



# The Landscape of Becoming a Science Teacher: A Case Study on Professional Identity, Inquiry and Emotions in Preservice Teachers' Education

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## Abstract

*In recent years, teaching identity has emerged as a growing research area in science education, considering its impact on students' performance. This study explores the interrelationships between teacher identity construction, inquiry orientation, and emotional experiences of Physics and Chemistry preservice teachers during their initial teacher education. We performed a multidimensional analysis using a case-study approach and validated instruments, such as the pre-service teachers' IBSE perception (PTIT) questionnaire for inquiry perception and the Professional Practice and Inquiry (PPI) questionnaire for identity perception. Results revealed that pre-service teachers generally recognised the value of inquiry-based approaches for students, experienced predominantly positive emotions during training, and had difficulty in establishing past-present connections, likely due to limited teaching experience. The study found that high teaching identity scores on the PPI questionnaire did not necessarily correlate with inquiry orientation. At the same time, positive emotions were observed across different profiles, suggesting that becoming a science teacher follows individualized pathways. Consequently, this research highlights the importance of integrating identity, inquiry, and emotions into teacher education programs and of designing personalised approaches to support diverse developmental trajectories while maintaining high professional standards.*

**Keywords:** Pre-service teachers, teacher identity, inquiry-based science education, emotions

## 1. Theoretical Framework

Research on the construction and development of teaching identity has recently sparked a growing interest in science education due to its influence on the development of teaching strategies and its direct impact on student learning. [1]. Determined by contextual and personal factors and with a dynamic and multidimensional nature, which evolves hand in hand with professional development [2], it refers to the self-concept or central image constructed from experiences, beliefs, and values, personal and practical practices that shape teaching actions.

In Secondary Education, pre-service teachers (PSTs) also face a duality between their identity as students and their identity as science teachers, giving rise to difficulties during teacher education programs. These difficulties are mostly related to the change in professional identity, the teaching model they aspire to, and their previous professional experience [3].

On the one hand, the construction of the teaching identity closely relates to PSTs' research capacity, not only to the skills to teach students through a research approach but also to the ability to address philosophies and ways of interacting within an educational community that values and practices science and technology through inquiry, being able to deliberate reflection aimed to focus on problem posing [4]. By inquiring and examining their understanding of teaching, PSTs question, think, discuss, and further increase awareness of their understandings, values, and dispositions to teach to solidify their role as teachers [5].

On the other hand, recent research has also highlighted the relevant role of emotions in configuring teacher identity [6]. The emotional profile that teachers experience about their identity is complex and not unidirectional, meaning that PSTs can face teaching challenges associated with "negative" emotions and yet have the ability to reverse these emotions, hence contributing significantly to the development of their teaching identity [7].



## 2. Aims and Research Questions

This research aims to explore the complex interplay between teacher identity construction, inquiry orientation, and emotional experiences in Physics and Chemistry PSTs during their initial teacher education. Specifically, we examine how these three factors interact and influence each other during the development of the professional teaching identity, addressing the following research question:

[RQ1] What are the PSTs' perceptions about inquiry, emotions and identity?

[RQ2] What patterns emerge from integrating identity perception, inquiry orientation, and emotional experiences in PSTs?

## 3. Methodology

This research presents a case study developed with eight Physics and Chemistry PSTs of the Secondary Teaching Master Degree (MEd) at the University of Málaga during the academic year 2020/2021. They all held a bachelor's or master's degree in either Science or Engineering, a prerequisite to enrolling in the MEd, which is compulsory to become a Secondary Education Teacher. All participants had different teaching and research experience levels, although not in a professional way.

Data were collected in agreement with the Ethics Committee of the University of Málaga (CEUMA) (ref. no. 139-2023-H) during the completion of the MEd, where PSTs received specific instruction about inquiry-based science education, teacher identity and emotions through a training program outlined to promote the professional development associated with these aspects [8],[9].

We employed an integrated multidimensional analysis approach to examine the relationships between teacher identity, emotional experiences, and inquiry orientation. This approach allows for systematically comparing and integrating data from three distinct quantitative instruments, identifying patterns and relationships across these factors of teacher development (Figure 1).

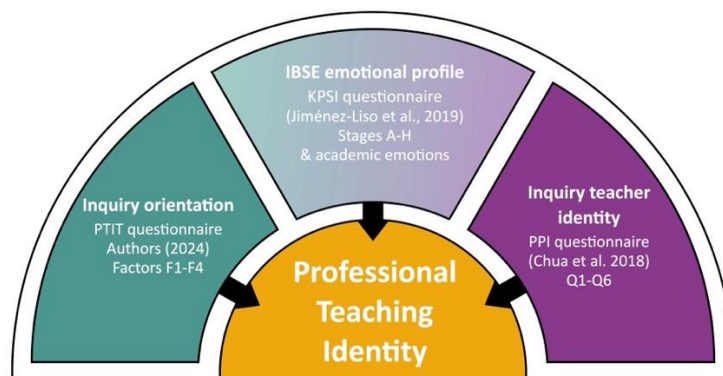


Fig. 1. Integrated multidimensional analysis framework

To deepen the perception of inquiry, we applied the validated PSTs IBSE perception (PTIT) Likert-type questionnaire (1: totally disagree to 4: totally agree) [10], which provides an idea of the PSTs' disposition towards inquiry-based science education (IBSE). To do so, we calculated the participants' scores for each of the four factors composing the questionnaire (**F1**, IBSE teaching practice; **F2**, IBSE students' applicability; **F3**, IBSE difficulties related to personal aspects; and **F4**, IBSE difficulties related to external aspects). Regarding the emotional profile that emerged in the teaching role, we adapted the instrument described by Jiménez-Liso et al. [11], including the stages of the design of inquiry activities (**A**, focussing; **B**, context; **C**: development; **D**: curriculum; **E**: management; **F**: assessment; **G**: communication, and **H**: transfer), combining the multiple selection of achievement (**TRU**, trust; **SAT**, satisfaction; **SHA**, shame, and **DIS**, dissatisfaction) and epistemic emotions (**INT**, interest; **CON**, concentration; **BOR**, boredom; **REJ**, rejection and **INS**, insecurity).

Finally, to explore identity perception we applied an adaptation of the validated Professional Practice and Inquiry (PPI) questionnaire created by Chua et al. [12], selecting six Likert-type questions (1: strongly disagree, 5: strongly agree) aimed to detangle what it means to be an inquiring teacher



professional (Q1-Q6), showing the PSTs capability of being effective inquirers regarding their teaching practices and identity development.

## 4. Findings

Figure 2 shows the comparison of the inquiry, emotions and identity profile by participant, revealing some interesting variations and commonalities. When analysing the participants' orientation toward inquiry [RQ1], some patterns across the group arose.

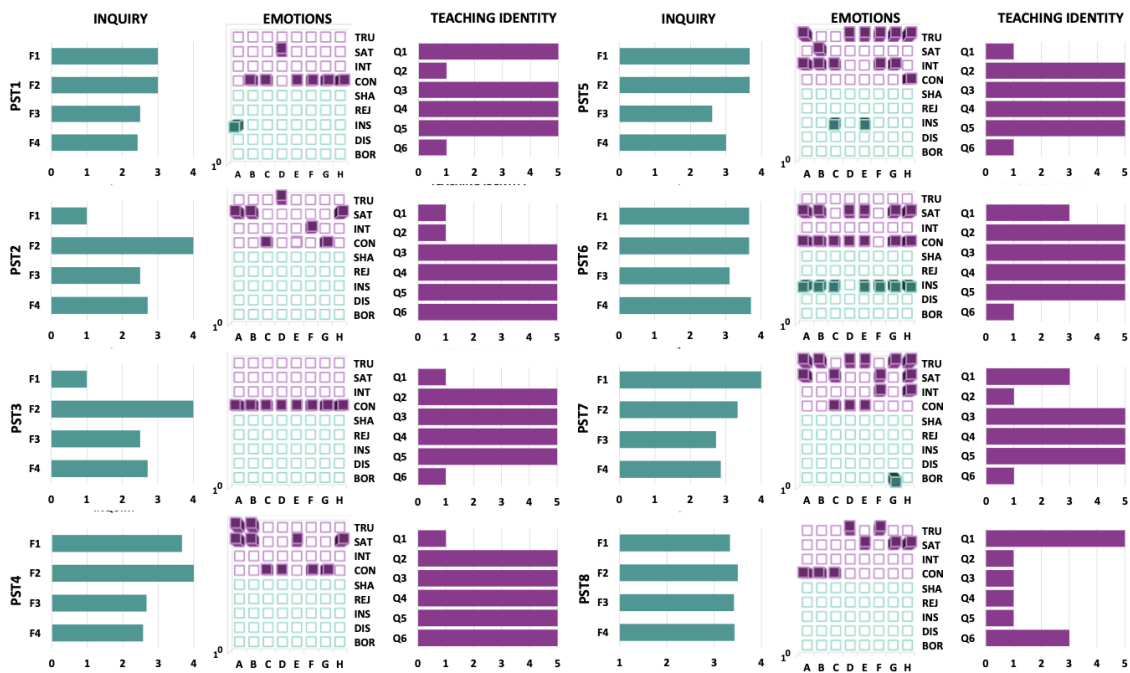


Fig. 2. Comparison of the identity, inquiry and emotional profile by participant

Factor **F2** emerged as a decisive dimension across participants, suggesting they recognise the motivational value of inquiry-based approaches for students and indicating a predominantly student-centred perspective. The contrast between internal difficulties (**F3**) and external difficulties (**F4**) provides mixed insight into perceived barriers, with scores being relatively similar in both dimensions. The data also revealed that PST6 and PST8 demonstrated exceptionally balanced scores across all inquiry factors, indicating a solid overall orientation toward inquiry-based teaching practices. In contrast, PST2 showed a disparity between factors, with particularly low scores in **F1**, but high in **F2**, suggesting strong recognition of IBSE value for students despite challenges in implementation.

The participants' emotional experiences during IBSE activities [RQ1] revealed a predominance of positive emotions, with concentration emerging as the most frequently experienced emotion. Trust and satisfaction also appeared consistently, though with varying patterns among different participants. PST5 and PST7 demonstrated particularly strong positive emotional profiles. While negative emotions (insecurity, dissatisfaction, boredom) were less frequent, some participants, such as PST6, exhibited a more diverse emotional range, stressing the complex nature of emotional development during teacher preparation.

Considering teaching identity [RQ1], most participants (except PST8) demonstrated stronger connections to aspects linked to questions **Q3**, **Q4**, and **Q5** related to ways to improve teaching practice. However, participants showed lower scores in establishing past-present connections (**Q6**) likely reflecting their limited teaching experience. The variation in **Q1** ("having a question in mind") and **Q2** ("thinking about classroom experiences to support my stance") also suggests different levels of engagement with evidence-based reflective practice. Particularly interesting were the cases of PST4 and PST8, who exhibited distinctly different identity profiles from their peers. PST4 demonstrated



remarkably consistent high scores across all identity dimensions, suggesting a well-developed and balanced teaching identity. In contrast, PST8's profile revealed more moderate scores, indicating a different trajectory in identity development.

One of the most compelling findings emerged from examining relationships between the three dimensions (identity, inquiry and emotions) [RQ2]. Some participants with high teaching identity scores (particularly in Q3-Q5) showed varying inquiry orientation scores, suggesting these aspects of teacher development might not be as directly related as previously assumed. The emotional dimension adds another layer of complexity, with positive emotions (*trust, satisfaction, confidence*) appearing across different profiles regardless of identity or inquiry scores.

A particularly interesting case was PST8, whose profile showed a distinctive pattern. Despite lower scores in identity dimensions (especially Q3-Q5), this participant demonstrated consistently moderate-to-high inquiry scores across all factors, while maintaining positive emotions (concentration, satisfaction), challenging simple correlations and suggesting that balanced inquiry perceptions can coexist with different identity profiles.

These findings lead us to suggest three main development patterns (table 1): i) confidence-led development, exemplified by PST4-PST6, showing particularly high reflection scores (Q3-Q5), strong F1 and F2 scores, and predominantly positive emotions across phases, though notably PST6 also expressed insecurity; ii) a growth-oriented pattern, exhibited by PST2, PST3 and PST7, with strong improvement-focused reflection (Q3, Q5) but more variations in Q1, Q6 and F1 scores, accompanied by generally positive emotional responses; and iii) a challenge-aware development, represented by PST1 and PST8.

**Table 1.** Suggested patterns correlating identity, inquiry and emotions for each participant

Pattern type	PST	Identity*						Inquiry**				Most frequent emotions
		Q1	Q2	Q3	Q4	Q5	Q6	F1	F2	F3	F4	
Confidence-led	4	1	5	5	5	5	5	3.7	4.0	2.7	2.6	CON, SAT
	5	1	5	5	5	5	1	3.7	3.7	2.6	2.1	INT, TRU
	6	3	5	5	5	5	1	3.7	3.7	3.1	3.7	CON, SAT, INS
Growth-oriented	2	1	1	5	5	5	5	1.0	4.0	2.5	2.7	CON, SAT
	3	1	5	5	5	5	1	3.5	4.0	2.7	2.6	CON
	7	3	1	5	5	5	1	3.5	3.3	2.7	2.9	SAT, TRU
Challenge-aware	1	5	1	5	5	5	1	3.0	3.0	2.5	2.4	CON
	8	5	1	1	1	1	3	3.3	3.5	3.4	3.4	CON, SAT

\* Scores \*\* Factor mean value

## 5. Conclusions and Educational Implications

This research shows how PSTs perceived the development of their teacher identity, their readiness to inquiry and their emotional profile experienced during the MEd. Performed as a case study, the varied profiles observed in this study highlight the importance of personalized approaches to teacher education that can accommodate and support different developmental trajectories while maintaining high standards for professional growth.

With the caution due to the reduced number of participants, the emergence of three distinct developmental patterns (confidence-led, growth-oriented, and challenge-aware) suggests that becoming a science teacher is not a uniform process but rather a highly individualized journey where multiple pathways can lead to successful professional development.

Despite the limitations of our small sample size, these insights provide valuable direction for future research and practice in science teacher education, particularly in understanding how to better support PSTs in developing their teaching identity through inquiry-based approaches while attending to their emotional well-being. Integrating these three dimensions - identity, inquiry, and emotions - is fundamental in shaping effective science teachers, suggesting that teacher education programs should explicitly address and support all three aspects of their curriculum and practice.



## 6. Acknowledgement

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