

Research paper

Motivational messages from teachers before exams: Links to intrinsic motivation, engagement, and academic performance

Maryam Alqassab^{a,b}, Jaime León^{a,*}^a University of Las Palmas de Gran Canaria, Department of Education, C/. Santa Juana de Arco 1, 35004, Las Palmas, Spain^b Open University of the Netherlands, Department of Online Learning and Instruction, Netherlands

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ABSTRACT

This mixed-method study explored teachers' motivational messages before exams and their impact on students' intrinsic motivation, engagement, and academic performance. High school students in Spain (N = 419) completed questionnaires on motivation and engagement and described teachers' motivational messages. Messages encouraging effort and capability were the most reported, followed by reassuring messages. Serial mediations showed a positive link between reassuring messages and academic performance via intrinsic motivation and engagement, while lack of messages had a negative effect. No moderation effect of gender was found. These findings underscore the importance of reassuring messages during exam periods.

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1. Introduction

Recognizing the pivotal role of teacher's behaviour in shaping the course of students' learning experience in classrooms, several parallel lines of research developed over the past decades showing substantial effects of teachers' behaviour on various student outcomes including motivation, engagement, and performance across different subject domains (Den Brok, Brekelmans, & Wubbels, 2004; Den Brok, Levy, Brekelmans, & Wubbels, 2005; Jang, Reeve, & Deci, 2010, 2012; Reeve & Lee, 2014; Sivan & Chan, 2013; Wubbels, Brekelmans, den Brok, & van Tartwijk, 2006). Earlier research on learning environments showed that teachers' interpersonal behaviour explained around half of the variance in student outcomes (Den Brok et al., 2004). In the classroom, teachers typically play multiple simultaneous roles to support students' learning including instructing, managing, and motivating roles (Doyle, 2006). Students' motivation to learn does not only entail intrapersonal processes reflected by their personal beliefs and orientations but it is also

driven by interpersonal processes largely defined by the teacher-student relationship (Reeve & Jang, 2006). To better understand the interpersonal dimension of students' motivation, research has examined how teachers attempt to motivate students in the classroom (i.e., teacher motivating style; Reeve, 2009).

Grounded in the self-determination theory (SDT; Ryan & Deci, 2017) cumulative research demonstrated that teacher motivating style that supports autonomy is associated with positive student outcomes as opposed to a controlling motivating style (Aelterman et al., 2019; Jang et al., 2010; Reeve & Lee, 2014; Ryan & Deci, 2020; Wang, Xing, & Moè, 2024). In this context, autonomous-supportive teacher motivating style is "whatever a teacher says and does during instruction to facilitate students' perceptions of autonomy" (Reeve, 2012, p. 167). While most of the studies on teacher motivating styles focused on teacher's behaviour during instruction (see e.g., Aelterman et al., 2019; Reeve & Jang, 2006; Wang et al., 2024) a growing interest has been observed in other important yet less frequently studied aspects of teacher motivating style. Particularly crucial are the messages teachers communicate in the classroom to motivate students in their educational journey (e.g., Putwain, Symes, Nicholson, & Remedios, 2021; Santana-Monagas, Núñez, Loro, Moreno-Murcia, & León, 2023; Santana-Monagas et al., 2022a,b). We broadly refer to these messages as *motivational messages*.

Despite the emergent evidence of the significant impact of these messages on students' motivation, engagement, and performance (Putwain, Symes, & Wilkinson, 2017; Putwain & Remedios, 2014;

* Corresponding author. Department of Education, University of Las Palmas de Gran Canaria, /. Santa Juana de Arco 1, 35004, Las Palmas, Spain.
E-mail address: jaime.leon@ulpgc.es (J. León).

Santana-Monagas et al., 2023; Santana-Monagas et al., 2022a,b) they remain relatively understudied. Communication studies have revealed that, from the student's perspective, teachers' messages play a crucial role in helping the students navigate challenging situations and difficult times (Kaufmann, Vallade, & Frisby, 2021; Nazione et al., 2011). Preparing for high-stakes and low-stakes examinations can be a challenging period for many high school students. While the initial research on teacher motivational messages was conducted in the context of high-stakes examinations, the focus of this research was mostly on one type of messages (i.e., *fear messages*, see Putwain et al., 2021), and the majority of these studies were conducted in the UK.

More recently, a growing number of studies carried out in Spain have shown the potential of non-fear-related motivational messages communicated by high school teachers to support students' engagement in learning activities (Santana-Monagas et al., 2022a,b; see also: Falcon et al., 2023a,b; Santana-Monagas et al., 2022a,b; Santana-Monagas et al., 2023). However, none of the studies carried out in Spain explored motivational messages used by teachers before exams. Our study attempts to fill in the current research gap by investigating different types of motivational messages communicated by teachers before exams, and how these messages are related to student outcomes. Additionally, the extent to which teachers' exam motivational messages affect student outcomes differently for males and females remains unknown. Knowing the impact of different motivational messages and whether they function differently for female and male students can help inform teachers to better support their students when preparing for exams.

1.1. Types of teacher exam motivational messages

Exam motivational messages are defined as messages communicated during exam periods intended to encourage students to put in effort towards their exams, persevere through challenges, and actively engage in their studies (Putwain & Roberts, 2012). Research on this type of messages is not new. An established body of research in the UK grounded in message framing theory (Rothman & Salovey, 1997) exists (see Putwain et al., 2021). Several types of messages were identified in previous studies that either exert negative or positive pressure on students to engage in learning (Putwain, 2009; Putwain & von der Embse, 2018).

Messages that remind students about the importance of passing examinations and the consequences of failure are referred to as *fear messages* (fear appeals), while messages that highlight the capability of students to reach a learning goal or outcome are *efficacy messages* (efficacy appeals; von der Embse, Schultz, & Draughn, 2015). Due to their possible negative impact, fear messages generally received more attention. Unlike, fear messages, efficacy messages have a positive impact on student performance (von der Embse et al., 2015). A classroom observational study further identified encouraging messages which were classified as providing rationale, reassurance, and empowerment (Wilkinson, Putwain, & Mallaburn, 2020). Providing rationale and reassurance are conceptualised within the SDT as supporting autonomy and competence respectively (Ahmadi, Noetel, Ryan, & Ntoumanis, 2023; Ryan & Deci, 2020). *Reassuring messages* can convey positive expectations of student success by expressing 'hope, encouragement, and optimism' (Ahmadi et al., 2023), and thus seem central in the context of exams. For instance, a study on communication in education revealed that students mostly reported reassuring messages as the teacher messages that helped the students in times of uncertainty (Kaufmann et al., 2021). However, little is known about this type of motivational messages when communicated to encourage students to prepare for exams. Further, evidence on how reassuring messages are related to students' learning outcomes is still lacking. Studies so far have focused on students' perceptions of motivational messages communicated to them by teachers. Yet, little is known about the experience of students who report no motivational messages, especially concerning their learning outcomes like motivation or academic performance.

Studies investigating teacher motivational messages in the classroom typically resort to survey data, aiming to provide more generalizable evidence on the impact of particular teacher messages on student outcomes (Putwain & von der Embse, 2018; Putwain et al., 2017, 2021; Santana-Monagas et al., 2022a,b; Santana-Monagas et al., 2023). Yet, this approach may fail to provide an in-depth picture of students' experiences and can restrict or bias students' responses (Reja, Manfreda, Hlebec, & Vehovar, 2003). The study by Wilkinson et al. (2020) adopted an observational method to explore how teachers communicate with students about upcoming high-stakes examinations. This study reported observing teachers delivering other types of messages such as reassuring messages which were overlooked by earlier survey-based studies. Despite the high ecological validity of naturalistic classroom observations, systematic analysis of classroom interactions is highly complex and extremely demanding and is consequently constrained by small sample sizes (Hennessy, Howe, Mercer, & Vrikki, 2020; Howe, Hennessy, Mercer, Vrikki, & Wheatley, 2019).

Open-ended questions can provide a less restrictive alternative to surveys. Even though this approach is not as ecologically valid as classroom observations it can provide a broader picture of students' experiences compared to closed-item surveys. Although data rendered from open-ended questions is more manageable to be systematically coded compared to classroom observations, the large amount of qualitative data can still restrict scaling up quantitative studies using open-ended questions.

The rapid advancement of text-based Generative Artificial Intelligence (GenAI) tools such as ChatGPT (Brown et al., 2020), opened up a wide array of possibilities for educational researchers (Kasneji et al., 2023) making it possible to scale up sample sizes of studies applying systematic analysis to qualitative data. The ability of large language models such as GPT to classify open-ended responses based on pre-defined categories with a high agreement with human coders has been supported by several studies (e.g., Álvarez-Álvarez and Falcon, 2023; Mellon et al., 2023; Ornstein and Blasingame, 2022; Santana et al., 2024). Guided by this research, our study aimed to fully automate the coding of qualitative open-ended responses using ChatGPT (OpenAI, 2023) to provide a more comprehensive picture of students' reports of teachers' motivational messages communicated in the classroom about exam preparation.

1.2. Motivational messages and links to motivation, engagement, and performance

In research on teacher's behaviour, there are established links to students' motivation, engagement, and academic performance (Reeve, 2009, 2012; Wubbels et al., 2006). Empirical research from the perspective of the SDT showed that autonomy-supportive teachers' motivating style is associated with students' intrinsic motivation, more engagement, and positive academic performance (Reeve, 2012; Ryan & Deci, 2020).

In line with these relationships, studies on teachers' motivational messages communicated before examinations found significant relationships between different types of messages and students' intrinsic motivation, exam performance, and engagement (Putwain & Remedios, 2014; Putwain et al., 2017; von der Embse et al., 2015). Putwain and Remedios (2014), found that fear messages—when perceived as threatening—predicted lower intrinsic motivation and examination performance. In an experimental study with university students, von der Embse et al. (2015) showed that students who received fear messages from their teachers performed significantly worse than students who received efficacy messages.

Adopting a broader perspective of studying teacher messages beyond examinations, Santana, Putwain et al. (2022) extended teacher messages communicated in the classroom based on the SDT. In this study, with high school students in Spain, the researchers found that students' perceptions of teachers' engaging messages that appealed to intrinsic

motivation and gain (e.g., “If you work hard, you will learn interesting facts.”) were positively related to students’ intrinsic motivation and performance. This study motivated several studies in Spain all showing links between these types of teacher messages in the classroom context and various student outcomes (Satana-Monagas et al., 2022a,b; see also Falcon et al., 2023a,b; Santana-Monagas et al., 2023; 2024). However, these studies did not make explicit reference to exams despite the observations by these researchers that teachers tend to refer to grades or passing exams when communicating these messages to their students (see Falcon et al., 2023a,b). Provided that earlier research on exam motivational messages heavily focused on one type of messages (i.e., fear messages) mostly in the context of high-stakes examination (see Putwain et al., 2021), research is further needed to examine how other types of messages communicated by teachers to students about preparing for exams are related to students’ motivation, engagement, and performance.

Although there are two main types of motivation namely intrinsic and extrinsic motivation (Ryan & Deci, 2020), for the purpose of our study, we only examined intrinsic motivation because its relationship with engagement and academic performance is well-established in the literature on teachers’ motivating style (Reeve, 2012; Reeve & Cheon, 2021; Reeve & Lee, 2014), and earlier research on exam motivational messages did not find a significant relationship between fear messages and extrinsic motivation (Putwain & Remedios, 2014). Additionally, there is a consensus in the literature that engagement consists of at least three elements, behavioural, cognitive, and emotional engagement (Reeve, 2012). We focus in our study on behavioral and cognitive engagement because these two types of engagement are relatively more salient for teachers to detect when observing students in the classroom (Lee & Reeve, 2012).

The large body of empirical research on teachers’ motivating styles based on the SDT further suggests a mediational role of motivation on the relationship between teachers’ motivating style and student performance (Reeve, 2012; Ryan & Deci, 2020), a pattern that has been also supported by prior studies on teachers’ motivational messages (Putwain & Remedios, 2014; Santana-Monagas et al., 2022b). Nevertheless, engagement has been reported to fully mediate the relationship between motivation and performance (Reeve, 2012; Reeve & Tseng, 2011) suggesting a serial mediational effect of motivation via engagement that has not been tested yet by studies on teachers’ motivational messages.

The finding by Putwain et al. (2017) that behavioral engagement mediated the relationships between fear messages and examination performance, together with earlier findings on the mediational effects of intrinsic motivation (Putwain & Remedios, 2014; Santana-Monagas et al., 2022b) allude to the bridging role of engagement (Reeve, 2012), yet this needs to be empirically tested. Further examining the intricate relationship between teachers’ motivational messages, motivation, engagement, and performance is important especially since the function of these types of messages is to encourage students to actively engage in their studies (Putwain & Roberts, 2012; Santana-Monagas et al., 2022b).

1.3. Gender differences in the relationships between motivational message motivation, engagement, and performance

Different types of teachers’ exam motivational messages may have varying impacts on students with diverse individual characteristics. Investigating the effect of gender is crucial in this context, as research based on the SDT has demonstrated gender effects on the relationship between teachers’ (de)motivating behaviors and student outcomes (Abós, Burgueño, García-González, & Sevil-Serrano, 2021; Koka & Sildala, 2018). Koka and Sildala (2018) found that teachers’ controlling behavior had a stronger negative effect on female students compared to male students. Similarly, Abós et al. (2021) examined the impact of gender on the relationship between teachers’ controlling behavior and student outcomes in a Spanish sample, revealing more negative SDT-related outcomes, including higher levels of amotivation, for

female students than for male students. However, these studies were conducted within the context of physical education, focusing on teachers’ behavior rather than motivational messages. In an experimental study, Moè and Putwain (2020) found that fear messages lead to improved mathematics performance only for male high-school students while females experienced decreased intrinsic motivation after receiving fear and efficacy messages. It is, therefore, still open for investigation what type of teachers’ exam motivational messages male and female students report in naturalistic settings, and to what extent these messages may trigger different motivational processes and result in different outcomes for female and male students.

1.4. Current study

The aim of this study was to explore different types of teachers’ exam motivational messages without a particular reference to high-stakes examinations, and how these messages are related to students’ intrinsic motivation, engagement, and academic performance. We also attempted to explore the impact of gender on the type of reported messages and on the relationships between exam motivational messages, intrinsic motivation, engagement, and academic performance. Informed by findings of prior research on teachers’ (exam) motivational messages (e.g., Putwain & Remedios, 2014; Putwain et al., 2017; Santana-Monagas et al., 2022b; von der Embse et al., 2015) and teachers’ motivating style (Reeve, 2012; Reeve & Tseng, 2011) we tested whether the relationship between teachers’ exam motivational messages and academic performance was serially mediated by intrinsic motivation and engagement, and whether these relationships differed for male and female students (Abós et al., 2021; Koka & Sildala, 2018; Moè & Putwain, 2020). The study attempted to answer the following research questions?

RQ1. What are the different types of teachers’ exam motivational messages reported by students, and do these messages differ depending on the gender of the students?

RQ2. How do different types of teachers’ exam motivational messages relate to students’ intrinsic motivation, engagement, and academic performance?

RQ3. Does students’ gender have an impact on the relationships between teachers’ exam motivational messages and students’ intrinsic motivation, engagement, and academic performance?

We tested the serial mediation model proposed in Fig. 1 guided by the following hypotheses to answer RQ2 and RQ3.

Hypothesis 1a. Efficacy and reassuring teachers’ exam motivational messages will be positively related to academic performance via intrinsic motivation and engagement due to the full mediation effect of engagement on the relationship between motivation and academic

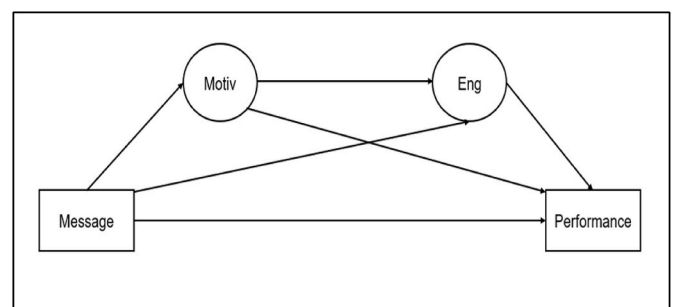


Fig. 1. Tested model of the relationship between teachers’ exam motivational messages and academic performance serially mediated by motivation and engagement. To test the gender effect the same model was tested for female and male students using multigroup SEM.

performance (Reeve, 2012; Reeve & Tseng, 2011) and the previously found positive relationships between these types of messages and academic performance (Putwain & Remedios, 2014; Putwain et al., 2017; Satana-Monagas, Putwain & Roberts, 2009; von der Embse et al., 2015).

Hypothesis 1b. Fear messages and lack of teachers' motivational messages (reported by students as nothing) will be negatively associated with academic performance via less intrinsic motivation and engagement.

Hypothesis 2. Based on previous findings on gender differences (Abós et al., 2021; Koka & Sildala, 2018; Moè & Putwain, 2020), fear messages and nothing messages will be negatively related to academic performance via intrinsic motivation and engagement for female students, while efficacy and reassuring messages will have positive relationships for male students.

2. Method

2.1. Sample

In this study we analysed responses from 419 Spanish high-school students, 50% males with a mean age of 17.01 years ($SD = 1.49$, range = 14–26 years old) recruited from 15 schools in Gran Canaria and Tenerife Canary Islands in Spain. Participants were informed that their participation was voluntary and anonymous, and they answered an online questionnaire via Google Forms during the first trimester of the academic year 2022–2023.

2.2. Instruments and measures

2.2.1. Exam motivational messages

Exam motivational messages communicated by teachers were measured by asking the students to provide a short answer to the question: "During exams period, what does your teacher usually tell you to do to make you work hard and study?". We developed this single open-ended question for the purpose of this study. The length of students' responses ranged from a single word to a maximum of around thirty words. Students were required to provide an answer to this question to be able to submit their questionnaires, therefore very few responses ($n = 3$) only included "." and we regarded them as belonging to the "nothing" category. A total of 419 responses were analysed using a quantitative content analysis approach (Krippendorff, 2004).

2.2.2. Coding scheme

We developed a coding scheme based on previous research on exam motivational messages (Putwain & Roberts, 2012; Putwain & von der Embse, 2018; Wilkinson et al., 2020) and the classification of teachers' motivational behaviour based on the SDT (Ahmadi et al., 2023). Initially, five message categories were distinguished: (1) fear messages, (2) time reminders, (3) efficacy messages, (4) reassuring messages, and (5) nothing. An additional sixth category "other" was also included for messages that did not belong to any of the five categories. The efficacy messages type was further specified into *effort* and *capability* guided by Ahmadi et al.'s. (2023) classifications. Time reminders were combined with fear messages as this type of messages was reported by students to elicit fear (Putwain, 2009). The final version of the coding scheme consisted of five types of messages: (1) fear, (2) effort, (3) capability, (4) reassuring, and (5) other (see Online Resource 1 on https://osf.io/ky3v5/?view_only=0c1c744e995f47d784091b7327379103). GPT 3.5¹ was used to evaluate and revise the categories of the coding scheme (details on this can be found online https://osf.io/h3b5a/?view_only=e758b3bd396d4a49b50c1d043dc59cc5).

¹ GPT-3.5 was used in the phase of developing the coding scheme, but for the actual segmenting and coding we used ChatGPT-4.

2.2.3. Academic performance

Students' academic performance was measured by their teacher-assigned grades which were accessed through high schools' official records. In Spain, teachers assess the performance of their students based on government-implemented rubrics using a grading scale with a minimum of one and a maximum of ten (Leon et al., 2017a,b). The mean of students' grades was 5.66 ($SD = 2.39$; min = 0, max = 10). The academic performance of 17 participants was missing because no official records were provided.

2.2.4. Intrinsic motivation

We measured students' intrinsic motivation using the Spanish subscale of intrinsic motivation which was validated in previous studies (see Núñez, Martín-Albo, & Navarro, 2005). This subscale consists of four items preceded by the statement: "Why do you study?". An example item is "Because for me it is a pleasure and a satisfaction to learn new things" (see Online Resource 2 for the full list of items on https://osf.io/59gz2/?view_only=5bcf09d027a64e059f0746e9cf58512c). Items were answered based on a 7-point Likert scale (1 = does not correspond at all to me, to 7 = fully corresponds to me). We assessed the internal consistency of the subscales using the sample of the current study with McDonald's omega based on congeneric CFA using the robust Maximum Likelihood Estimator (MLR). The model we tested using the current study data had an acceptable fit, $\chi^2(2) = 9.179$, $p = .010$, RMSEA = .093 [.046, .145], TLI = .971, CFI = .990, and a good internal consistency: McDonald's omega = .899. A Factor score was then computed based on the Expected A Posteriori (EAP) estimate because this method is recommended for secondary data analysis (i.e., using factor scores as outcome variables in further analyses; Zitzmann, 2023). This factor score was used in the correlation analysis.

2.2.5. Engagement

We used two subscales of the Spanish version of the Jang, Kim, and Reeve (2012) Classroom Engagement scale, validated in a previous study Núñez and León (2019) to measure students' engagement. The two subscales –each consisting of three items– measured cognitive engagement (e.g., item: "Before starting an assignment for this class, I try to figure out the best way to do it."), and behavioural engagement (e.g., item: "I try hard to do well in this class") (see Online Resource 2 for items on https://osf.io/59gz2/?view_only=5bcf09d027a64e059f0746e9cf58512c). Items were rated on a 7-point Likert scale. The tested model using the current study data showed that the factor structure had a satisfactory fit: $\chi^2(3) = 17.005$, $p = .001$, RMSEA = .106 [.086, .224], TLI = .900, CFI = .980, and good internal consistency of the general factor (cognitive and behavioral); McDonald's omega = .922. A Factor score was then computed based on the EAP estimation method to be used in correlation analysis.

2.3. Analyses

2.3.1. Coding students' open-ended responses using ChatGPT

To code the open-ended responses, we used a hybrid human-ChatGPT quantitative content analysis approach. To automatically code the qualitative data using ChatGPT we adopted a multi-layer quantitative content analysis following the framework by Mu, Stegmann, Mayfield, Rosé, and Fischer (2012). According to this framework, segmentation and coding must be systematically and independently performed in the process of automatic coding.

Segmentation. We performed the segmentation following Strijbos, Martens, Prins, and Jochems (2006) procedure. An intercoder agreement was calculated for the segmentation from the perspective of two independent coders, with a minimum of 80% of the proportion agreement. Further details on the segmentation procedure can be found online: https://osf.io/h3b5a/?view_only=e758b3bd396d4a49b50c1d043dc59cc5. After a short meeting (30 min) to discuss the segmentation procedure, the first author and a research assistant independently

segmented 10% of the responses ($n = 42$) in a single trial. Both coders identified the same number of segments with a proportion agreement of 95% (from the perspectives of both coders). The first author created a simple prompt based on the segmentation procedure performed by the human coders (see Table 1). The same 10% of the responses segmented by the human coders were analysed by ChatGPT-4. The proportion agreements on segmentation between ChatGPT and both human coders were greater than 80% (see Table 2). All the data was subsequently segmented using ChatGPT.

Coding. Once the coding scheme was finalized, the first author and a research assistant independently coded 10% of the segmented data. Proportion agreements and Krippendorff's α were used to establish human intercoder agreements. A good intercoder agreement (Krippendorff, 2004) was achieved between the two human coders in a single coding trial, with 89.90% and Krippendorff's $\alpha = .85$ [.68, .93] (agreements are reported in Tables 3 and 4). The first author created a prompt based on the coding scheme (see Appendix A for the entire prompt), and the performance of ChatGPT was compared to the coding by the two human coders of the same 10% of the data coded by humans showing a good reliability Krippendorff's $\alpha = .80$ (see Tables 3 and 4). The prompt started with:

Here are some open-ended responses by secondary school students to the question "En época de exámenes, ¿qué te suele decir tu profesor/a para que te esfuerces y estudies?".

Can you help me to sort these responses by their content? I need to categorize them for my research project.

Assign one of the following categories to each open-ended text response:

Once an acceptable inter-rater agreement was established with ChatGPT, the remaining of data were coded by ChatGPT by assigning a categorical number to each type of message as follows: '1 = fear', '2 = effort', '3 = capability', '4 = reassuring', '5 = nothing', and '6 = other' (see Appendix A for detailed description of each category and https://osf.io/ky3v5/?view_only=0c1c744e995f47d784091b7327379103 for the coding scheme). Then, we created six binary variables for the six categories of motivational messages. For each participant, these variables were assigned 0 if the specific category was not detected in the response of the student or 1 if it was detected. Further statistical analyses were conducted using these binary variables.

2.3.2. Statistical analyses

Rank-based point-biserial correlations were performed to investigate the relationship between different types of exam motivational messages and student outcomes due to violation of the assumption of normality (descriptives of all study variables can be found online: https://osf.io/nfwpg/?view_only=3edf9d12d33c42579f6230d9c9ba1435). We ran the mediation analyses using serial mediation models with two mediators using the structural equation model (SEM) approach in lavaan R package (Rosseel et al., 2023) with 5000 resample bootstrap estimation to account for the non-normality of the data (Nevitt & Hancock, 2001). The fit indices used to evaluate the models were the Comparative Fit Index (CFI) > .95, Tucker–Lewis index (TLI) > .95, Root Mean Square Error of Approximation (RMSEA) < .08, Standardised Root Mean Square Residual (SRMR) < .08 (Hu & Bentler, 1999). To assess the significance of the indirect effects, we applied bootstrapping analysis with 5000 resample to acquire 95% confidence intervals for the indirect effects of the models (Preacher & Hayes, 2008). If the 95% confidence interval did not include zero, the indirect effect was considered significant. Following the same approach of earlier studies (Falcon et al., 2023a,b; Santan-Monagas, Putwain & Roberts, 2009), separate serial mediation models were tested for each type of messages given the size of our sample and the complexity of the model if all messages types were included in a single model. To investigate if gender moderated the relationships between exam motivational messages, motivation,

engagement, and academic performance, we compared multi-group serial mediation models using SEM (with gender as a grouping variable) to the single-group SEM serial mediation model using a χ^2 difference test. A significant χ^2 difference test indicates that the multi-group model provides a better fit suggesting a gender effect, while an insignificant test suggests no gender effect. We applied the Benjamini-Hochberg correction to the p-values to account for multiple testing in SEM while running the multi-group serial mediations to examine the gender effect. For the statistical analyses syntax see https://osf.io/926qu/?view_only=3207a13d6d58484ea25f7d2417caca4.

2.3.3. Statistical software

Descriptives and correlation analyses were performed using JASP version 0.17.2.1 (JASP Team, 2023). The remaining analyses were conducted using RStudio version 2023.06.0 + 421 (RStudio Team, 2020). Krippendorff's alphas were computed using the R package krippendorffsalpha (v. 2.0; Hughes, 2022). Reliability analyses of the used measures were computed using CFA using lavaan (v. 0.6-15; Rosseel et al., 2023), and McDonald's omegas were computed using the EFAtool package (Steiner et al., 2023). The serial mediation models were estimated using SEM in the lavaan package. The function standardizedSolution_boot_ci(.) from the R package semhelpinghands v.1.1.9.11 (Cheung, 2024) was used to calculate the 95% bootstrap CIs of the indirect effects.

3. Results

3.1. Content of teachers' exam motivational messages

As can be seen in Fig. 2, the most reported type of messages was effort (47%) followed by capability (23%), and reassuring messages (19%). Fear messages were only reported by a limited number of students (8%), and those who reported that their teacher did not tell them anything were around 12%. Male and female students showed overall similar patterns of the reported messages, however while females seemed to report more effort messages males reported more reassuring messages (see Fig. 3). A post-hoc Multiple Analysis of Variance (MANOVA) with Bonferroni correction for multiple testing of theoretically related variables (effort, capability, and reassuring messages) was conducted to examine the effect of gender on the types of teachers' messages effort, capability and reassuring. According to Pillai's Trace test, there was no significant multivariate effect of gender on the combined dependent variables, $V = 0.018$, $F(3,415) = 2.523$, $p = 0.171$, $VS-MPR^2 = 2.245$.

The rank-based point-biserial correlations showed that only reassuring messages and the nothing messages were significantly related to student outcomes (see Table 5).

3.2. Relationships between motivational messages, intrinsic motivation, engagement, and academic performance

Serial mediation analyses were only conducted for the reassuring and nothing messages because they were the only types of messages significantly related to student outcomes (see Table 5). The tested models initially showed non-acceptable fit for both reassuring and nothing messages. Modification indices suggested covariance between the error terms of 1 pair of items within the intrinsic motivation scale and 2 pairs of items within the classroom engagement scale respectively (see the syntax file for the exact items). The modified models based on the modification indices showed acceptable fit for both models; see Table 6).

Reassuring messages. According to the direct effects shown in Table 7 and Fig. 4, reassuring messages was positively related to intrinsic

² Vovk-Sellke Maximum p-Ratio based on the p-value, the maximum possible odds in favor of H1 over H0 (Sellke et al., 2001).

Table 1
Prompt used with ChatGPT to perform the segmentation.

Prompt
Tell me if the following sentences have more than one idea. Each part of the sentence can be regarded as a segment if it is meaningful in itself without the need to read the other parts of the sentence. Return the segments of each sentence as shown in the following examples: ID Segment 10037 Que si me esfuerzo ahora puedo lograr muchas cosas 10012.1 Que yo puedo hacerlo 10012.2 que no me rinda 10427 Si no apruebas es porque no estudias Input: ##Insert data here ### Output: ID Segment

Table 2
Percentage agreements between ChatGPT and human coders of data segmentation.

	Human coder 1	Human coder 2
ChatGPT-4		
Lower bound	91% (human)	86% (human)
Upper bound	91% (model)	86% (model)
Overall	88%	82%
Agreement between human coders		
Human coder 2		
Lower bound	95%	-
Upper bound	95%	-
Overall	94%	-

Note. Lower bound = agreement from the perspective of the coder with smaller segments; Upper bound = agreement from the perspective of the coder with larger segments; Overall = proportion agreement of segments identified by both coders.

Table 3
Intercoder proportion agreements per message type between human coders and ChatGPT.

Agreement/ category	Message type					
	Fear	Effort	Capability	Reassuring	Nothing	Other
Coder 1 & ChatGPT-4	67%	91%	77%	80%	100%	100%
Coder 2 & ChatGPT-4	80%	89%	75%	73%	100%	100%
Coder 1 & coder 2	40%	93%	82%	92%	100%	100%

Table 4
Intercoder agreements measured by percentage agreement and Krippendorff's alpha between ChatGPT and human coders.

Model	Human coder 1	Human coder 2	2 Human coders & Model
ChatGPT (GPT-4)			
% agreement	86.2%	84.6%	81.5%
Krippendorff's α 95% CI	0.80 [0.63, 0.90]	0.77 [0.60, 0.88]	0.80 [0.67, 0.89]
Agreement between human coders			
Human coder 2			
% agreement	89.9%	-	-
Krippendorff's α 95% CI	0.85 [0.68, 0.93]	-	-

Note. CI = confidence interval.

motivation ($\beta = 0.180, p = .000, 95\% \text{ CI} = [0.095, 0.275]$), intrinsic motivation was positively related to classroom engagement ($\beta = 0.616, p = .000, 95\% \text{ CI} = [0.516, 0.709]$), and engagement was positively

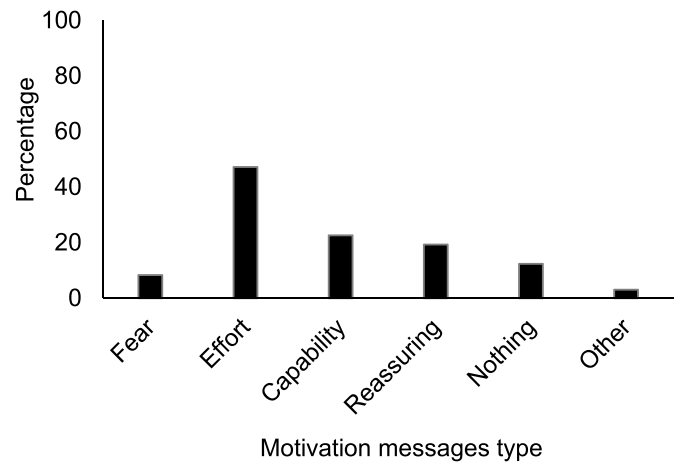


Fig. 2. Percentage of teacher exam motivational messages reported by students.

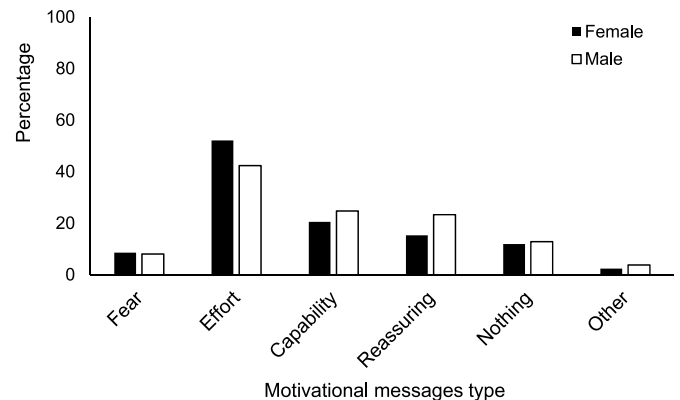


Fig. 3. Percentage of Teacher Exam Motivational Messages Reported by Female and Male students.

related to academic performance ($\beta = .406, p = .000, 95\% \text{ CI} = [0.265, 0.536]$). Reassuring messages ($\beta = 0.042, p = .383, 95\% \text{ CI} = [-0.054, 0.136]$) and intrinsic motivation ($\beta = -0.010, p = .898, 95\% \text{ CI} = [-0.161, 0.143]$) were not directly related to academic performance.

Serial mediation with intrinsic motivation and classroom engagement mediating the relationship between reassuring messages and academic performance revealed a significant positive indirect effect through intrinsic motivation and classroom engagement ($\beta = 0.046, p = .001, 95\% \text{ CI} = [0.021, 0.076]$). Intrinsic motivation and classroom engagement fully mediated the relationship between reassuring messages and academic performance. Mediation summary is presented in

Table 5
Spearman's correlations between outcome variables and message types.

Outcome Variable		Message type				
		Fear	Effort	Capability	Reassuring	Nothing
Performance	Spearman's rho	0.050	-0.058	0.031	0.114	-0.097
	p-value	0.319	0.245	0.535	0.022^a	0.053
	Upper 95% CI	0.142	0.027	0.128	0.208	0.006
	Lower 95% CI	-0.036	-0.154	-0.063	0.017	-0.194
	Effect size (Fisher's z)	0.050	-0.058	0.031	0.114	-0.097
Motivation	SE Effect size	0.050	0.050	0.050	0.050	0.050
	Spearman's rho	0.034	-0.046	0.022	0.153^b	-0.141^b
	p-value	0.489	0.345	0.655	0.002	0.004
	Upper 95% CI	0.125	0.051	0.121	0.240	-0.040
	Lower 95% CI	-0.053	-0.137	-0.075	0.059	-0.242
Engagement	Effect size (Fisher's z)	0.034	-0.046	0.022	0.154	-0.142
	SE Effect size	0.049	0.049	0.049	0.050	0.050
	Spearman's rho	0.064	-0.048	0.049	0.206^c	-0.147^b
	p-value	0.194	0.329	0.313	<0.001	0.003
	Upper 95% CI	0.142	0.045	0.147	.296	-0.047
	Lower 95% CI	-0.019	-0.142	-0.041	0.109	-0.243
	Effect size (Fisher's z)	0.064	-0.048	0.049	0.209	-0.148
	SE Effect size	0.049	0.049	0.049	0.050	0.050

Note. Confidence intervals based on 1000 bootstrap replicates.

Significant correlations are in bold.

^a p < .05.

^b p < .01.

^c p < .001.

Table 6
Model fit indices for the serial mediation models.

Model	X ²	p-value	RMSEA [CI]	CFI	TLI	SRMR
Reassuring	122.363	.000	.063 [.050, .077]	.972	.960	.040
Nothing	122.456	.000	.063 [.050, .077]	.972	.960	.040

Table 7
Standardised direct effects.

Path	β	SE	p	95% CI
<i>Reassuring Model</i>				
Reassuring→Performance	0.042	0.048	0.383	[-0.054, 0.136]
Reassuring→Motivation	0.185	0.046	0.000	[0.095, 0.275]
Reassuring → Engagement	0.054	0.045	0.234	[-0.033, 0.141]
Motivation→Engagement	0.616	0.050	0.000	[0.516, 0.709]
Motivation→ Performance	-0.010	0.076	0.898	[-0.161, 0.143]
Engagement→ Performance	0.406	0.069	0.000	[0.265, 0.536]
<i>Nothing Model</i>				
Nothing→Performance	-0.025	0.048	0.605	[-0.121, 0.068]
Nothing→Motivation	-0.187	0.061	0.003	[-0.303, -0.064]
Nothing→ Engagement	-0.079	0.054	0.152	[-0.182, 0.030]
Motivation→ Engagement	0.611	0.050	0.000	[0.510, 0.706]
Motivation→ Performance	-0.007	0.076	0.931	[-0.159, 0.139]
Engagement→ Performance	0.406	0.069	0.000	[0.266, 0.536]

Note. Significant path coefficients are bolded; 95% Confidence Intervals (CI) based on 5000 bootstrapping.

Table 8.

Nothing messages. As shown in Table 7 and Fig. 5, nothing messages was not associated with academic performance ($\beta = -0.025, p = .048, 95\% \text{ CI} = [-0.121, 0.068]$) or classroom engagement ($\beta = -0.079, p = .152, 95\% \text{ CI} = [-0.182, 0.030]$), but was negatively related to intrinsic motivation ($\beta = -0.187, p = .003, 95\% \text{ CI} = [-0.303, -0.064]$). Intrinsic motivation was not related to academic performance ($\beta = -0.007, p = .931, 95\% \text{ CI} = [-0.159, 0.139]$), yet was positively related to classroom engagement ($\beta = 0.611, p = .000, 95\% \text{ CI} = [0.510, 0.706]$) which was also positively related to academic performance ($\beta = 0.406, p = .000, 95\% \text{ CI} = [0.266, 0.536]$).

Serial mediation with motivation and engagement mediating the relationship between nothing messages and academic performance

revealed a significant negative indirect effect through motivation and engagement ($\beta = -0.046, p = .015, 95\% \text{ CI} = [-0.087, -0.014]$). Intrinsic motivation and classroom engagement fully mediated the relationship between nothing messages and academic performance. Mediation summary is presented in Table 8.

3.3. Gender differences in the relationship between motivational messages and intrinsic motivation, engagement, and academic performance

To test the gender effect, the same serial mediation models for the reassuring and the nothing messages were estimated using two multi-group SEM models with gender as a grouping variable. The χ^2 difference tests comparing the single-group and the multi-group models were not significant (reassuring: $\chi^2(\Delta 47) = 53.264, p = .2459$; nothing: $\chi^2(\Delta 47) = 62.09, p = .0691$) indicating that the multi-group model did not fit the data significantly better than the single-group model (model estimates and fit measures are available online via: https://osf.io/x68rd/?view_only=4a4306d1412042f9b04f185b65cbea2e). We did not find evidence that the relationships between the reassuring and the nothing messages and intrinsic motivation, engagement, and academic performance were significantly different for male and female students.

4. Discussion

This study explored the types of teachers' exam motivational messages reported by students and how they were related to student outcomes (intrinsic motivation, engagement, and academic performance) by testing serial mediation models. We also investigated the effect of students' gender on the type of reported messages and the moderating effect of gender on the relationships between the reassuring and the nothing messages, and intrinsic motivation, engagement, and academic performance. Students' responses to an open-ended question about motivational messages communicated by their teachers during the preparation period for exams were analysed using a hybrid human-ChatGPT quantitative content analysis approach prior to the serial-mediation analyses.

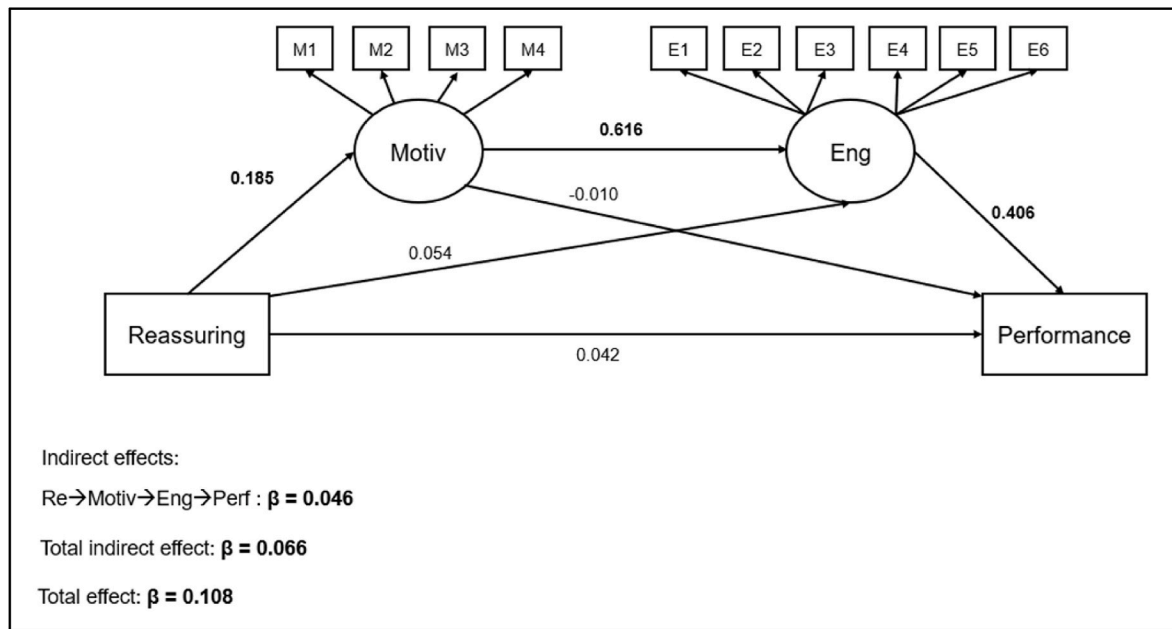


Fig. 4. Serial models of direct and indirect relations between reassuring messages motivation, engagement, and academic performance; significant coefficients are bolded; all coefficients are standardized.

Table 8
 Indirect effects for serial mediating effects of intrinsic motivation and classroom engagement.

Path	β	SE	p	95% CI
<i>Reassuring Model</i>				
Re→Motiv→Perf	-0.002	0.015	.901	[-0.030, 0.031]
Re→Eng→Perf	0.022	0.019	.238	[-0.014, 0.058]
Re→Motiv→Eng→Perf	0.046	0.014	.001	[0.021, 0.076]
Total indirect effect	0.066	0.023	.004	[0.022, 0.114]
Total effect	0.108	0.050	.030	[0.009, 0.204]
<i>Nothing Model</i>				
Noth→Motiv→Perf	0.001	0.015	0.935	[-0.028, 0.033]
Noth→Eng→Perf	-0.032	0.022	0.155	[-0.076, 0.012]
Noth→Motiv→Eng→Perf	-0.046	0.019	0.015	[-0.087, -0.014]
Total indirect effect	-0.077	0.027	0.005	[-0.131, -0.024]
Total effect	-0.102	0.052	0.050	[-0.201, -0.003]

Note. Re = Reassuring, Noth = Nothing, Motiv = Motivation, Perf = Academic performance, Eng = engagement; Total indirect effect = Total indirect effect of message type on academic performance via motivation and engagement; Total effect = Total effect of message type on academic performance. 95% Confidence Intervals (CI) based on 5000 bootstrapping.

4.1. Content of teachers' exam motivational messages and their relation to student outcomes and gender

We found that students in our study mostly reported messages that encourage effort and capability (i.e., efficacy messages) followed by reassuring messages. These findings align with the results of previous communication studies in which college students reported positive messages and reassuring messages when asked about teachers messages that helped them navigate difficulties (Kaufmann et al., 2021; Nazione et al., 2012). Our findings also support the finding of the observational study by Wilkinson et al. (2020) who identified reassuring exam motivational messages, yet in that study, the frequency of this type of messages was not reported. Importantly, our study provided empirical evidence of the potential positive impact of reassuring messages by examining the relationship between this type of message and student outcomes.

Descriptive analysis showed that male and female students reported overall similar patterns of teachers' exam motivational messages. While

female students appeared to report descriptively more effort messages, males reported more capability and reassuring messages. Such differences may be related to stereotypical perceptions of males being more capable and females exerting more effort, a finding that translated into significant impacts of message type on mathematics performance in the study by Moè and Putwain (2020). Notwithstanding, we did not find a statistically significant gender effect in our study on the types of teachers' exam motivational messages encouraging effort or capability, or reassuring messages.

Despite the focus on fear messages in the literature on exam motivational messages communicated by teachers, this type of messages was reported only by 8% of the participants in our study, and it was not related to students' outcomes. A small proportion of students (12%) mentioned that their teacher did not tell them anything to motivate them to work hard (i.e., nothing messages). Of the reported messages, only the reassuring and the nothing messages were significantly related to students' outcomes. Although an experimental study by von der Embse et al. (2015) showed a positive impact of efficacy messages (i.e., effort & capability) on university students' test performance we did not find an association in our study between efficacy messages and students' performance, intrinsic motivation, or engagement. One explanation for the lack of relationships between this type of messages and student outcomes is that students might evaluate different types of messages differently. According to Putwain et al. (2021) the effect of exam motivational messages on student outcomes is mediated by students' appraisal of these messages. For instance, these researchers found a negative impact of fear messages only when students appraised them as threatening. Further research is required to understand how students appraise reassuring and efficacy messages, and whether students' appraisals shape the impact of these messages on different learning outcomes.

Our results of more positive messages (i.e., efficacy and reassuring messages) compared to fear messages also align with the findings of an earlier study conducted in Spain showing in general that teachers tend to rely more on positive messages (i.e., messages emphasizing gains; Santana-Monagas et al., 2022a,b). The same study found that students with teachers relying on more of these messages perform better than those with teachers who use few messages. Although the focus of that study was not on messages related to exams and they classify the messages

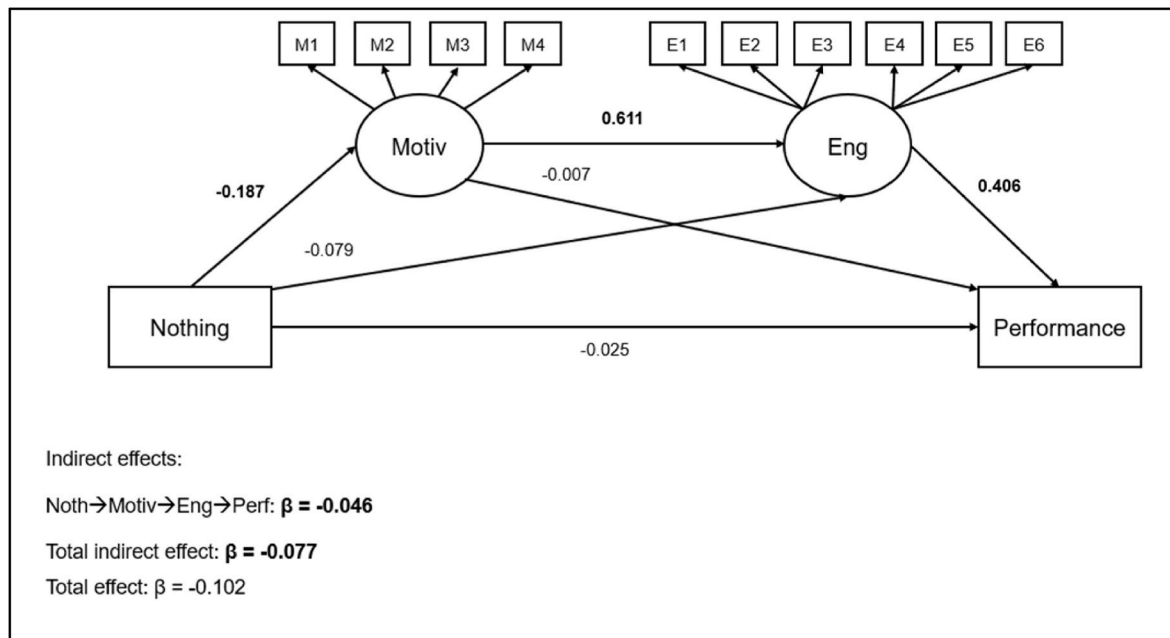


Fig. 5. Serial models of direct and indirect relations between nothing messages motivation, engagement, and academic performance; significant coefficients are bolded; all coefficients are standardized.

differently, their findings together with our findings point to the importance of positive messages in the Spanish context warranting further investigation of the impact of various types of positive messages and how they can best support high school students' learning in this context.

4.2. Intrinsic motivation and engagement as mediators

Based on the prior findings on the relationships between teachers' (exam) motivational messages, motivation, engagement, and academic performance (Putwain & Remedios, 2014; Putwain et al., 2017; Santana-Monagas, Putwain & Roberts, 2009) and teachers' motivating style (Reeve, 2012) we examined the relationships between teachers' exam motivational messages, intrinsic motivation, engagement, and academic performance through serial mediations. We performed this separately for the reassuring messages and the nothing messages as these were the only two types of messages with significant correlations with the outcomes in this study.

For the reassuring messages, we found an indirect effect of this type of messages on academic performance through intrinsic motivation and engagement (with a small effect $\beta = .046$). This sequence tested through the serial mediation was aligned with the established finding from research on teachers' motivating style (Reeve, 2012; Reeve & Tseng, 2011) and suggests that the reassuring messages told by teachers regarding exams were associated with more intrinsic motivation, which in turn was associated with more engagement that can result in higher academic performance. This relationship was fully mediated as there was no direct effect of reassuring messages on academic performance (Hypothesis 1a was partially supported). In line with previous findings on the full mediating function of engagement of the relationship between motivation and academic performance (Reeve & Tseng, 2011), there was no direct effect of motivation to academic performance in our tested model. Our results extend the current body of research on teachers' motivational messages communicated before exams (Putwain et al., 2017; Putwain & Remedios, 2014) by showing that the relationship between the newly identified type of messages (i.e., reassuring messages; Wilkinson et al., 2020) and academic performance is also mediated by intrinsic motivation. Yet we also showed that engagement fully mediated the motivation-to-performance relationship which was

not tested by earlier studies. It seems that the mediational effect of intrinsic motivation on the relationship between the (reassuring) teacher messages and academic performance (Santana-Monagas, Putwain, Núñez, Loro, & León, 2022a,b) is 'bridged' by engagement (Reeve, 2012). Yet, more studies are needed to uncover the dynamics of this relationship, especially since in our study only cognitive and behavioural engagement were measured. Future research should consider other types of engagement including emotional and agentic engagement (Reeve et al., 2022; Reeve & Lee, 2014). Noteworthy, reassuring messages were the only messages that were positively related to students' intrinsic motivation, engagement, and academic performance. Reassuring messages show positive teacher expectations, emotional support, hope, and optimism (e.g., 'don't give up', 'it's going to be alright') likely to support students' competence (Ahmadi et al., 2023; Ryan & Deci, 2020). Students might need this type of messages particularly during exams which can be a stressful period for some of them. An alternative explanation is that students who are high achievers, do not find messages on effort and capability as motivating and they just need reassurance from their teacher. Or it might be that teachers use these reassuring messages with students who are high achievers. Unlike earlier studies (e.g., Putwain et al., 2017; Putwain & Remedios, 2014), we did not find significant links between other types of messages (fear and efficacy messages) and students' outcomes. Additional research is required to better understand the conditions under which different types of teachers' motivational messages influence students' learning outcomes.

For students who reported that their teachers told them nothing to motivate them to study for exams, we found a negative indirect effect on academic performance via intrinsic motivation and engagement (with a small effect $\beta = -.046$), hypothesis 1b was partially supported. These findings support the results by Santana-Monagas et al. (2022a,b) who reported that teachers identified as providing few messages—as perceived by the students—had students with lower academic performance highlighting the importance of the presence of teachers' motivational messages from the perspective of the students. The serial mediation sequence is again consistent with prior research on teachers' motivating style showing that the absence of teacher motivational messages as perceived by the students is negatively associated with intrinsic motivation that can lead students to be less engaged and

consequently perform poorly (Reeve, 2012). Similar to the reassuring messages, this relationship was fully mediated by intrinsic motivation and engagement as there was no direct effect of the nothing messages on academic performance. Additionally, no direct effect of intrinsic motivation on academic performance was observed suggesting that engagement fully mediated this relationship as proposed by Reeve (2012).

4.3. Gender differences in the relationship between motivational messages and intrinsic motivation, engagement, and academic performance

The results of the multi-group serial mediation models for the reassuring and the nothing messages compared to the single-group models suggest that there is no evidence to support that the mediation paths differ for males and females (Hypothesis 2 was not supported). Unlike the study by Koka and Sildala (2018), the simple single-group model fits the data in our study just as well as the complex multi-group model. Although Abós et al. (2021) found a stronger negative effect of teachers' controlling behavior on females' motivation, we did not observe a similar effect for the relationship between the nothing messages and intrinsic motivation. Differences in the findings can be attributed to differences in the focus of the study as both studies examined teacher's motivating behaviour while our study specifically studied teachers' motivational messages. Future studies should further examine the moderating effect of gender on the relationships between teachers' (exam) motivational messages and students' outcomes, especially that existing evidence supports gender differences in the impact of some types of motivational messages (fear and efficacy messages) on academic performance (Moè & Putwain, 2020).

4.4. Limitations and future directions

Although this study provided more insights into the relationship between teachers' exam motivational messages and academic performance by showing that some types of messages were serially mediated by intrinsic motivation and engagement, it has several limitations. Firstly, the student-teacher dialectical framework within the SDT (Reeve, Deci, & Ryan, 2004) assumes a reciprocal relationship between teachers' motivational behaviour and students' engagement in the learning environment. Our study only examined one aspect of this relationship, and as all of the measures used in this study were taken during the same semester, the serial mediation results must be interpreted cautiously. Future studies should attempt to adopt a longitudinal research design in which teachers' exam motivational messages, students' motivation, engagement, and academic performance are measured over several waves to examine the reciprocal relationship (Reeve & Lee, 2014; Santana-Monagas, da Costa Ferreira, Veiga Simão, & Núñez, 2024) and to further explain the underpinning mechanisms of teachers' exam motivational messages. Additionally, multilevel mediation analyses are typically used to provide a more comprehensive understanding at the teacher level and the student level (Preacher, Zhang, & Zyphu, 2011), but due to the small sample size of this study it was not possible to conduct this type of analysis. Secondly, it might be the case that some teachers tend to use more types of exam motivational messages than others, or that they might use different types to communicate to different students depending on the student characteristics (Santana-Moganas et al., 2022a,b).

Thirdly, our study relied on self-reports which might not be representative of the exam motivational messages actually communicated by teachers. Although we used a coding scheme based on the integration of the findings from previous studies and classifications based on the SDT, this approach might still not be able to capture all of the nuanced messages used by teachers about exam preparation due to the complexity teacher-student communication in the learning settings. Future studies may adopt systematic classroom observations method to provide more objective and extensive measures of teacher exam

motivational messages through video or audio recordings (e.g., Falcon et al., 2023a,b; Wilkinson et al., 2020). This approach allows the analysis of other non-verbal aspects of teachers' messages such as motivational prosody (Paulmann & Weinstein, 2023) and emotional intensity (Falcon et al., 2023a,b) and can provide deeper insights into the impact of these messages. Moreover, the phrasing of the open-ended question used in this study might have contributed to the large proportion of the effort messages in particular as it emphasized working hard and studying.

Importantly, while our study did not only consider high-stakes examinations, in the context in which our study was conducted final exams account for the largest portion of the course grade even at the higher education level (Panadero, Fraile, Fernández Ruiz, Castilla-Estévez, & Ruiz, 2019). In terms of future research, it would be useful to extend the current findings by examining teachers' motivational messages when they communicate with their students regarding other forms of assessment including formative assessment practices such as peer or self-assessment, and how these messages might influence different student outcomes. Finally, our study is an exploration as we utilized a correlational design to study how other types of understudied exam motivational messages were related to students' outcomes. Future studies might adopt (quasi-)experimental designs (e.g., von der Embse et al., 2015) to test the impact of reassuring messages when delivered by teachers during the period of exam preparation, or the absence of motivational messages on students' motivation, engagement, and performance.

4.5. Practical implications

The findings of this study have several implications for classroom teachers, those who communicate with students in educational settings, and for teacher educators. When advising students to prepare for high-stakes and low-stakes exams, teachers might stress the importance of exerting effort and they attempt to reinforce students' capabilities. But this might be at the expense of providing emotional support. Our study shows that messages that provide emotional support such as reassuring messages can be equally important for students' intrinsic motivation, engagement, and academic performance. We therefore encourage teachers to also use this type of messages when they communicate with students about preparing for exams. The lack of messages seems to be negatively associated with intrinsic motivation, student engagement, and academic performance. We, therefore, encourage teachers and educators to incorporate motivational messages when talking to their students about exams. Due to the malleability of teachers' behaviour (Reeve & Cheon, 2021) including the communication of motivational messages (Leon et al., 2017a,b) we encourage teacher educators to train teachers to provide these types of messages to equip them to support their students to learn and prepare for exams. Teachers' enthusiasm plays a significant role in their adoption of a motivating teaching style (i.e., autonomy supportive style; Moè & Katz, 2022) and in their use of more motivating messages (Falcon et al., 2023a,b). While we cannot control teachers' experienced enthusiasm, supporting their basic psychological needs can enhance their enthusiasm (Moè & Katz, 2022) and encourage them to adopt more motivational messages, such as reassuring messages. This is particularly important given that teachers' psychological need for autonomy is linked to their use of motivational messages (Santana-Monagas et al., 2022a,b).

4.6. Conclusions

In summary, the present study contributes to the growing body of evidence on the positive impact of motivational messages communicated by teachers to their students when preparing for exams. Not only we shed light on reassuring messages that have been already identified in previous research, but we also illustrated the potential link between this type of messages and intrinsic motivation, engagement, and

academic performance. Furthermore, this study opens a new venue for research on teachers' motivational messages by showing the relevant role of engagement in bridging the relationship between teachers' messages, motivation, and academic performance.

Declaration of generative AI use

During the preparation of this work the first author used ChatGPT in some occasions in order to improve the comprehensibility of written sentences. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

CRedit authorship contribution statement

Maryam Alqassab: Writing – review & editing, Writing – original draft, Investigation, Formal analysis. **Jaime León:** Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A

ChatGPT coding prompt:

Here are some open-ended responses by secondary school students to the question “En época de exámenes, ¿qué te suele decir tu profesora/a para que te esfuerces y estudies?”. Can you help me to sort these responses by their content? I need to categorize them for my research project.

Assign one of the following categories to each open-ended text response:

'1' (fear) are messages that highlight the importance or the value of the exams for the students, or the date and timing of forthcoming examination. These messages highlight an external pressure to study such as lack of choice, lack of time, complexity of the exam, grades, high-stake exams (EBAU), or future outcomes. They can also remind students that they are in high school. These messages induce anxiety in students. Examples include: “es tu futuro”, “no tienes elección”, “no conseguirás trabajo”, “Bachillerato no es una asignatura para estudiar una semana antes”, “Notas”, “Que es por mi bien”, “mira los exámenes de la EBAU”, “estás en segundo de bachillerato”, “Estudio por qué si no vas a suspender”, “sobre todo estudia para que tengas un futuro como te gustaría”

'2' (effort) are messages aimed at increasing students' effort, persistence, and time management. They provide strategies or actions required to avoid failure or increase the likelihood of success. They can be as simple as a single word to encourage students to study, or they can provide specific strategies for studying and time management. These messages make reference to time by suggesting how early or for how long students should study. They can also highlight that little is left to encourage effort. They can also describe what the teacher does to help students to study. Examples include: “estudia”, “práctica”, “repasa”, “haz los ejercicios solo”, “organiza bien tu tiempo”, “hay que estudiar 2 horas todos los días”, “estudia una semana antes”, “queda poco”, “nos da un repaso de lo que caerá en el examen”, “no dejes el estudio para última hora”, “Ánimo”, “Que tengo que llevar todo el día”, “preste atención”, “Diario”, “Que tenemos que estar al día”, “Simplemente dependemos de

nosotros mismos”, “seguir adelante”, “nos anima a estudiar”

'3' (capability) are messages aimed at boosting students' confidence and providing positive teacher expectations for student success. These messages stimulate how capable an individual is of reaching a goal or an outcome. These can indicate that the teacher expects the students to do their best. Examples include: “Puedes hacerlo”, “Confío en ti”, “Puedes hacer lo que quieras”, “Puedes aprobar el examen”, “que puedo dar más de mí”, “Que lo puedo sacar fácilmente”, “si estudien seguro que les sale”, “Aprobar la asignatura”, “en general suele decir que demos lo mejor de nosotros”, “que siente confianza en como saldrán los exámenes”.

'4' (reassuring) are messages aimed at reducing threat and fear of failure. These messages often show emotional support, hope, and optimism, but they do not refer to an individual's capability to reach a goal or outcome. These messages may highlight that the exam is not difficult. Or, they can refer to exams or grades as not being of major importance, or the opportunity to set the exam again. Examples include: “Relájate”, “Que no me desmotive”, “Que no me rinda”, “no te estreses”, “no nos agobiamos”, “todo va a salir bien”, que estará ahí para ayudarme en lo que necesite”, “deséanos buena suerte”, “no es difícil”, “los exámenes no valen mucho”

'5' (nothing) are messages that highlight that nothing was told to the students, or when no answer is provided. Examples include: “nada”, “No”, “No sé”, “No me acuerdo”, “aún no hemos hecho exámenes, así que no puedo contestar”, “.”

'6' (other) are vague or irrelevant information that doesn't fit any of the other categories. Examples include: “sí”, “cosas buenas”

Classify all the responses.

Responses:

####[paste your data here]####

Output:

ID Category number.

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