivational resources throughout the year. In fact, previous research has shown how teacher emotions are shaped by student traits and, in turn, influence teachers' emotional support to students (Burić & Frenzel, 2023; Frenzel et al., 2015).

In addressing the fourth objective regarding the relation between empathy messages and students' grades. Results suggest complex dynamics between the trajectories of empathy messages and grades. The results from the correlation between the intercept of grades and the slope of messages suggest that

initially high grades appear to relate to an increase in empathy messages over time. However, the relation between both slopes suggests that a rapid improvement in grades may be linked to a more stable or declining frequency of these messages. This could imply that teachers adjust their empathy messages based on students' academic needs, potentially decreasing as students achieve higher performance levels. This aligns with previous findings, as teacher empathy has been shown to impact various student outcomes (Aldrup et al., 2019), though its relation with academic performance remains inconclusive. While some studies have found a positive link between teacher empathy and student performance (Franklin, 2013; Latchaw, 2016), others have not supported this association (Aldrup et al., 2020; Curci et al., 2014). Given the role of empathy in enhancing teaching practices related to academic success, such as fostering classroom management, instructional support and student engagement (Kunter et al., 2013; Ruzek et al., 2016), a positive relation between teacher empathy and grades is plausible. In addition, teachers who demonstrate empathy may enhance the classroom environment by providing social and emotional support that encourages students' engagement and motivation. This support could lessen as students' performance improves, possibly due to the diminishing need for motivational reinforcement when students already exhibit high achievement levels. These findings also align with research showing that empathetic teachers are more adept at understanding and responding to student needs, promoting positive classroom dynamics and student outcomes (Bieg et al., 2017; Nett et al., 2010).

Limitations and future directions

Despite the novelty of this study and its practical and theoretical implications, some limitations should be considered. First, we could not analyse data on context and appraisal empathy messages due to the limited number of messages found, so the impact of those categories could not be investigated. Secondly, given the scope of a typical academic year, eight audio lessons per term may not capture all situations in which these messages are expressed. Furthermore, we collected audio lessons at the end of each term. Even though this time allows teachers and students to know each other better, it is plausible that students' concerns and fears are shown at the beginning or middle of each term due to the uncertainty they face. Moreover, it is also possible that these messages might be conveyed privately outside the classroom. Therefore, future studies should consider recording over a more extended period and include both classroom sessions and individual teacher–student interactions such as mentoring sessions. Regarding messages, the present study focused on negatively valanced emotions, since these are often more pronounced among secondary students (Hascher et al., 2024; Meyer & Schlesier, 2022; Moeller et al., 2020) and thus can be more apparent to teachers (due to their intensity, outward expressions or changes in behaviour), making them easier to identify and address in the classroom. Moreover, these emotions are more likely to elicit teacher support (Chen & Leung, 2023). However, we encourage future research to examine messages targeting both positively and negatively valanced emotions. Additionally, empathy measures rely solely on audio data which could lead non-verbal cues (i.e., such as tone, body language or facial expressions) and other forms of empathy being missed. Given that the contextual nuances of classroom interactions can be critical for the understanding on teacher empathy, incorporating both empathy questionnaires and video recordings could provide a more comprehensive understanding by including self-reports, students' perceptions and teachers' non-verbal behaviour. The AI techniques employed could be considered a third limitation of this study. Hence, AI should not be viewed as the perfect coding machine; although a two-step coding process was implemented to minimize errors and biases, the potential for biased or incomplete training data remains a concern. Potential biases such as sampling bias, where the data may not fully represent all relevant subgroups, or label bias, where human annotation might introduce subjectivity, can affect the present results. While efforts were made to enhance the quality and representativeness of the dataset through manual review and refinement, it is important to acknowledge that the AI's performance is ultimately dependent on the robustness of its training data. This includes the risk of historical bias, where the AI may inherit pre-existing prejudices in the data or algorithmic bias, where the model may disproportionately prioritize

certain features over others. Additionally, AI lacks the ability to fully capture cultural nuances, which can be a critical factor in interpreting data. These biases could lead to inaccurate predictions or unfair outcomes, as the model may not generalize well across different subgroups, result in the model learning incorrect associations or result in models that make unjust decisions or recommendations, even if the data itself appears unbiased.

Moreover, despite the inclusion of broader text fragments and the transcription process capturing certain tonal elements through punctuation, these measures cannot fully substitute for the richness of multimodal data. This highlights the need for future research to integrate multimodal approaches and improve transparency in AI decision-making processes including diverse data types such as text, images or audio data. Such integration would not only enhance the interpretative depth but also mitigate biases by providing a more comprehensive and contextual aware understanding of the data. In education, multimodal approaches could include the combination of text analysis with facial expressions, voice tone and body language. We also encourage researchers to manually review the training data and results, alongside conducting reliability tests, as we did, to ensure more accurate and fair AI outputs. Finally, the cultural context is also a limitation, as the study was limited to the Spanish population. Therefore, the generalizability of these results to other cultural contexts remains unknown. Future research should include a more diverse sample to determine if similar results are observed across different cultural settings.

Implications for practice

Years of research have established the undeniable fact that empathy is an essential component of social occupation, such as teaching. Nonetheless, standing on someone else's shoes is no easy task. Without some effort from teachers knowing and understanding what students' want, think, feel and need can be more challenging than expected (Tettegah & Anderson, 2007), as accurately inferring someone else's inner motivations is tough. But it is not all bad news. Empathy has proven to improve after training (Ngo et al., 2022; van Berkhout & Malouff, 2016). Hence, the results from the present research can be of great relevance for school staff and teachers to improve both teachers' communication in class and student outcomes. For instance, it could be useful for teacher training programmes to provide teachers with feedback on the messages they use in order for them to know where they are and where they want to be. This could be done by either recording their lessons or by implementing systematic observations among teachers as peers. Once this starting point is identified, one straightforward approach to start taking the students perspective is simply asking them (Reeve et al., 2022). Teachers could therefore be trained in ways in which they could gather such information. For instance, questions such as 'How does this sound?' after introducing student's learning objectives of the day or simply asking 'Are you okay with this?', 'What do you need?', 'Is everything okay?' would probably enhance the teacher–student relation and hence student outcomes. Once teachers are aware of their students' needs, tailoring empathy messages to them would most likely become easier. Moreover, the findings on the relation between teacher enthusiasm and the use of empathy messages suggest that teachers with higher enthusiasm may rely less on such messages because their overall positive attitude naturally influences students. However, sustaining enthusiasm requires effective management of stress and burnout. As such, recent research suggests that positive affect contributes to teacher enthusiasm both directly and indirectly via self-efficacy and job satisfaction (Burić & Moè, 2020). Enhancing teachers' self-efficacy through professional development programs that build classroom management skills and problem-solving abilities can boost their confidence and therefore their enthusiasm. School principals and teacher trainers who encourage a growth mindset, empower teachers with autonomy and leadership while also encourage a positive and supportive school culture would most likely make a difference. Moreover, given that policymakers play a crucial role in shaping the conditions that influence teacher enthusiasm, they can prioritize strategic policies that provide teachers with adequate resources to perform their duties. For instance, allocating funds for socially orientated training programs for teachers (Wu et al., 2024), classroom supplies,

learning tools, and technology as well as access to support staff such as counsellors, teaching assistants and IT professionals. This added to a workload support work–life balance initiatives, focus on teacher well-being (i.e., counselling services, stress management workshops), promote a positive school culture that values teacher contributions and opportunities for collaboration with peers and schools would most likely increase their job satisfaction, further fostering enthusiasm for teaching. Furthermore, the present methodology and framework could also aid the research community by setting the basis for future research on empathy's role in effective teaching.

CONCLUSION

Aldrup et al. (2020) underscore that while there may be limited consistent evidence linking teachers' empathy directly to student outcomes, this gap should inspire innovative approaches rather than dismissal. Our findings take a step in this direction by proposing a framework for assessing teachers' empathy through recorded empathy messages during lessons, offering an operationalization that reconnects empathy to effective teaching by embodying the idea of 'standing in someone's shoes.'. By defining empathy as messages that reflect an understanding of students' contexts, appraisals and emotions, this framework not only expands upon Control-Value Theory (CVT) but also clarifies how teachers' motivational states relate with their own teaching practices. Teachers' enthusiasm, shown to reduce reliance on empathy messages, suggests that it can be contagious to students and thus could serve as a source of emotional support for students. Moreover, although grades and teacher empathy messages were shown to be related, more research is needed to clarify this relation. This integrated approach offers a more nuanced view of teacher empathy within the CVT framework, suggesting a potential pathway for future interventions aimed at enhancing classroom climate and educational outcomes.

AUTHOR CONTRIBUTIONS

Elisa Santana-Monagas: Conceptualization; formal analysis; methodology; supervision; writing – original draft; writing – review and editing. **Juan L. Núñez:** Supervision; project administration; writing – review and editing. **Jaime León:** Formal analysis; funding acquisition; methodology; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

ORCID

Elisa Santana-Monagas https://orcid.org/0000-0003-4676-5757
Juan L. Núñez https://orcid.org/0000-0002-2400-7843
Jaime León https://orcid.org/0000-0002-9587-4047

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