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Mathematical redemption and the Springboard Effect among pre-service primary teachers with negative mathematics experiences

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ABSTRACT

In this study, we seek to answer the question: *Why would someone want to become a teacher when their personal relationship with mathematics has been predominantly negative?* To examine this question, we address the underexplored phenomenon of Mathematical Redemption. We characterise Mathematical Redemption through teachers' emotions towards mathematics, drawing on the Cognitive Structure of Emotions Theory. We employ a qualitative methodology. Seventeen Mexican pre-service teachers participated by responding to four items designed to explore their emotions; subsequently, four participants were selected through purposive sampling to take part in structured interviews. The data were analysed from the perspectives of narrative inquiry and emotion-centred life history. The findings suggest that Mathematical Redemption constitutes a particular case of the Springboard Effect because painful experiences with mathematics became a driving force for teaching it differently. Our main finding is that the Springboard Effect provides an operational framework for identifying and analysing Mathematical Redemption in pre-service teachers.

Keywords: Springboard Effect, affective domain, mathematical redemption, pre-service teachers, cognitive structure theory of emotions, emotions

INTRODUCTION

Several studies have reported that some pre-service teachers may experience negative emotions towards mathematics, which in turn influences the quality of their future teaching practice (Coppola et al., 2012, 2013a, 2013b; Di Martino et al., 2013). This issue is particularly relevant in mathematics education, where the importance of identifying the key elements for effective teaching has been repeatedly emphasised (Coppola et al., 2013a).

Teacher affect has been identified as a key factor in determining the quality of instruction. Previous research suggests that teachers' emotional experiences with mathematics can shape their attitudes towards teaching the subject (Coppola et al., 2013b; Di Martino & Zan, 2011; Hannula, 2012; García-González & Martínez-Sierra, 2020). In particular, research has shown that negative experiences with mathematics can become a source of motivation for some pre-service teachers to teach in a more learner-sensitive way, a phenomenon described as Mathematical Redemption (Di Martino & Gregorio, 2019; Pérez-Torres & García-González, 2024).

In this paper, we draw on the Springboard Effect (SE) proposed by Pals (2006), developed within the framework of narrative identity psychology. This effect describes how some individuals manage to turn highly negative experiences into drivers of personal growth through a three-stage process. This framework has not yet been applied to the study of mathematics teachers or to Mathematical Redemption (MR) in particular; however, it has been used to explain processes of positive re-signification of painful experiences in other contexts (Pals, 2006; Pals Lilgendahl & McAdams, 2011; Dörnyei et al., 2014), which makes it a valuable reference for examining in greater detail the process of MR that is the focus of the study presented here. As such, this study aims to analyse the emotional trajectories of pre-service teachers in order to understand and document how Mathematical Redemption is configured in their life narratives with mathematics (as students), and examine the extent to which the structure of the Springboard Effect provides an analytic account of the emotional transformation represented in those narratives.

On this basis, we address the following research questions: (1) What emotions did pre-service teachers experience during their mathematics lessons in primary school, secondary school, and upper secondary education? (2) How is Mathematical Redemption configured in their life narratives with mathematics? and (3) In what ways is the Springboard Effect manifested as a mechanism of emotional transformation within Mathematical Redemption?

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THEORETICAL FRAMEWORK

The Affective Domain and the Emergence of the Phenomenon of Mathematical Redemption

The affective domain in mathematics education refers to emotional, attitudinal and belief-related aspects that influence the learning of mathematics. This domain is crucial because students' beliefs, emotions and attitudes towards mathematics can significantly affect both their performance and their willingness to learn (McLeod, 1992). According to McLeod (1992), the affective domain comprises three descriptors: attitudes, beliefs and emotions. However, Grootenboer and Marshman (2016) propose three additional descriptors: identity, engagement and values. Research on the affective domain has also led other scholars to consider further components, among them motivation (Hannula, 2006; Hannula et al., 2016; Ignacio et al., 2006; Rojo Robas et al., 2018).

Mathematical Redemption has been defined as "the desire to face the 'challenge' of teaching mathematics, starting from a personal reconstruction of the relationship with the discipline" (Di Martino et al., 2013, p. 226). This phenomenon is examined under the descriptor "emotion" and emerged from the study conducted by Coppola et al. (2012), in which primary teachers' affect was understood as a decisive variable in how they taught mathematics and the kinds of opportunities their students had to learn mathematics. Coppola et al.'s (2012) contribution consisted in shifting attention away from purely cognitive outcomes towards the emotional and relational dimensions of the classroom, showing that teachers' emotions are not merely reactions but also mediating factors in the configuration of school mathematical discourse. A subsequent study by Coppola et al. (2013a) deepened the analysis of the relationship between beliefs and emotional dispositions towards teaching, revealing that emotions are not limited to individual states but constitute meaning structures that orient pedagogical decision-making. According to Coppola et al. (2013a), the interplay between beliefs and emotions shapes an affective disposition towards mathematics that can either foster or constrain teachers' engagement.

However, it was in the work of Coppola et al. (2013b) that a decisive conceptual shift took place: it was recognised that teaching mathematics can become an opportunity for personal redemption. This proposal marked the emergence of the phenomenon termed Mathematical Redemption, in which teachers with previously negative experiences of the discipline re-signify their past in order to "reconcile" with mathematics. This finding is innovative because it introduces a narrative–emotional framework in which teaching becomes a space for identity reconciliation, integrating emotions, biography and professional meaning.

A study by Di Martino et al. (2013) analysed the emotions associated with mathematics and with the idea of teaching it, using an open-ended questionnaire administered to 90 Italian pre-service primary teachers and 11 in-depth narrative interviews. The results showed a strong presence of negative emotions towards the discipline: almost one third of the participants mentioned only negative emotions, and around three quarters used terms such as fear, anxiety or frustration to refer to school mathematics. However, when considering the prospect of teaching mathematics, a substantial proportion expressed positive emotions and the explicit desire to "obtain their redemption".

Subsequently, studies conducted in Latin America have extended this line of research by bringing in new cultural and contextual perspectives. Pérez-Torres and García-González (2024) transferred the analysis to the Mexican context, showing that MR also emerges among in-service teachers. They identified motivating factors (personal growth, influential teachers, family members, and the use of didactic materials) and demotivating factors (teachers, problem solving, lack of mathematical knowledge, family members, lack of perceived meaning in mathematics, and classmates) associated with the emergence of redemption. Narrative analysis enabled them to characterise this desire for Mathematical Redemption through three central features: 1) the pain linked to school experiences marked by teachers who act as negative models, 2) the need to reconstruct one's relationship with mathematics as a condition for becoming a "good teacher," and 3) the positive consequences of taking on this challenge for teachers' emotional disposition and self-perception.

In turn, Solis-Jimenez et al. (2025) conducted an exploratory study with pre-service primary teachers. After administering the *Teachers' Attitude Toward Mathematics and Its Teaching* (TAMT) test, they found that the emotions experienced in the past were negative (mainly reproach) and were triggered by their mathematics teachers; however, the participants reported positive emotions (hope and happiness) when thinking about teaching mathematics in the future. The authors concluded that pre-service teachers who display this negative–positive pattern in their relationship with mathematics are close to MR, with a key motivational factor being the presence of patient teachers who helped them to overcome their difficulties in mastering mathematical content.

Taken together, previous studies on Mathematical Redemption have shown that the phenomenon exists and have described its main features, but they generally remain at the level of establishing whether redemption is present or absent in different contexts. This leaves open the question of what lies behind the phenomenon and why it occurs; that is, which affective and biographical processes allow a predominantly negative relationship with mathematics to be transformed into a desire to teach it differently. In this paper, we aim to move precisely in that direction: we do not only identify the presence of MR, but also analyse why it emerges and how it is configured, paying close attention to the emotional trajectory of the participants. This notion will be developed in a later section and will enable us to trace the thread that connects their past experiences with their professional projects as future mathematics teachers.

OCC Theory

The Theory of the Cognitive Structure of Emotions, better known as OCC theory after its three authors (Ortony, Clore, and Collins), understands emotion as "valenced reactions to events, agents or objects, with their particular nature being determined by the way in which the eliciting situation is construed" (Ortony et al., 1988, p. 13).

OCC theory proposes a multidimensional framework that integrates the classification, grouping and modulation of emotional responses on the basis of cognitive appraisal processes. Within this theory, emotions can be divided into classes that represent

Table 1. Typology of emotions according to OCC Theory

Class	Group	Emotions types (sample name)	Factors that affect the intensity of emotions (intensity variables)		
			Local variables	**Central variables**	**Global variables**
Reactions to events Based on the appraisal of events according to how they affect our goals.	Fortunes-of-others	Pleased about an event desirable for someone else *(happy-for)* Pleased about an event undesirable for someone else *(gloating)* Displeased about an event desirable for someone else *(resentment)* Displeased about an event undesirable for someone else *(sorry-for)*	Desirability for others Liking Deservingness	Desirability (Evaluation in terms of goals)	Sense of reality Proximity Unexpectedness Arousal
	Prospect-based	Pleased about the prospect of a desirable event *(hope)* Pleased about the confirmation of the prospect of a desirable event *(satisfaction)* Pleased about the disconfirmation of the prospect of an undesirable event *(relief)* Displeased about the disconfirmation of the prospect of a desirable event *(disappointment)* Displeased about the prospect of an undesirable event *(fear)* Displeased about the confirmation of the prospect of an undesirable event *(fears-confirmed)*	Likelihood Effort Realization		
	Well-being	Pleased about a desirable event *(joy)* Displeased about an undesirable event *(distress)* Pleased due to a desirable cognitive state of attention *(interest)* Displeased due to an undesirable cognitive state of distraction *(boredom)*			
Reactions to agents Moral evaluations of the behaviour of others or of oneself.	Attribution	Approving of one's own praiseworthy action *(pride)* Approving of someone else's praiseworthy action *(appreciation)* Disapproving of one's own blameworthy action *(self-reproach)* Disapproving of someone else's blameworthy action *(reproach)*	Strength of unit Expectation deviation	Praiseworthiness (Evaluation in terms of norms).	
Reactions to objects Aesthetic or preference-based evaluations of objects.	Attraction	Liking an appealing object *(liking)* Disliking an unappealing object *(disliking)*	Familiarity	Appealingness (Evaluation in terms of attitudes).	
Reactions to events and agents simultaneously	Well-being / Attribution	Approving of someone else's praiseworthy action and being pleased about the related desirable event *(gratitude)* Disapproving of someone else's blameworthy action and being displeased about the related undesirable event *(anger)* Approving of one's own praiseworthy action and being pleased about the related desirable event *(gratification)* Disapproving of one's own blameworthy action and being displeased about the related undesirable event *(remorse)*			

general categories of emotions according to the type of cognitive appraisal that gives rise to them, and further subdivided into groups that label specific types of emotions.

Finally, the intensity with which each emotion is experienced is modulated by various variables, which are present from the very onset of the situation that gives rise to the emotion (García & Martínez, 2018). These variables include:

- Global variables: they affect all classes and groups of emotions.
- Central variables: they affect an entire class of emotions.
- Local variables: they affect only certain groups of emotions.

Table 1 presents the typology proposed by OCC theory. Its elaboration draws on two sources. The first is Ortony et al. (1988), who identify twenty-two types of emotions, eleven positive and eleven negative. The second is Martínez-Sierra and García-González (2014), who make an important contribution to OCC theory by identifying two additional emotions: interest (as a positive emotion) and boredom (as a negative one), both within the Well-being group, as they are reactions to events; that is, they are based on the appraisal of occurrences that affect personal goals.

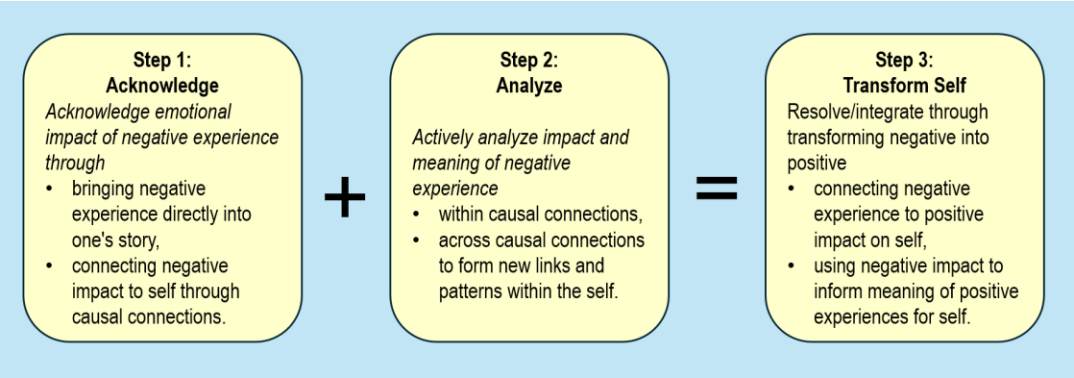


Figure 1. Constructing the "springboard effect" within the life history (Pals, 2006, p. 193)

The integration of classes, groups and variables proved particularly useful for the analysis of the data in this study, as it allowed us to systematically identify which type of emotion was at stake on the basis of the triggering situation in each reported episode.

Since there is no explicitly established definition of *emotional trajectory*, in this paper we define it as a set of emotions (both positive and negative) that a person experiences over a given stage of their life.

Springboard Effect

The Springboard Effect (Pals, 2006), originates in personality and developmental psychology, within the field of research on narrative identity and the cognitive–emotional processing of adverse life experiences. In this work, the author examines how individuals transform negative past experiences into a driver of personal growth through the elaboration of narratives. Within this effect, the researcher identifies three steps in the process (see **Figure 1**).

From the perspective of Mathematical Redemption, it is possible to explain how a person's identity in relation to mathematics is transformed, from someone who fears or avoids the discipline to someone who incorporates it into their professional identity through the desire to become a teacher. By contrast, the Springboard Effect accounts for how the global self-identity is transformed, as the negative experience is integrated as a source of strength and meaning. In this way, the SE can be regarded as a more general mechanism that explains MR through its three steps

METHODOLOGY

This study was framed within a qualitative approach (Creswell, 2014; Guzmán Arredondo & Alvarado Cabral, 2015), with an explanatory scope (Miles et al., 2014). Narrative inquiry (Clandinin & Connelly, 2000) was used as the main analytical method, drawing on life histories and a structured interview (Yin, 2016) in order to identify and analyse the emotional trajectories of pre-service teachers.

The participants were 17 first-semester students enrolled in the Primary Education Teacher Education Programme at a private university located in central-eastern Mexico**.** Their involvement began on the first day of classes at the university, following informed consent from the pre-service teachers and the authorisation from university authorities to administer the initial instrument and conduct interviews.

Data collection was carried out in four phases, which are described below.

Phase 1. Emotional trajectories in life histories

The aim of Phase 1 was to explore the emotional trajectories that pre-service teachers experienced during their mathematics lessons in basic education (primary and lower secondary school) and upper secondary education (high school). Although preschool (ages 3-6 years) is also part of compulsory basic education in Mexico, we chose not to include it, as we could not be certain that all participants would have clear memories of their emotional experiences at that level.

To investigate participants' emotional trajectories in their life histories, we administered a questionnaire consisting of four items: three sentence-completion prompts and one open question. Drawing on Pals (2006), the three sentence completions were designed to elicit the students' academic history specifically in mathematics lessons. These prompts were:

1) *In mathematics lessons at primary school, I almost always felt… because…*
2) *In mathematics lessons at lower secondary school, I often felt… because…*
3) *In mathematics lessons at upper secondary school (preparatoria/bachillerato), I often felt… because…*

The fourth item was adapted from Coppola et al. (2012) to identify participants' emotional disposition towards teaching mathematics:

4) *What emotions do you feel when you think that you will have to teach mathematics? Why?*

Table 2. Structured interview protocol

Question	Purpose of the question
1. How did your desire to become a teacher arise?	To explore the participant's personal and vocational motivations for choosing teaching as a career.
2. Do you like mathematics? Why?	To inquire into the interviewee's current attitude towards mathematics.
3. What are the reasons why you like or do not like mathematics?	To identify the causes or experiences that underlie their liking or disliking of mathematics.
4. Which aspects of mathematics do you like or not like?	To identify the specific elements of mathematics that generate enjoyment or displeasure.
5. In general, what emotions have you experienced in your mathematics lessons?	To understand the emotional component that has accompanied their experience with mathematics.
6. Describe what your relationship with mathematics was like in primary, lower secondary and upper secondary (preparatoria/bachillerato) school.	To analyse the life history of their relationship with mathematics throughout their schooling.
7. In which type of upper secondary programme did you study, and in which years was this?	To contextualise the type of education received at the upper secondary level and the time period in which it took place.
8. How do you think your past experiences influence the way you will teach mathematics to your students?	To prompt reflection on how previous experiences influence their future teaching practice.
9. At what moment did you feel that your relationship with mathematics changed? Was there any specific event or experience that influenced that change?	To identify key turning points in their relationship with mathematics.
10. Was there any family member, friend or teacher in your schooling who changed your perspective on mathematics? What did this person do differently?	To recognise the positive influence of significant others on changes in their perception of mathematics.
11. If you could relive your basic or upper secondary education, what would have helped you to have a better relationship with mathematics from the outset?	To identify actions or conditions that would have fostered a better experience with mathematics from early stages.
12. What would you try to prevent your future students from experiencing, that you yourself went through in relation to learning mathematics?	To explore pedagogical intentions that arise from their own negative experiences.
13. What would you say to a student who, like you in the past, experiences negative emotions towards mathematics?	To elicit the type of emotional and academic support they would offer to students facing difficulties similar to their own.
14. In the questionnaire you completed, you wrote that… *(the interviewer refers to the emotions experienced by the pre-service teacher during basic and upper secondary education).* If you reported negative experiences with mathematics, why do you want to become a teacher?	To understand the desire to become a teacher despite having had negative experiences, from a possible perspective of redemption.
15. What does being able to teach mathematics represent for you?	To explore the meaning that the possibility of teaching mathematics has for the interviewee.

The questionnaire was administered during the first hour of the first day of classes. The aim of doing so was to avoid any influence derived from students' initial experience in the mathematics course of their degree programme.

To identify and label participants' emotions accurately, we drew on OCC theory (Ortony et al., 1988). Using this framework helped us avoid ambiguities in the classification and naming of emotions, since the theory's categories provide clear and distinct criteria. In this way, the identification process, conducted collaboratively by the three authors, did not rely solely on subjective interpretations but was grounded in a robust and widely recognised conceptual structure, which contributed to greater validity and coherence in the analysis of data obtained from the sentence-completion items.

The results of the life-history inquiry were organised into tables, delimiting the information as follows: emotions or words expressing an emotional experience were written in *italics*; the concise phrase expressing the situations that triggered the emotion was written in **bold**; the intensity variable affecting the identified emotion was placed in {curly brackets}; and words required by the reader to fully understand the history were placed in [square brackets] (García & Martínez, 2018).

Phase 2. Exploring Mathematical Redemption

The aim of Phase 2 was to identify participants who showed signs of Mathematical Redemption through their emotional trajectory and their vision as future teachers. To this end, we conducted purposive sampling (Patton, 2015), selecting those students who reported negative emotional experiences in their mathematics classes during basic and upper secondary education, but who expressed positive emotions when thinking of themselves as future teachers. Thus, out of the 17 pre-service teachers, only 4 were selected who met these criteria.

Phase 3. Establishing Mathematical Redemption

The aim of Phase 3 was to establish, through interviews, the presence of Mathematical Redemption in the four pre-service teachers selected in Phase 2. For this purpose, we designed and administered a structured interview (Yin, 2016) consisting of 15 open-ended questions (see **Table 2**), which guided the inquiry into participants' life experiences. The interviews were conducted individually, in a quiet, noise-free room within the university, and each lasted approximately 15 minutes. With participants' informed consent, all interviews were audio-recorded and subsequently transcribed verbatim for analysis.

Table 3. José's emotional trajectory

Level	Reported narrative in the incomplete sentences	Interpretation based on OCC Theory
Primary school	In primary school I almost always felt *frustrated* because the teachers were bad educators; their explanation of the topics was minimal and I **didn't understand the topics** {Proximity}.	Based on OCC theory, the emotion is *reproach* because he is disapproving that his teachers gave only minimal explanations of the topics. The identified intensity variable is Proximity, since by referring to "the topics" he indicates that there was more than one, which means that the triggering situation occurred on multiple occasions.
Secondary school	I felt *calm* because **mathematics was not difficult for me** and, if there was a mistake, [the teachers] **supported me** {Effort}.	The emotion is *satisfaction* with the mathematics he did understand. The intensity variable is Effort, because it reflects the degree to which resources have been invested to avoid an event (not making mistakes).
Upper secondary education	I felt *bored* because **the work was only copying a book into my notebook** {Familiarity}.	The emotion is *boredom* because it shows displeasure with an undesirable cognitive state (just copying from a book). The intensity variable is Familiarity, since it is related to the number of times a person is exposed to the object.
Undergraduate	I feel *happiness* knowing that I **can show that mathematics is not complicated** and that **it is not always frustration** {Desirability}.	The emotion is *happy-for*, because it refers to a desirable event for others (his future pupils), showing them that mathematics is not complicated. His goal is to demonstrate that mathematics is not difficult; therefore, the intensity variable is Desirability.

Phase 4. Emotional Trajectory Analysis

The aim of Phase 4 was to analyse in detail the emotional trajectories of the four cases using the steps of the Springboard Effect. To do so, it was necessary to develop narrative reconstructs of the pre-service teachers interviewed in Phase 3.

Reconstructed narratives constitute a methodological resource that makes it possible to present participants' experiences in an articulated and coherent way while still retaining their first-person voice (Clandinin, 2007). This procedure involves a slight reorganisation and editing of the original discourse in order to provide temporal continuity and thematic coherence, without altering the essential content of what was expressed. In research on teacher education and teacher identity, this type of narrative is particularly appropriate, as it preserves the affective and reflective load of the account and allows the complexity of processes of personal change to be captured.

In our study, the reconstructed narratives were used as the central unit of analysis to identify, in each case, the three steps of the SE (Pals, 2006) in the participants' life histories. For this purpose, we added to the narratives an **(Ac)**, to indicate acknowledgement of the impact of the negative experience (in past mathematics classes) on the pre-service teacher; an **(An)** to mark the analysis of the impact of the event on the positive development of the self (pre-service teacher); a **(T)** to signal the integration of the experience into the life history as a symbol of transformation and re-signification of the self (pre-service teacher); and an **(MR)** to indicate the explicit phrases, common across cases, that document the phenomenon of Mathematical Redemption. For example, the sequence *(Ac) "I was afraid of mathematics", (An) "I realised those experiences influenced the teacher I wanted to become", (T) "I now see those experiences as an opportunity for growth", and (MR) "I want my pupils to enjoy mathematics because I do not want them to experience what I experienced"* illustrates the coding process.

RESULTS

Emotional Trajectories in Life Histories

The sentence-completion items and the question we posed to these pre-service teachers provided a means of anticipating possible histories of Mathematical Redemption, since, following the structured interview (Yin, 2016), evidence consistent with the phenomenon was identified in each selected participant. To ensure confidentiality, we use fictitious names that were assigned randomly and bear no relation to the actual identity of the participants.

José is a pre-service teacher who reports having had a positive relationship with mathematics as a student; however, in the sentence-completion items he states that only in lower secondary school did he feel calm (satisfaction) in mathematics classes. His emotions were negative in two school levels, especially in primary school; despite this, he now feels joy at the prospect of sharing the positive side of mathematics (see **Table 3**).

Orlando's reconstructed narrative reveals an emotional trajectory characterised by fear and distress during his school years, followed by hope at the undergraduate level. When he anticipates that his answer might be wrong—that is, even before knowing whether the exercise was correct or incorrect—he already felt *fear* (a reaction to an event), and *distress* due to his displeasure at not understanding some topics. At the undergraduate level, he expressed *hope* (see **Table 4**).

Table 4. Orlando's emotional trajectory

Level	Reported narrative in the incomplete sentences	Interpretation based on OCC Theory
Primary school	I almost always felt *nervous* **when I thought about whether** [the mathematics exercise] **was right or wrong** {Probability}.	The emotion is *fear* because it refers to displeasure about anticipating whether the exercise would be correct or incorrect. The intensity variable is Probability, since it indicates how certain one is that an event may occur.
Secondary school	I felt *amazed* because [the teachers] **used a different kind of [numerical] assessment** {Unexpectedness}.	The emotion is *joy*, since Orlando wanted a different way of being assessed numerically. The intensity variable is Unexpectedness, because it was a situation he had not anticipated.
Upper secondary education	I felt *unhappy* because in **some topics it was not easy to understand them** {Proximity}.	The emotion is *distress* at not understanding the mathematical content of the lessons. The intensity variable is Proximity, because by mentioning "some topics" he implies that there was more than one, which means that the triggering situation arose more than once.
Undergraduate	I feel *joy* [on knowing that I will be a future teacher] because I **will show that mathematics is not difficult and that it is surprising** {Desirability}.	Although Orlando used the word joy, from the OCC perspective the emotion is interpreted as *hope*, since it involves anticipating a desirable event. The intensity variable is Desirability, because his goal is to show that mathematics is surprising and not difficult.

Table 5. Roberto's emotional trajectory

Level	Reported narrative in the incomplete sentences	Interpretation based on OCC Theory
Primary school	I almost always felt *nervous* because **I didn't know whether I would be able to solve the exercises that were assigned** {probability}.	The emotion is *fear* because it refers to displeasure about anticipating having the exercises solved correctly or incorrectly. The intensity variable is Probability, since it reflects the degree of belief that a foreseen event is going to occur.
Secondary school	I felt *bored* because **I didn't understand either the topic or the teacher** {sense of reality}.	The emotion is *boredom*, due to displeasure with an undesirable cognitive state (not understanding the topic). The intensity variable is Sense of reality, because it refers to what, for a person, is the real triggering situation.
Upper secondary education	I felt *afraid* because **it was hard to cope with the teachers**, since **most [of the teachers] were serious and imposing** {proximity}.	The emotion is *anger* because it represents disapproval of the blameworthy action of another person (the teacher) and displeasure with the undesirable event (having to cope with the teachers). The intensity variable is Proximity because, by mentioning "most", Roberto experienced the emotion with more than one mathematics teacher, which confirms that the event was repeated over short time intervals.
Undergraduate	Knowing that I will be a mathematics teacher, I feel *excitement*, *satisfaction* and *nervousness* because I am glad that I will be able to **know which [teaching] techniques to apply when teaching the topics and to create new ones in the way I would have liked to be taught** {desirability}	The emotion is *hope*, because Roberto anticipates a desirable event: applying teaching techniques and creating new ones. The intensity variable is Desirability because his goal is to teach in the way he would have liked to be taught.

Table 6. Karla's emotional trajectory

Level	Reported narrative in the incomplete sentences	Interpretation based on OCC Theory
Primary school	I almost always felt *safe* because **my teachers explained what I didn't understand** {realization}.	The emotion is *satisfaction* because it is related to the confirmation of a desirable event: the teachers' explanations when Karla had mathematical difficulties. The intensity variable is Realization, because the anticipated event actually occurs.
Secondary school	I felt *satisfied* because **I understood most of the exercises very well** {realization}.	The emotion is *satisfaction* because it is related to the confirmation of a desirable event: understanding most of the mathematics exercises. The intensity variable is Realization, since the event did in fact occur.
Upper secondary education	I felt *stressed* because **[the mathematics topic] was difficult for me** and **I had little time** [to solve the exercises] {sense of reality}.	The emotion is *distress*, since Karla feels displeasure about the limited time she had to answer the exercises and about the difficulties she faced in solving them. The intensity variable is Sense of reality, because it refers to what, for her, is the real triggering situation.
Undergraduate	I feel *joy* [on knowing that I will be a future teacher] because **I will be able to share all the positive things my mathematics teachers taught me and also improve the negative ones** {desirability}.	The emotion is *hope* because she anticipates what she desires: sharing the positive aspects of mathematics. The intensity variable is *Desirability* because her goal is to improve, in her own teaching, the negative aspects she experienced with mathematics.

Unlike José and Orlando, Roberto experienced only negative emotions throughout his schooling (see **Table 5**). *Fear*, *boredom* and *anger* are emotions directly related to events, with *anger* being triggered simultaneously by events and agents. Despite this, he expressed positive emotions when realising that he can change the way he will teach mathematics for the better.

Karla reported having negative emotions only during her upper secondary education (see **Table 6**). However, when envisioning herself as a future primary mathematics teacher, she intends to improve the negative aspects she experienced as a student.

The results shown in **Table 3** through **6** indicate that in primary education negative emotions (fear and reproach) predominated, due to deficient teaching experiences or a lack of understanding of the topics. As previous studies have shown

(Hannula, 2002; Op 't Eynde et al., 2006), students' perceptions of mathematics at this stage are strongly influenced by the teacher's attitude and the learning context. This is evident in José's case, who reported that his difficulties at this level were related to the teachers' instructional methods and the way the content was delivered.

In lower secondary school, a change was observed in Karla, Orlando and José. These participants each experienced positive emotions, either because they understood the topics, were assessed in a different way, or felt that mathematics became more accessible with the teachers' support. Meanwhile, Roberto continued to report negative emotions due to difficulties in understanding the content.

In upper secondary education, the situations that triggered negative emotions persisted in Roberto and reappeared in Karla, Orlando and José, especially in relation to mathematical content, teaching methods and academic demands. Emotions such as *distress*, *displeasure* and *anger* were identified, arising from a lack of understanding of the topics and the limited time available to solve exercises.

A significant finding is that, despite their previous negative experiences, all participants reported positive emotions at the university level (undergraduate) upon realising that they can change the way they will teach mathematics in the future. The predominant emotion at this level is hope, characterised by the desire to transform teaching and prevent other students from going through the same difficulties. This result is a clear indication of the process of Mathematical Redemption, since the future teachers not only overcame their negative experiences but also seek to rebuild their relationship with mathematics (Di Martino et al., 2013) through teaching. Within the framework of OCC theory, the intensity of this hope is associated with desirability, as the participants perceive their teaching work as an opportunity to modify their future pupils' learning experiences. This suggests that MR involves not only a change in personal attitude but also a commitment to improving the teaching of the discipline.

The Springboard Effect in Mathematical Redemption

In this section, we present the reconstructed narratives (Clandinin, 2007) of José, Orlando, Roberto and Karla, showing that Mathematical Redemption (Di Martino et al., 2013) is a process that follows the same emotional structure described by the Springboard Effect (Pals, 2006): going through a crisis, reinterpreting it and emerging transformed. To this end, we used the coding system introduced in Phase 4 of the method: (R, A, T), which identify the type of episode to which each fragment of the account is assigned, and (MR), which marks the explicit redemption statements.

Reconstructed narrative of José:

> **(Ac)** My relationship with mathematics in primary school was something I did not like, because of the teacher. I felt it more as an obligation than as something enjoyable. In primary school I did not have good guides; **(Ac)** in third grade I had a teacher who treated us badly, she even hit me. She was very closed-minded, so in one math lesson where we were doing multiplication and division, I began to have difficulties with division. **(Ac)** I started to feel nervous in class and would stay quiet so as not to give a wrong answer, because the teacher did not help. Instead of saying "don't worry, you can try again later", she would say "you're stupid, can't you solve it? it's the easiest thing in the world". **(Ac)** In a way, I developed a trauma. During one lesson on multiplication, I started playing with my pencil and when I looked up, the teacher was there. I don't know what happened to her that day, I have no justification to explain why she did it and, **(Ac)** when I looked at her, bam! a slap in the face. So, when she slapped me, I got scared; instead of crying, I was frightened, because I thought I had done something very bad. I have no idea what was going on with that teacher; I hope she is no longer teaching, because that is not a teacher. **(An)** That is how my need to know mathematics began. **(An)** Later, in 6th grade, the teacher was closer to the pupils; she cared about us understanding the topics, it was not just about writing, she would come over and ask how you were solving the problems; as a result of that, I no longer got stuck. **(T)** I want to become a teacher so as not to make the same mistakes that were made with me; **(MR)** I do not want my students to live through the same experiences that I did. **(T)** I would like children to learn through games and not only by doing exercises; I want to walk into the classroom feeling excited and for children not to feel frustrated. **(T)** I do not want to be a bitter teacher.

In José's history, the three steps of the Springboard Effect are clearly distinguished. First, he acknowledges his negative experiences and the impact they had on his life; feelings of nervousness, mistreatment and even being hit by a teacher combined to produce a traumatic experience with mathematics. Second, his analysis of these experiences led him to recognise the need to understand the topics in order to know mathematics. Third, José decided to become a teacher so as not to reproduce the harm he suffered and to ensure that his future pupils have emotionally caring and playful experiences; in this way, the initial negative episode becomes the springboard for his current commitment as a future mathematics teacher. With the explicit statement "I do not want my students to live through the same experiences that I did", José confirms Mathematical Redemption, as he wishes to face the challenge of teaching mathematics after having had a predominantly negative emotional trajectory as a student.

Reconstructed narrative of Orlando:

> Since I was a child, the idea of being a teacher caught my attention. I remember that my aunt, who taught in lower secondary school, would invite me to her school and I liked watching what the dynamics of the lessons were like. That was when I started to think that this was something I also wanted to do. **(Ac)** As for mathematics… to be honest, I'm not that much of a fan. **(Ac)** What happens to me is that, if I understand the topic, I like it, but if I find it hard to understand, I get frustrated; I feel anxious about not being able to answer correctly. In mathematics lessons I have felt happiness, **(Ac)** but also frustration. In primary school I did badly, in lower secondary a bit better, and then in upper secondary my relationship with mathematics improved a little more. It was not a sudden change; rather, **(An)** by myself became aware and told: "not everything has to be so difficult". **(T)** I began to focus on my studies, especially on mathematics, because I knew I could

> improve. It felt like a personal achievement. **(T)** Now that I am here as a future teacher, **(MR)** I want to teach mathematics in a different way; I want to tell my pupils not to think the way I used to think, not to believe that it is difficult; I want them to love it. **(MR)** I do not want any child to go through what I went through, failing and then thinking: "it was so easy and I didn't understand it!". **(T)** I do not want them to have that negative emotion. I would like to explain things very clearly, calmly, so that they understand and feel good. **(T)** I do not want my pupils to say that they hate mathematics; on the contrary, I would like them to say: "this teacher really explained well, paid attention to me and now I like mathematics". **(T)** Teaching mathematics represents an achievement, a way of overcoming the fears I had as a child.

In the first step of the Springboard Effect, Orlando recalls having an ambivalent relationship with mathematics, marked by failing grades, frustration and anxiety when he did not understand, which together constitute an explicitly acknowledged negative emotional experience with the subject. He then engages in a process of analysis and challenges himself with the idea that "not everything has to be so difficult". In this particular case, that moment of awareness became an important motivation to rebuild his relationship with mathematics—what Di Martino et al. (2013) describe as the *seed* of Mathematical Redemption. Finally, when he projects himself as a future teacher, he re-signifies his negative experiences, and the initial discomfort becomes the driving force behind his pedagogical commitment.

In his emotional trajectory, Roberto experienced only negative emotions during his basic and upper secondary education. In his narrative he elaborates this life history, yet he expresses positive emotions when realising that he can change, for the better, the way he will teach mathematics.

Reconstructed narrative of Roberto:

> My desire to become a teacher arose when I remembered what I was like as a child. I started thinking about the things I went through, especially in primary school. Reliving those moments made me realise that I wanted to be on the other side, now as a teacher. I do like mathematics, although **(Ac)** I found it quite difficult. I always wanted to understand it and I made an effort. When I finally understood something, I liked it more. **(Ac)** Sometimes it stressed me a lot; if I didn't understand it the first time, I would get annoyed and frustrated; but **(An)** that annoyance pushed me to keep searching, to investigate more. **(Ac)** What I like least are complex formulas; I find it hard to reason when there are many things to memorise; but I like mathematics when it allows me to solve a problem, when it makes me think and understand. **(Ac)** In primary school I felt very nervous, especially during the standardised exams. I remember that **(Ac)** we spent the whole day solving exercises and that stressed me a lot. **(Ac)** In lower secondary school I went in with a different mindset, but the lessons were very boring and the content more complex; I felt overwhelmed. In upper secondary school, although I was afraid of getting stuck, I tried to make an effort because I wanted to study engineering; but that fear was still there, thinking that I was not going to make it. **(An)** I feel that my experiences with mathematics have been more negative than positive, but that has served as motivation for me. **(MR)** I don't want my students to go through what I went through. **(MR)** I don't want them to feel afraid or to become discouraged because they don't understand. I want them to feel comfortable and safe, and if they cannot solve something, I will look for ways to help them; I Will investigate what to do so that they can succeed. **(T)** My lessons are not going to be just "solve this and hand it in"; I want something more dynamic and interactive. **(An)** There was one teacher who marked me deeply. His way of explaining, his fluency, his way of conveying knowledge… that made us feel accompanied. He didn't let us get stuck. That teacher made me see that it is indeed possible to teach mathematics without losing patience with the students. **(An)** If I could go back, I would make better use of my free time to study and review. I would be more focused. **(T)** And if now one of my students felt what I felt, I would tell them not to hate mathematics, that it is useful and necessary. I would tell them that if they don't want to learn it, they can get stuck, and that in the future they will come across it in any path they choose. **(T)** I don't want to leave my students on their own. **(MR)** I don't want to repeat what I experienced: being given the exercises and, if you didn't understand them, "too bad". **(T)** I want to reach out to them, not wait for them to come to me. Not to focus only on one, but on all of them. **(T)** For me, teaching mathematics represents a difficult task. I know it is going to be challenging, but that will not stop me from being a teacher. **(MR)** I want to bring about change; I want my students to see mathematics as something useful, enjoyable and dynamic, not as the mechanised "I teach you and that's it" that I had to live through. **(T)** I want to truly teach, not just repeat content.

In Roberto's case, the Springboard Effect begins with a trajectory marked by stress, fear of becoming stuck and frustration in the face of standardised tests, boring lessons and complex content, which together constitute a predominantly negative experience with mathematics. Subsequently, his experiences do not remain at the level of discomfort; instead, he recognises them himself as a "motivation" to make an effort and seek ways to improve. At this point in his life, inspired by the model of a teacher who taught fluently and without losing patience with students, he begins to see that a different kind of relationship with the subject is possible. Finally, when he projects himself as a future teacher, he transforms that past into commitment by explicitly stating that he does not want his students to go through what he went through.

Karla acknowledged having hated mathematics at the only educational level in which she experienced negative emotions, reaching her point of true crisis, also referred to as a turning point (Di Martino et al., 2013).

Reconstructed narrative of Karla:

> Since I was a child, I have been interested in becoming a teacher. I think it comes from listening to my grandmother talk about her pupils, but it was during my social service in primary school that I really reaffirmed my desire to be a teacher and realised that this was what I wanted to do. In primary school things went very well for me, I understood a lot and I liked mathematics very much. **(Ac)** In lower secondary school it started to seem complicated because I had to memorise many

> formulas and learn many steps to solve an exercise. **(Ac)** In upper secondary school the relationship was very bad: the teachers only gave us photocopies and said "solve it", without explaining anything. They were not interested in us and that made me feel confused, because I used to think that mathematics was easy and that I liked it, but with those experiences I ended up hating it. **(Ac)** The pandemic also affected me a lot, because classes were online and I did not even have a mobile phone to connect. **(Ac)** I stopped understanding and stopped caring about everything. **(An)** Even so, at university, my current algebra teacher has helped me a lot to change the way I think; he always tells us that we must love mathematics in order to transmit that love to our pupils. Over time I understood that **(An)** if I hate mathematics, I will make my pupils hate it too. **(An)** That is why, when I think about my past experiences, I realise that they helped me to understand the importance of teaching with patience and empathy. **(T)** Now I want to change that lack of interest that many teachers generate in their students. **(T)** I want my students to feel comfortable and confident to ask questions, not to be afraid of having doubts or of doing their own research. If any of them has difficulties, I will look for strategies to help them, because I was a child too and I know what it feels like. **(MR)** I do not want my students to go through what I went through when I lost my love for mathematics. Teaching mathematics represents a major challenge, but **(T)** I will always be determined to be patient and to teach with love, without imposing learning or forcing memorisation. **(T)** I want my students to see mathematics as something useful, interesting and positive.

In the first moment of the Springboard Effect, Karla moved from a positive relationship with mathematics to an increasingly negative trajectory, marked by mechanical memorisation, lessons without explanation, teachers' lack of interest and the impact of the pandemic, culminating in *hatred* of the subject. In a second moment, at university, she reworked these experiences under the influence of her algebra teacher and became aware (the seed of Mathematical Redemption) of the impact it could have on her future students if she herself hated mathematics. Finally, she integrated that past into an affectively positive teaching project, wishing that her students would not go through what she went through.

The three steps of the Springboard Effect (Pals, 2006) emerged consistently in the cases of MR analysed. This suggests that Mathematical Redemption can be conceived as a particular form of emotional transformation whose underlying mechanism matches the structure of the SE. Thus, the contribution of this study is to identify the SE as a useful operational framework for detecting MR in pre-service teachers.

DISCUSSION

Di Martino et al. (2013) defined the phenomenon of Mathematical Redemption on the basis of narratives from Italian pre-service teachers. In this article, we showed how this process can be analysed using the three steps of the Springboard Effect proposed by Pals (2006). By operationalising the phases of recognition, analysis, and transformation as narrative coding categories, MR becomes a structured process that can be identified with explicit criteria in pre-service teachers' accounts. In the recognition of the impact of the negative experience (Step 1), the narratives reveal moments in which pre-service teachers explicitly name their emotional experiences with mathematics: fear, humiliation, frustration, shame about errors or a sense of incapacity. Methodologically, these excerpts are identified as units of meaning in which the painful past is brought into the present and made explicit as such. This phase of recognition was already partially suggested in the work of Di Martino et al. (2013), but in our study, it is more precisely delimited as a first analytical move within the redemption process and essential for understanding the subsequent steps.

The explanatory analysis (Step 2) becomes visible when participants not only recount what happened to them, but also actively interpret the impact and meaning of these negative experiences: they attribute responsibility to particular teachers, to specific assessment practices, to the way content was explained, or to the lack of support. In this step, we also identify that becoming aware of their negative emotional trajectories (the *seed* of Mathematical Redemption) is a motivational factor for future primary teachers to re-signify their relationship with mathematics. From a methodological point of view, the use of the Springboard Effect makes it possible to distinguish these analytical segments from the mere description of anecdotes, showing how pre-service teachers reconstruct the links between lived events and their self-concept as learners of mathematics. This level of analysis provides a framework for studying how suffering is re-signified.

The transformation and re-signification of the self (Step 3) is identified in those passages where participants turn their negative history into a future pedagogical project: they express an explicit desire to teach mathematics "in a different way", to offer their pupils experiences that are more humane, comprehensible and emotionally safe. Methodologically, we coded this phase as the moment when the narrative stops looking only to the past and becomes oriented towards the teaching identity they aspire to develop. In this sense, Mathematical Redemption can be understood as the form the Springboard Effect takes when negative prior experiences with mathematics are transformed into a motivation to teach mathematics differently.

In contrast with some published studies (Di Martino et al., 2013; Pérez-Torres & García-González, 2024), this study also acknowledges demotivating factors such as teacher maltreatment (José's history), pressure for results (Karla), lack of explanation or pedagogical abandonment (Orlando and Roberto), as well as motivating factors such as the desire to teach differently, personal growth, and the memory of teachers who elicited positive emotions. Thus, the process of MR is not manifested merely as a transition between affective states, but as a reconstruction of professional identity in which past discomfort becomes the narrative and ethical driving force of the future professional.

CONCLUSIONS

This study stems from the question: Why would someone want to become a mathematics teacher when their personal relationship with mathematics has been negative? The results show that not all future primary mathematics teachers have had favourable trajectories with mathematics; on the contrary, several recounted histories of fear, frustration, stress or lack of interest linked to their school experiences. In this group, four of the 17 participants met the study's criteria for further examination of Mathematical Redemption.

Recognising MR is important because some histories of suffering with mathematics do not lead solely to rejection or avoidance, but may instead be transformed into an explicit desire to "teach in a different way"; that is, to offer future pupils emotional experiences that are more caring, respectful and meaningful than those experienced in one's own schooling. This perspective extends what has been found in previous research on emotions and mathematics teaching, where negative experiences are often projected into insecurity or fear of teaching, but can also give rise to processes of reconstruction and change.

To understand and operationalise this transformation, the present study drew on the Springboard Effect (Pals, 2006), understood as a three-step narrative sequence: the recognition of negative experiences, the analysis of their impact on one's own history, and the integration of those experiences into a future project. This framework, developed in the field of the psychology of narrative identity, makes it possible to describe how certain difficult episodes can become leverage points for a new configuration of self. In the cases analysed here, Mathematical Redemption can be interpreted as a particular way the Springboard Effect operates in the field of mathematics education: painful experiences with the subject may be rewritten as an ethical and professional driving force for the task of teaching.

The finding that the Springboard Effect constitutes an operational framework for identifying and analysing Mathematical Redemption in pre-service teachers is especially relevant for those involved in teacher education, as well as for those who teach mathematics at all educational levels. For teacher educators, it points to the need to create spaces in which future teachers can narrate, analyse, and re-signify their emotional trajectories with mathematics, so that the affective dimension is not left out of didactical and disciplinary development. For practising teachers, this result serves as a reminder that their practices not only produce cognitive achievements, but also lasting emotional traces that, over time, may become obstacles or springboards in their students' relationship with the subject.

Finally, it is important to note some limitations of the study. The number of participants is small, and they belong to a group of pre-service teachers from a specific institutional context, which limits the generalisability of the results. Future research could broaden the sample and follow participants longitudinally through their first years of professional practice, in order to explore in greater depth how Mathematical Redemption is sustained and how the Springboard Effect continues to operate in the personal transformation of pre-service teachers.

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