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Consolidating Research on Student Teacher Professional Agency: A Quantitative Study with an Ecological Approach in the Global South

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Abstract
Studies indicate that student teachers' engagement in continuous professional learning, (i.e., student teacher professional agency [STPA]), can improve their readiness for their careers. Unlike earlier qualitative studies often from the Global North, this research contributes geographical and methodological relevance to the literature by investigating STPA in a Brazilian teacher education program using a quantitative approach that aligns with an ecological understanding of STPA. A questionnaire assessing STPA, environmental (i.e., curriculum coherence and learning environment), and individual (i.e., teacher identity) factors was administered to 283 student teachers. Data were analyzed using structural equation modeling and network analysis. The student teachers' perceptions of (1) coherence between parts of the program, theory, and practice; (2) positive climate with their peers and mentors' recognition; and (3) teacher identity were the most relevant factors regulating STPA. These findings offer insights into developing a Brazilian teacher education curriculum to strengthen STPA.

Keywords: teacher education, lifelong learning, triangulation, Global South

Introduction

Extensive literature has addressed the relevance of investigating and promoting (student) teacher professional agency during and after teacher education (Heikonen et al., 2017, 2020; Leite et al., 2022). This is required to prepare novice teachers for the challenges in their career (Bransford et al., 2005; Ebersöhn & Loots, 2017) and the fast-paced changes that schools have experienced in the last decade (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2022), which have been even more accentuated by the Covid-19 pandemic (Azorín, 2020).

However, both systematic reviews done by Deschênes and Parent (2022) and Cong-Lem's (2021) pointed out a prevalence of qualitative research designs in the Global North and suggested a more diverse methodological framework in developing countries. Addressing these issues, this paper expands the literature's geographical reach and methodological framework through a quantitative and ecological study in Brazil. The approach used in this study uses a triangulation method for quantitative data analysis (Leite et al., 2022) with the purpose of opening new discussions about student teacher professional agency in the Global South with an international perspective.

Such discussion is of relevance in the Global South, because of an increasing pressure by transnational organizations (e.g., Organisation for Economic Co-operation and Development) for states to reform their national curriculum policies and teacher training programs in line with international

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standards, usually set in the Global North (e.g., Chung, 2017). For example, in Brazil, Melo et al. (2022) discussed how the educational reform approach of accountability adopted by policy makers under the pressure of external assessment mechanisms has limited the agentic power of teachers as curriculum protagonists. Teachers are seen as mere appliers of an internationally standardized competence-oriented curriculum, alienated from the school contextual reality, and distanced from a holistic view of student learning and growth. The goal of nurturing student teachers with critical, analytical, reflective, and creative capabilities, as suggested by the International Commission on the Futures of Education (UNESCO, 2022), seems to vanish from the horizon.

As a strategic mechanism of resisting this curriculum policy attempt to de-professionalize the teaching practice, Melo et al. (2022) showed how "the power of agency," referred to as student teacher professional agency (STPA) in this paper, must be a central element of teacher education programs. Integrating this concept into theory-driven practices during teacher education offers opportunities for student teachers to engage in critical, continuous, and contextualized professional development (Gonçalves et al., 2020; Heikonen et al., 2020; Leite et al., 2020). To achieve such a goal, this study investigates how factors in the environment and individual characteristics influence STPA during a teacher education program in Brazil with quantitative methods, as a study case from the Global South.

Student teacher professional agency

This study adopts the ecological understanding of STPA, according to which the engagement of actors is viewed as a dynamic process shaped by individual and environmental resources and constraints (Biesta et al., 2015). Soini et al. (2015) proposed a framework to understand the process of continuous engagement in professional learning among student teachers, focusing on their development as future educators. Their framework identified four interconnected elements. 1) Teaching *competence*, which involves continuous improvement in instructional skills, adapting teaching methods to various subjects and students' requirements, and evaluating one's professional practice (Bransford et al., 2005). 2) The capacity to build *collaborative learning environments* while fostering a positive classroom climate using interpersonal skills that engage students differentially in activities while also supporting their learning processes (Bronkhorst et al., 2014). 3) *Reflection* in the classroom, where student teachers engage in meaningful analysis of teaching situations, assess students' thinking, and continuously learn how to enhance students' education (Leite et al., 2020). And finally, 4) *modeling* experienced teachers by observing them in authentic classroom situations and integrating effective teaching practices (Brown et al., 2015).

These elements are relevant during teacher education, as student teachers take ownership of their future continuous learning (Heikonen et al., 2017, 2020). Emphasizing intentional learning strategies, such as experimentation, reflection, behavior change, and idea development, both individually and with peers, helps student teachers succeed in their academic journeys (Bronkhorst et al., 2014). Additionally, they relate to sustaining motivation for self-oriented learning (Pyhältö et al., 2015) and the belief in overcoming learning-related challenges (Goh & Canrinus, 2019).

Environmental factors and individual characteristics of student teachers that regulate their professional agency

International literature has emphasized two factors in the environment of teacher education programs: the clear coherence between theory and practice in the teacher education curriculum (Canrinus et al., 2017), and the role of pedagogical interactions in the learning environment (Toom et al., 2017). Regarding individual attributes, previous research has emphasized the process of students negotiating their teacher identities (Edwards & Burns, 2016; Ruohotie-Lyhty & Moate, 2016) while embracing their role as educators committed to ongoing professional growth. This research analyzed

how the above environmental and individual factors regulate the development of STPA in the different phases of a teacher education program in Brazil.

Aligning theory and practice in the teacher education curriculum

Past research has explored how the organization of the curriculum affects the outcomes of teacher education (Hammerness & Klette, 2015; Zeichner et al., 2015). Key aspects, such as well-aligned courses and training in real educational settings, as well as the application of embodied situated social learning (Korthagen, 2010), significantly influence novice teachers' performance (Bronkhorst et al., 2014; Klette et al., 2017). Studies have revealed that a coherent educational program enhances student engagement and the development of teaching mastery over time (Canrinus et al., 2017), leading to higher teaching confidence to better handle classroom situations (Goh & Canrinus, 2019). Conversely, the absence of curriculum coherence has been linked to pre-service teachers perpetuating outdated and inefficient teaching practices (Korthagen, 2010) learnt during their own school experiences. Therefore, the way teacher education curriculum is organized has the potential to facilitate—or prevent—the development of STPA.

To evaluate student teachers' perceptions of curriculum coherence, Canrinus et al. (2019) developed a framework encompassing six dimensions: (1) *Linking to practice* as opportunities for students to incorporate tangible teaching practices within campus coursework. (2) *Using theory* as opportunities for students to integrate educational theories and research to enhance students' understanding and application of theoretical concepts. (3) Developing *research methods* as opportunities for students to cultivate research skills to foster an inquiry-based approach to handling real classroom situations. (4) *Coherence between courses* as how students perceive a cohesive and progressive understanding of teaching and learning by identifying interconnected themes across different courses. (5) *Coherence between courses and field experiences* as how much students perceive meaningful connections between theoretical courses and field experiences. And (6) *coherence between parts of the program* as opportunities provided for students to integrate various components of the program, fostering the development of a comprehensive understanding of education. This framework has shown validity and reliability across diverse cultural contexts (e.g., Klette et al., 2017; Jenset et al., 2019).

The role of pedagogical interactions for student teachers

The social environment in teacher education has shown to influence STPA through various pedagogical interactions between students and educators (Pyhältö et al., 2015; Toom et al., 2017). Bransford et al. (2005) emphasized that initial teacher training should help student teachers delve with an inquiry-based and reflective mindset into their own personal experiences and assumptions about learning and teaching through meaningful dialogs with peers and educators. Receiving recognition and support from educators empowers and boosts student teachers' confidence, especially at the outset of teacher education, when students seek role models more intensely (Turnbull, 2005).

Teacher educators and the ways in which they develop their pedagogical practices serve as significant role models for student teachers and contribute to the future practice of student teachers (Cruz, 2017). In addition, peer collaboration helps students address learning challenges by providing them with a safe space for making mistakes and asking questions (Le Cornu, 2009). Both are regarded as sources of support who build a collaborative learning environment and benefit mutually from it (Edwards, 2005).

Four elements highlighted by Soini et al. (2015) compose a framework for investigating the pedagogical interaction aspect of the learning environment: the *support* from educators, the sense among peers of belonging *equally*, a positive *climate* for collective knowledge building, and the *recognition* given by the teacher educators.

Negotiating professional identity during teacher education

Student teachers develop their professional identity as a negotiation, as the teacher identity is continually evolving and adapting to student teachers' resources and contextual experiences (Beauchamp & Thomas, 2009). They start shaping their professional goals, interests, career plans, and values from their personal experiences at school (Vähäsantanen et al., 2019). Their experiences during the teacher education program become, then, only a part of this ongoing negotiation process (Edwards & Burns, 2016; Ruohotie-Lyhty & Moate, 2016).

In Brazil, professional identity has been identified as one of the leading factors driving student teachers to become teachers, among their recognition of the social role of the teaching profession, family influence, and employability (Cruz, 2017). Roldão (2007) expanded this discussion to consider that becoming a teacher involves transforming a social predisposition through professional socialization into a personal disposition through teacher education.

Studies indicate that a strong connection between theory and practice in teacher education leads to a more realistic negotiation of professional identity for student teachers (Ruohotie-Lyhty & Moate, 2016). When students' expectations of being teachers closely align with their experiences during teacher education and their future careers, a realistic professional identity emerges. This realistic identity empowers student teachers to integrate their teaching competences effectively, adapt to school challenges, and engage in continuous learning (Kwakman, 2003).

Current research

To broaden the geographical scope and methodological framework of the existing literature regarding the professional agency of student teachers to the Global South, this study employs a quantitative design with an ecological approach (Leite et al., 2022). For this reason, the investigation delves into the development of STPA during teacher education at a Brazilian university. The research question of this study was: How do perceptions of factors in the environment and individual characteristics regulate the development of STPA among Brazilian student teachers?

Based on the previous literature review, we hypothesize that students' perceptions of curriculum coherence (H1), pedagogical interactions of the learning environment (H2), and teacher identity (H3) all dynamically correlate to and influence STPA in diverse ways over the years of a Brazilian teacher education program.

Methodology

Research context, data collection, and participants

Teacher education in Brazil faces significant challenges (Cruz, 2017). The majority of students entering these programs are young, single women from economically disadvantaged backgrounds with a low entry academic level (Daboín & Ribeiro, 2019). Additionally, Brazilian teacher education programs have been criticized for deficiencies in the curricula, insufficient pedagogical training. Despite the inclusion of theoretical subjects, didactics, and supervised internships, many teacher education programs suffer from a lack of cohesion, with significant disparities in the balance between subject knowledge over practical pedagogical skills (Cruz, 2017). This fragmentation has resulted in student teachers often planning their teaching independently, with little guidance or support. Additionally, the emphasis on research over teaching skills in graduate programs has left teachers relying on outdated methods, while teacher educators themselves often lack the pedagogical competence necessary to effectively train new teachers (Magalhães Júnior & Cavaignac, 2018).

This research's data were collected between 2019 and 2022 at the Federal University of Ceará (FUC), where the Faculty of Education has a long-standing tradition, and it is considered a reference in the region (FUC, 2013). The Teacher Education Degree Program at FUC focuses on training professional educators who will be capable of working as teachers from Early Child Education to Adult

Education and as education administrators responsible for the planning, coordination, implementation, and monitoring of formal, non-formal, and informal education work. The program curriculum (FUC, 2013) emphasizes research as the central axis of teacher education, assuming that an inquiry posture will favor reflective teaching practice. In addition, it seeks theory–practice articulation through supervised internships in which students have contact with the educational reality from the first period of the academic training. It comprehends a 4-year training period, structured with obligatory and optional courses divided between a branch of pedagogical basic studies and a branch of pedagogical deepening and diversification studies (a total of 2,672 hours); complementary activities, varying from research, artistic, community-driven, and organizational activities (a total of 176 hours); obligatory supervised internship (320 hours); and a bachelor thesis work (48 hours).

Data was collected once a year during class periods with the permission of teacher educators. Before the Covid-19 pandemic, data collection happened during in-person classroom time; however, in 2021 and 2022, the collection was online. Of the 640 registered students in the degree program, 283 student teachers (224 women, 79%) from all years of the degree program participated (response rate = 44%; N_{female} = 531, 83%).

The participants of this study were enrolled in different teacher education programs, such as Early Childhood Education, Primary and Secondary Education, Special Education, and Adult Education. Their ages ranged from 17 to 66 years (Mdn = 22.00, M = 25.87, SD = 8.96), representing diverse cohorts within the teacher education program: first-year students (n = 73), second-year students (n = 72), third-year students (n = 75), fourth-year students (n = 29), fifth-year students (n = 18), and sixth-year or beyond (n = 16). The students in their fifth year or beyond were those who had not been able to graduate on time.

Prior to data collection, all participants were briefed about the research, and their involvement was voluntary, with informed consent sought. The study adhered to the EU's General Data Protection Regulation (GDPR, 2016/679) and was also approved by the Brazilian National Research Ethics Commission in 2019.

Measures

The four instruments of this research have been used and found reliable in international contexts (Leite et al., 2022). In 2019, a pilot was conducted at the State University of Ceará, which follows a curriculum similar to that of FUC. The study included 102 students enrolled in the bachelor's degree in Pedagogy. The research instruments were initially translated into Portuguese by a certified translator, with the Brazilian co-authors verifying the accuracy of the scales' items. To ensure consistency between the language versions, the measures were then back-translated into English. Following a few wording adjustments, the psychometric properties of the questionnaire were reassessed using the pilot sample, yielding predominantly good reliability results. Additionally, students provided feedback on the clarity of the scales' items through a separate form with open-ended questions, which led to adjustments in the questionnaire based on their suggestions. The final measures are described as follows, with the reliability results obtained in the current study:

(1) The *Student Teacher Professional Agency in the Classroom scale* (STPA; Soini et al., 2015) measures student teachers' motivation to learn, efficacy beliefs about learning, and active learning strategies. The STPA contains 20 items organized into four subscales: sense of competence (COM, five items, α: .89), collaborative environment and transformative practice (CLE, eight items, α: .89), reflection in the classroom (REF, five items, α: .78), and modeling (MOD, two items, α: .85). Students responded on a seven-point Likert scale ranging from 1 (*completely disagree*) to 7 (*completely agree*).

(2) The *Teacher Education Coherence scale* (TEC, Canrinus et al., 2017) measures student teachers' perceptions of coherence in their teacher education program. It has 41 items organized in five subscales: linkage to practice (LP, 12 items, α: .90), using theory (UT, 7 items, α: .85), research methods

(RM, four items, α: .89), coherence between parts of the program (CPP, five items, α: .86), coherence between courses (CBC, 10 items, α: .82), and coherence between courses and field experiences (CCF, three items, α: .66). Students responded on a four-point Likert scale ranging from 1 (*none*) to 4 (*extensive opportunity*).

(3) The *Learning Environment scale* (LE; Soini et al., 2015) measures the social pedagogical interactions between teacher educators and student teachers, and among student teachers, together with their pedagogical impact. It has 12 items organized into four subscales: support (LES, three items, α: .81), equality (LEE, three items, α: .81), climate (LEC, three items, α: .76), and recognition (LER, three items, α: .89). Students responded on a seven-point Likert scale ranging from 1 (*completely disagree*) to 7 (*completely agree*).

(4) The *Negotiating Professional Identity scale* (NPI; Vähäsantanen et al., 2019) measures how student teachers reflect about their expectations of being teachers based on their understanding of future career possibilities. It has four items on a seven-point Likert scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*), and was found reliable (α = .87).

Data analysis

Initially, SPSS v.25 statistics software was used for reliability analysis and Pearson's correlation. For interpreting adequate reliability using Cronbach's alpha (α), a threshold of $\alpha > .70$ was adopted (Nunnally & Berstein, 1994). As indicated in the previous session, the scales presented good reliability. This was relevant for aggregating all the subscales' individual items into mean items for subsequent analysis. The mean items were considered normally distributed, with skewness ranging from -1.70 to 0.66 and kurtosis between -0.71 and 2.87. These values fall within Collier's (2020) recommended standards of absolute |2| and |10|. Next, a Pearson correlation was conducted on the mean items.

Next, Mplus version 6 statistics software was used investigating the simultaneous relationships between STPA, teacher education coherence, learning environment, and negotiating professional identity using latent path analysis for the whole sample based on the theoretical assumptions and previous research. In this Structural Equation Modeling (SEM) analysis, STPA, learning environment, and negotiating professional identity were considered latent variables, while the subscales that measured teacher education coherence were considered distinct observed variables.

The latent path analysis with latent and observable variables was estimated using maximum likelihood with robust standard error and mean-adjusted model χ^2 test statistics (MLM, $p > .05$) procedures (Muthén & Muthén, 1998–2010). The models used the mean items, which are indicated by an "m" in front of their acronyms in the final model of the latent path analysis. The latent path analysis models were progressively tested by adding one new variable at a time while running specification searches simultaneously with modification indices to improve the model's fit. The estimated standardized model was selected by evaluating their goodness-of-fit indicators, such as the comparative fit indexes CFI and TLI, and the absolute index RMSEA. Generally, a CFI or TLI above 0.95 is considered an excellent fitting model, and an RMSEA value lower than 0.05 is considered excellent (Hu & Bentler, 1999).

Last, R statistics software and its packages, with special relevance to the *qgraph* (Epskamp et al., 2012), were used to implement a network analysis to better visualize statistical information taken from the dynamic correlations between all the items. This allowed for a more open and detailed understanding of the interrelationships of each individual item from all the measures.

The network analysis was done by clustering the students into three groups: students in the 1st and 2nd years composed the *Beginning group* (n = 145); students in the 3rd and 4th years composed the *Intermediate group* (n = 104); and students attending more than five years of education were placed in the *Advanced group* (n = 34).

The network models developed for the three groups of students used an iterative process based on the positive and negative correlations of each item on all scales. The software computed those correlations with a minimum *r* value of .25. Therefore, the patterns of items' correlations set the placement of the network nodes, computing a layout in which the length of the edges depended on the absolute weight (*r* values) of those edges (i.e., shorter edges for stronger weights) and showing how variables clustered.

This study explored both SEM and network analysis of cross-sectional data to better understand the interactive processes of the factors being investigated. Additionally, while SEM ensured statistical reliability via goodness-of-fit indicators, the network analysis enhanced the potential to identify interdependencies among all variables, conceptualizing their interrelationships as dynamic and processual systems (Schmittmann et al., 2013).

Methodological limitations

This study collected data that relied solely on self-reported measures, which could be influenced by social desirability bias and lacked validation from concrete behavioral data. Additionally, the data collected from different student cohorts was uneven and had a large age distribution, potentially introducing bias into the analysis. Despite this, the median age of 22 suggests that most of the sample is fairly close to the average age, indicating a degree of consistency within the data. Additionally, to address data discrepancies in the advanced statistical analysis, the participants were organized into two-year clusters. However, future research should investigate if age influences STPA, controlling for this variable.

Lastly, the findings were derived from a convenience sample and focused only on one teacher education institution in Brazil. In addition, using modification indices to improve the model's fit limits this study's results to this sample. Therefore, these findings cannot be generalized to other educational contexts. However, the reliability of the findings obtained—thanks to the analytical triangulation method (Leite et al., 2022)—are strong enough to consider this study's lessons relevant to other teacher education programs in Brazil and elsewhere.

Findings

Table 1 features descriptive statistics of the data and suggests that, overall, participants exhibit a robust perception of professional agency. Specifically, their inclination toward classroom *reflection* yielded the highest outcomes (REF: M = 6.41, SD = .70), while the sense of *modeling* experienced teachers' practices displayed the lowest outcome (MOD: M = 5.56, SD = 1.30). Furthermore, students noted a robust sense of *equality* in their learning environment (LEE: M = 6.07, SD = 1.07), albeit with reported weak *support* from their educators (LES: M = 5.05, SD = 1.31). As for teacher education coherence, students reported varying experiences across all investigated aspects, ranging from some opportunities to *connect ideas between courses* (CBC: M = 2.86, SD = .39) to much fewer opportunities to *enact practices* based on the theory they learned in the courses (LP: M = 1.86, SD = .59). Finally, students synchronized their work practices well with their teaching interests, values, and career goals, which represented a good process of *negotiating professional identity* (NPI: M = 5.98, SD = .95).

Table 1.

Means, standard deviations, and correlations of mean variables (N = 283)

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Collaborative environment and transformative practice (CLE)	5.57	0.92														
2. Reflection in the classroom (REF)	6.41	0.70	.52**													
3. Teaching competence (COM)	5.81	1.01	.70**	.54**												
4. Modeling (MOD)	5.56	1.30	.47**	.36**	.62**											
5. Linkage to practice (LP)	1.86	0.59	.23**	.15*	.14*	.15**										
6. Using theory (UT)	2.40	0.66	.27**	.16**	.25**	.19**	.66**									
7. Research methods (RM)	2.15	0.76	.20**	.09	.23**	.12*	.53**	.62**								
8. Coherence between parts of the program (CPP)	2.60	0.76	.23**	.20**	.18**	.15*	.57**	.67**	.55**							
9. Coherence between courses (CBC)	2.86	0.39	.23*	.06	.27**	.23**	.08	.12*	.09	.18**						
10. Coherence between courses and field experiences (CCF)	2.63	0.43	.30**	.27**	.30**	.18**	.27**	.32**	.24**	.19**	.35**					
11. Support (LES)	5.05	1.31	.20**	.10	.20**	.24**	-.05	-.09	-.07	-.05	.59**	.15**				
12. Equality (LEE)	6.07	1.07	.17**	.18**	.17**	.12**	-.05	-.08	-.13*	-.04	.41**	.13*	.58**			
13. Climate (LEC)	5.39	1.29	.26**	.18**	.25**	.24**	.03	.02	-.00	.05	.48**	.20**	.65**	.62**		
14. Recognition (LER)	5.34	1.34	.33**	.25**	.28**	.21**	.00	-.01	-.08	.00*	.48**	.25**	.71**	.66**	.73**	
15. Negotiating professional identity (NPI)	5.98	0.95	.50**	.32**	.53**	.43**	.07	.06	.05	.05	.25**	.22**	.29**	.22**	.22**	.31**

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Concerning the bi-variate relationship between the elements under investigation, 83 out of 105 were significant correlations among the mean variables, with several of these correlations displaying moderate to strong effects (32 correlations have *r* exceeding .30). In addition, significant correlations were observed between the subscales of teacher education coherence, showing that students experience FUC's curriculum as an integrated process.

Next, we present how STPA changes over the teacher education program influenced by curriculum coherence, learning environment, and negotiating professional identity utilizing the findings from the SEM analysis, and subsequently, the network analysis.

Factors regulating student teachers' professional agency in the whole sample

The SEM analysis explored the interrelationships between the environmental factors, individual characteristics and STPA for all students. Figure 1 illustrates the model with the optimal goodness of fit and standardized coefficients depicting relationships across the entire sample. In this model, two components of teacher education coherence, i.e., using theory (UT) and coherence between courses and field experience (CCF), along with the pedagogical interactions of the learning environment (LE) and negotiating professional identity (NPI) played a significant role in regulating STPA.

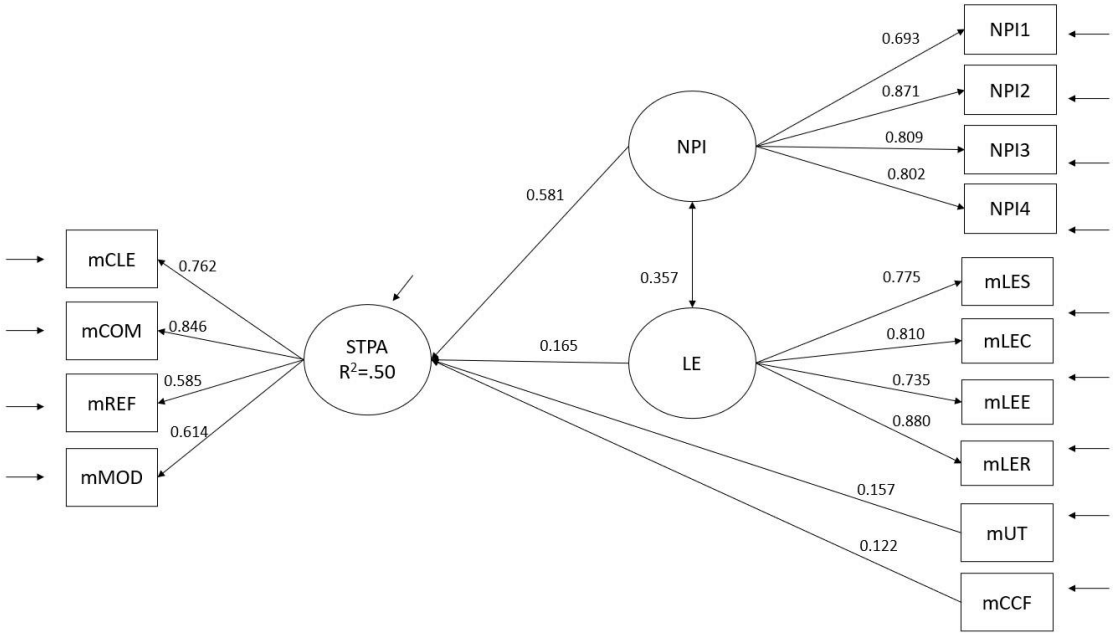

Figure 1. The interrelations between components of STPA, NPI, LE, mUT, and mCCF for the whole sample of students. (Standardized model: χ^2 (41, N = 283) = 242.22, p = .0081; CFI/TLI = .97/.97; RMSEA = .04, 95% CI [.02, .05].)

All the factor loadings of using theory (UT) and coherence between courses and field experience (CCF), learning environment (LE), and negotiating professional identity (NPI) over STPA are significant. In addition, all the standardized regression weights of STPA, learning environment (LE), and negotiating professional identity (NPI) factors' items are over .5 (p < .01). Together, these factors explain 50% of the variance in STPA within the entire sample, reflecting a substantial effect size. This suggests that participating students have their professional agency significantly influenced by how much coherence they perceive between theoretical courses and using them in practical experiences, their social pedagogical interactions with educators and peers, and the development of their professional identity.

Visualizing how factors in the environment and within individuals regulate student teacher professional agency

Figure 2 displays the networks derived from three distinct student groups: Beginning, Intermediate, and Advanced. It provides a visual representation of how the items within the scales of teacher education coherence (TEC), learning environment (LE), and negotiating professional identity (NPI) distribute among the groups, depicting the "movement" of items based on the strength of their positive or negative relationships. Within the Beginning group, three distinct peripheral clusters and an intermediating cluster are evident, whereas in the Intermediate network, the clusters converge while still maintaining their distinctiveness. Lastly, the Advanced group exhibits a more compact network. Understanding these dynamics is crucial for discerning the items and clusters central to the development of STPA, as well as those with minimal impact on its development. Subsequent sections provide detailed findings pertaining to each student group, accompanied by their respective figures.

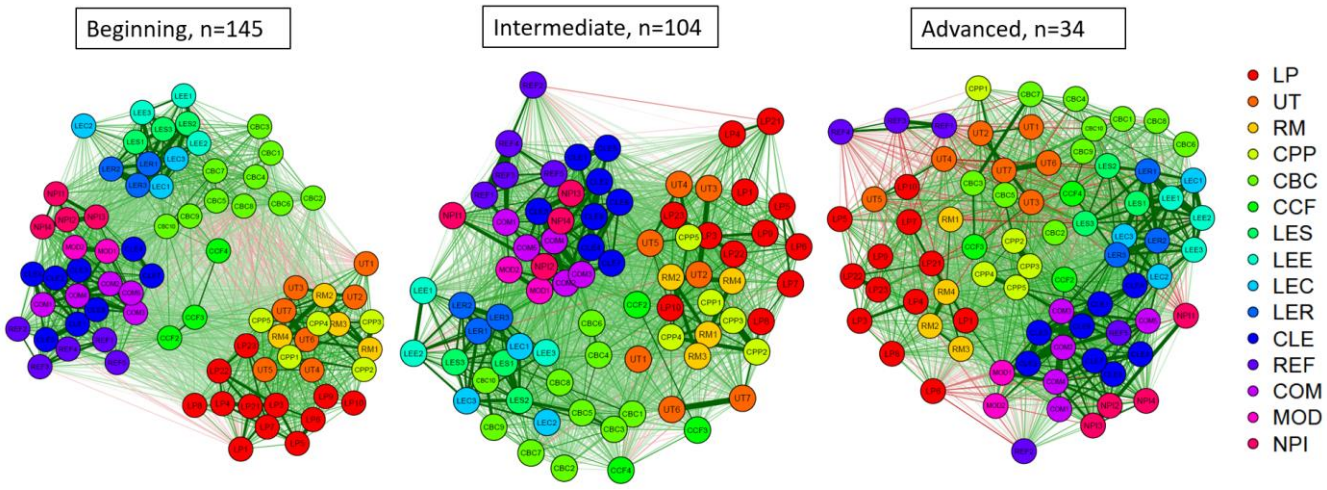

Figure 2. The networks generated by all the scales' items for the three groups of students: Beginning, Intermediate, and Advanced.

(The nodes represent items, and the edges represent the empirical correlation between items. The numbers in the nodes refer to the order of appearance in the questionnaire. A stronger correlation (positive: green; negative: red) results in a thicker and darker edge. The acronyms in the legend correspond to the subscales featured in Table 1.)

Clear isolated clusters in the initial stage

Figure 3 represents the network of the Beginning group, wherein three clusters of items are situated on the periphery, while one cluster serves as an intermediary.

Firstly, items related to STPA and negotiating professional identity (NPI) are closely positioned, forming a single cluster, i.e., STPA/NPI. Within this cluster, competence (COM) and collaborative environment and transformative practice (CLE) items occupy central positions. Secondly, the learning environment (LE) cluster has mentors' support (LES) items centrally located, and mentors' recognition (LER) items are adjacent to the STPA/NPI cluster. Thirdly, the teacher education coherence 1 (TEC1) cluster is characterized by strongly correlated items related to linking practice in courses (LP), while items related to using theory (UT) are positioned furthest away. Fourthly, the teacher education coherence 2 (TEC2) cluster holds an intermediate position. Items related to coherence between courses and field experience (CCF) mediate the relationship between TEC1 and the STPA/NPI clusters, while items related to coherence between course (CBC) mediate the relationship between TEC1 and LE clusters.

Regarding the overall correlation between items and clusters within the entire network, items related to negotiating professional identity (NPI) and modeling (MOD) are closely associated with the learning environment (LE) cluster, suggesting that students perceive their educators as role models for teaching and learning practices, and they shape their professional identity through pedagogical interactions with them. Furthermore, the STPA/NPI shows predominantly positive correlations with the learning environment (LE) cluster and both teacher education coherence (TEC1/2) clusters.

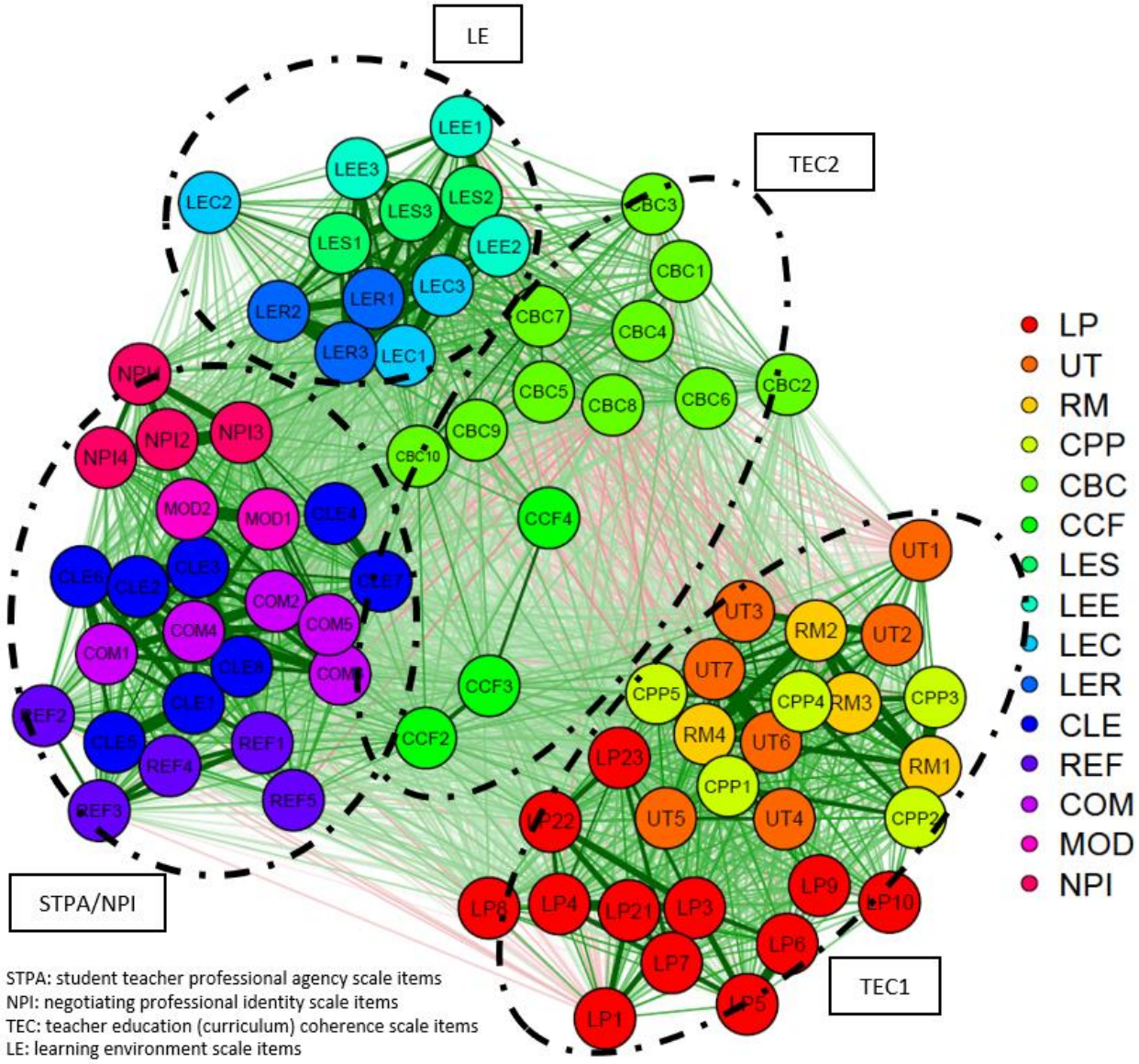

Figure 3. The network generated by all the scales' items for the Beginning group (n = 145), with four clear clusters: STPA/NPI, TEC1 and TEC2, and LE.

These findings are consistent with the SEM analysis. Among students in the initial stages of their teacher education, their professional agency is significantly influenced by their process of negotiating professional identity, which could involve discussions with mentor educators. The construction of students' teacher identity is influenced by their ability to integrate components of their education program, particularly their perceptions of coherence between theoretical coursework and field

experiences as initial teaching observations, as well as coherence among the various courses of the program.

Transitory changes in the intermediate stage

In Figure 4, the network for the Intermediate group depicts three clusters somewhat distinct, but with items more intertwined.

First, the STPA/NPI cluster still forms a clear group, with competence (COM), negotiating professional identity (NPI), and collaborative environment and transformative practice (CLE) items at its core. Second, a new cluster compounded by learning environment (LE) and teacher education coherence 2 (TEC2) items was formed (i.e., LE/TEC2). Most of the coherence between courses (CBC) items are closely linked to items of the learning environment (LE). Furthermore, there is a notable transformation within the teacher education coherence 1 (TEC1) cluster: Linking practice (LP), using theory (UT), and research methods (RM) items are strongly interconnected and further "linked" with the items related to coherence between parts of the program (CPP).

In terms of cluster relationships, modeling (MOD) items are positioned closer to the LE/TEC2 cluster, suggesting that students also shape their practice based on their perceptions of their mentors' recognition. This result reinforces the previous tendency observed in the Beginning group. Collaborative environment and transformative practice (CLE) items are in close relationship with some items of the teacher education coherence 1 (TEC1) cluster, such as using theory (UT) and linking practice (LP) items, showing how theoretically embedded discussions about students' practices help them develop their agency to build collaborative learning environments.

Some changes are noticeable in the whole network dynamics. Now, all the clusters are closer compared to the previous network, and the teacher education coherence 1 (TEC1) and LE/TEC2 clusters are positively correlated and mediated mostly by using theory (UT) and coherence between courses and field experience (CCF) items. This suggests that students in this stage of education prioritize connecting theoretical concepts to practical teaching applications, while also receiving support from educators and peers to cultivate their professional agency.

These findings corroborate the SEM analysis. Students in the intermediate phase of their degree program continue to exhibit a strong correlation between their professional agency and professional identity, with a heightened emphasis on their interactions within the learning environment—especially through modeling and recognition by their mentor—and to how much they can engage in enacting practices embedded with theory in their campus courses.

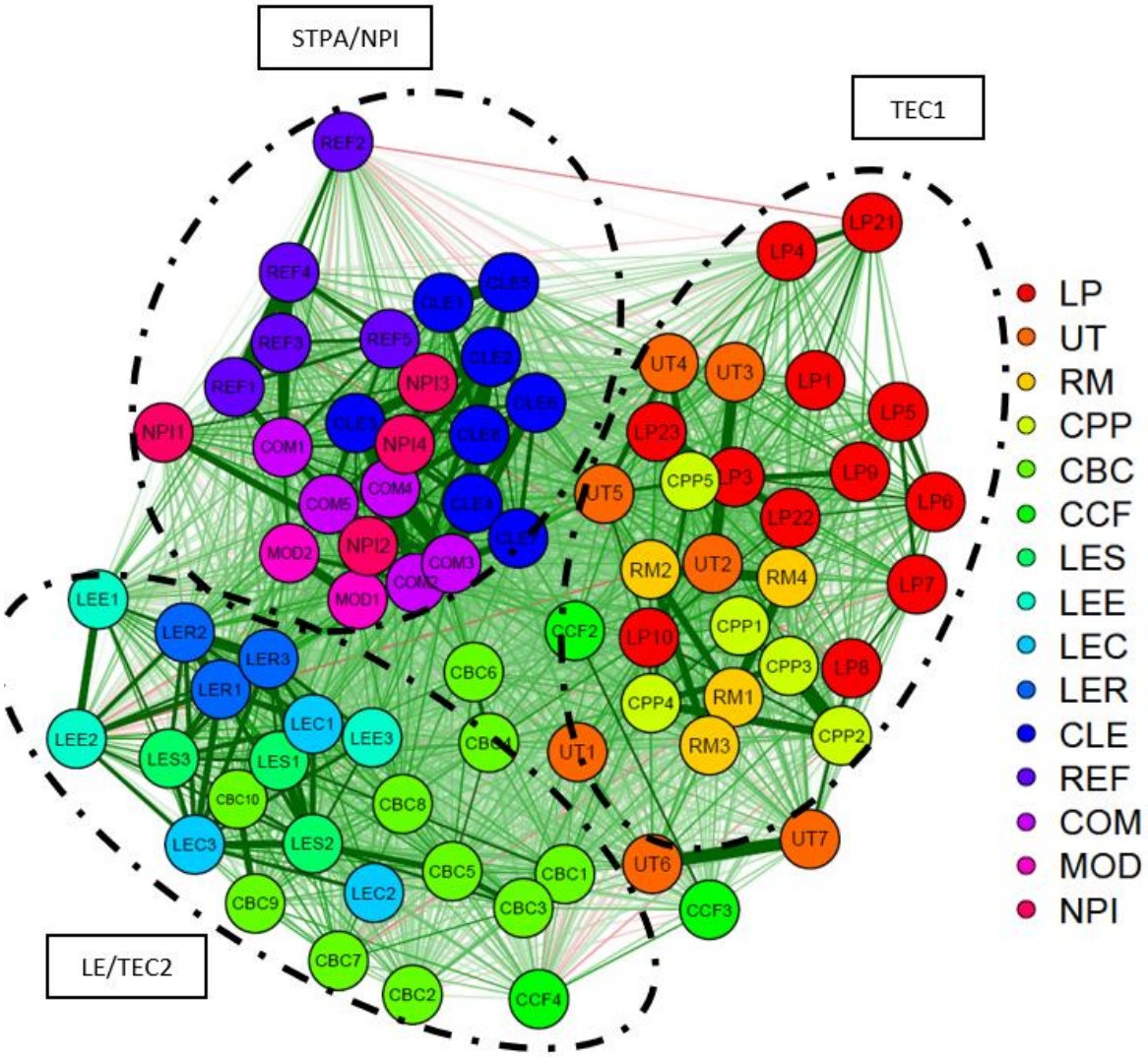

Figure 4. The network generated by all the scales' items for the Intermediate group (n = 104), with three clusters still somewhat separated but more intermeshed: STPA/NPI, TEC1, and LE/TEC2.

The compact network in the advanced stage

Ultimately, Figure 5 illustrates the interrelationships among items within the Advanced group, where distinct clusters have converged into a compact network. Two dense agglomerations of specific items are observed on the right side, with other items loosely distributed across the center and left side of the network.

Collaborative environment and transformative practice (CLE) and competence (COM) items are strongly correlated at the center of the STPA/NPI cluster, indicating that students at this stage of their education feel competent to create collaborative environments with their pupils and transform their practices according to their pupils' needs and classroom situations. This sense is strongly related to the nearby learning environment (LE) items, particularly the feeling of recognition from mentors (LER), continuing the trend found in the previous networks. Additionally, the STPA/NPI core is strongly connected to some items regarding the perception of coherence between parts of the program (CPP), which are now positioned at the center of the global network. The other teacher education coherence (TEC) items are spread across the central and left margins of the global network.

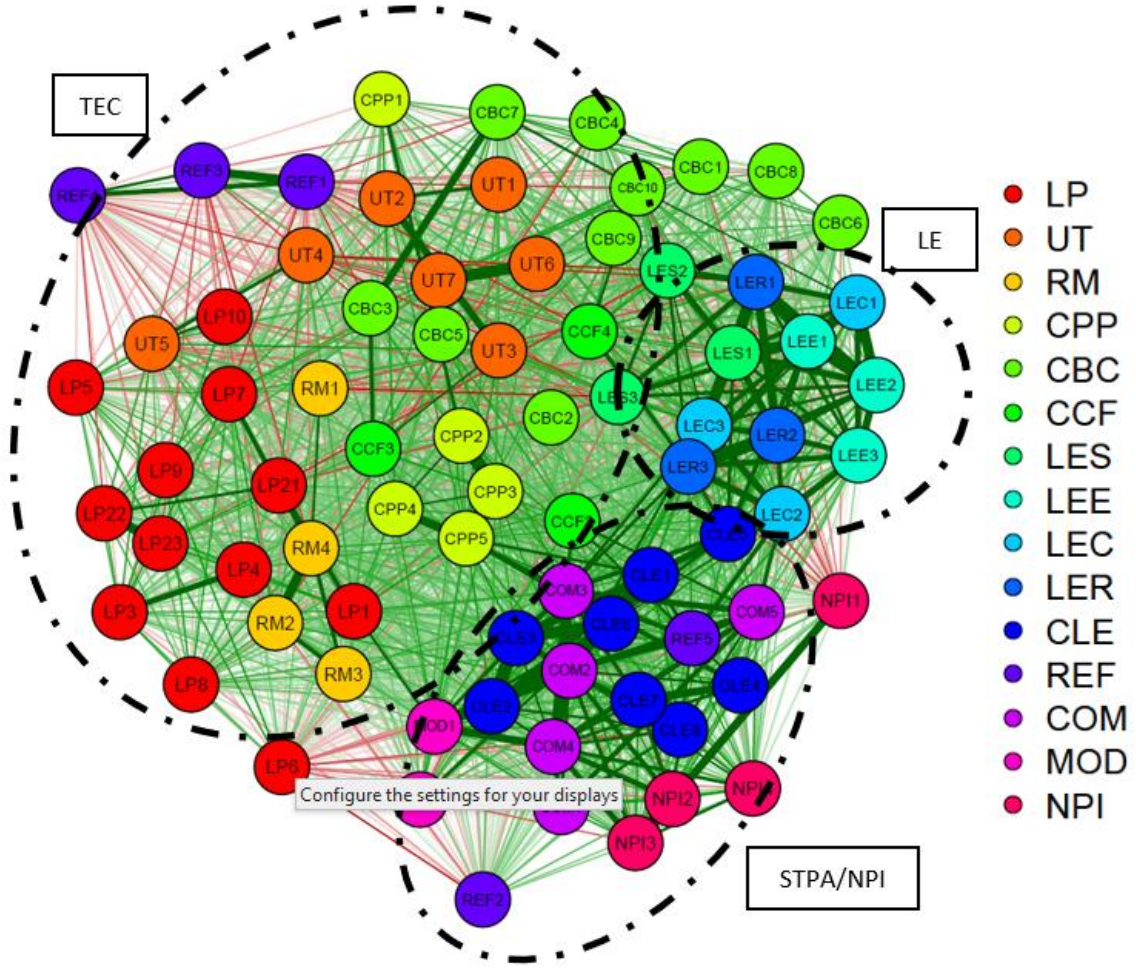

Figure 5. The global network generated by all the scales' items for the Advanced group (n = 34).

The global network of the Advanced group has, in its core, the items related to the perceptions of the teacher education curriculum (TEC), especially the coherence between parts of the program (CPP) items. These items are surrounded by other teacher education curriculum (TEC) items, which might show how students try to make a holistic sense of their whole education program and build a coherent vision of teaching and learning at the offset of their careers.

Discussion

This study sought to answer the research question: How do perceptions of factors in the environment and individual characteristics regulate STPA among Brazilian student teachers? Its contribution to the international literature on STPA is twofold. First, by exploring how STPA changes during a teacher education degree program in a Brazilian university, the geographical area of the literature on this topic is expanded. Second, a quantitative method with an ecological perspective was used to consolidate a triangulation approach for data analysis in the field of STPA (Leite et al., 2022). Next, we address the study's research question and discuss these two major contributions, taking the results and study hypothesis as starting points.

The initial results provided basic information for understanding the general aspects of STPA and the factors in the environment and individual characteristics that regulate STPA during a Brazilian teacher education program. For example, the high outcome of the *reflection* elements of STPA suggests that participating students consider that the curriculum afforded many opportunities for developing

critical thinking, in line with the teacher education degree program description (FUC, 2013). This facet of STPA is important in fortifying students' readiness for their future teaching careers.

Conversely, the low perception of *enacting teaching practices in the courses* from the teacher education coherence aspect confirms what Cruz (2017) found in her research on pedagogical–didactic teaching in teacher education programs across Brazil. This pattern highlights a curricular dissociation of content (pedagogical theory) from methods (didactic modes of teaching and instructional design), resulting in a lack of practical preparation and synergy between school subjects and didactic–pedagogical training.

This situation seems to explain the intriguing configuration of the last compact network, in which the items related to reflection in the classroom are close but linked with negative correlations to the items of didactic–pedagogical theories. This outcome aligns with Magalhães Júnior and Cavaignac's (2018) investigation of teacher education at the Federal University of Ceará (FUC). Their research underscores a disproportionate emphasis on research skills geared toward a research-oriented career. Unfortunately, this focus seems to come at the expense of developing strong didactic–pedagogical teaching competencies. The research highlights an overarching prevalence of conceptual and subject knowledge, disproportionately overshadowing the cultivation of essential pedagogical knowledge.

What adds a layer of intrigue to our findings is the persistence of a low perceived linkage between theory and practice in coursework, as previously indicated. Remarkably, despite this, the results affirm our initial hypothesis (H1), suggesting that student teachers' perceptions of coherence between program components and the alignment of theoretical courses with practical field experiences, particularly in the early stages of the education program, emerge as pivotal factors in regulating STPA. This result underscores the relevance of teacher education programs providing a varied set of activities that favor the hands-on learning of student teachers. Affording extensive opportunities for school observations and in-service experiences, wherein student teachers encounter many teaching strategies that they can mobilize in their future careers (Korthagen, 2010), appropriately supported by teacher mentors in the field placement (Orland-Barak & Wang, 2021), are crucial facets of a coherent teacher education program.

The results validated our second hypothesis (H2) as well, indicating that students' sense of a positive atmosphere among peers and recognition from their mentors exert the most significant influence on STPA. This environment not only promotes peer learning and collaboration but also underscores the strong role of teacher educators in shaping students' confidence and attitude toward the teaching profession and their will to engage in professional development. This comes as no surprise, as Cruz (2017) already reported that it is the mentors' pedagogical style and the way they support students' learning—for example, by favoring peer learning, project-based learning, and mentor support—that sets the base for the students' future teaching approaches.

The increased use of peer learning, propelled in part by the constraints imposed by the Covid-19 pandemic, during which students had limited physical interactions with their mentors, appears to have fostered the development of collaborative learning skills among student teachers. This not only addressed the challenges posed by the pandemic but also equipped student teachers with valuable collaborative teaching strategies. These skills are expected to serve their future roles as educators, positively influencing their interactions with pupils. This strategic pedagogical approach retrieves Freire's (1996) assertion that "there is no teaching without learning".

Finally, it was found that negotiating teacher identity consists of the strongest element correlated with STPA over the years of teacher education, confirming our third hypothesis (H3). This result also reaffirms a virtuous cycle wherein the cultivation of STPA serves as a contributing factor for pre-service teachers to construct an autonomous and creative professional identity (Melo et al., 2022). It has been observed that at the beginning of their education, students' identity is strongly correlated to aspects of *modeling*, emphasizing the relevance of the teacher educators' *ethos*, as noted by Cruz (2017). Later,

students' identity negotiation becomes more intermeshed with aspects of teacher *competence* and *building collaborative environments and transformative practices*. This is in line with Nóvoa's (2017) assertion that a teacher must be ready to act in a setting of unpredictability—typical characteristics of a classroom with individual learners with their own particularities and learning needs.

The second major contribution of this paper centered on consolidating the triangulation approach for quantitative data analysis in STPA studies using both structural equation modeling and network analysis (Leite et al., 2022). We conclude that it advanced our comprehension about STPA during the initial training of teachers, influenced by individual characteristics and environmental factors. While latent path analysis offers robust measures of validation and confidence in the models developed, network analysis explains the complex relationship between STPA and the individual constructs and environmental factors that influence it. However, network analysis still needs to improve its techniques for calculating reliability and quality indices to ensure more security and robustness in future studies.

This complementation of analytical methods using network analysis can be an interesting tool for curriculum planners to use, because it accommodates, both theoretically and methodologically, investigations about the agency of student teachers (Heikonen et al., 2020). Schmittmann et al. (2013) also highlighted the potential of network studies when considering observable variables, representing both psychological constructs and environmental factors as autonomous causal elements. This shift in perspective motivates the investigation of these elements from the configuration and the position that each variable (or group of variables) has in the network.

In this study, items representing coherence between courses and parts of the program were positioned in the center across all the networks, suggesting that the participants perceive the teacher education program in an integrated way. Thus, students can trace their trajectory of learning over time and reflect on how their understanding of teaching and learning developed during the program (e.g., item CPP4, repeatedly located at the center of the networks). By deploying the network analysis on this result, curriculum developers should ponder whether changing this perception would be desirable, considering that it might affect many other items surrounding it in the network.

Complementarily, curriculum developers can debate how to "move" STPA items to the center of the network, starting from the nearby items at each stage of the teacher education program. For example, promoting activities that explicitly help students make connections between educational theory and actual classroom teaching (CPP5 item) and allowing them to try out the theories, strategies, and techniques learned in their coursework (CCF2 item) were items strongly linked to the STPA/NPI cluster in the end. These items directly show what kinds of activities could nurture STPA elements and "pull" them to the center of the last network.

Therefore, network analysis offers conceptual and visual tools for contemplating interventions on the phenomena under investigation. It allows for a nuanced assessment of the relative centrality of specific elements, distinguishing them from less pertinent (peripheral) components. Additionally, it allows a better visualization of stable or transitory states of networks, aiding in devising effective strategies for curriculum developers intervening in curriculum design.

Conclusion

This study provides contextualized evidence for Brazilian curriculum developers and teacher educators to strengthen STPA throughout initial training. For example, offering extensive opportunities for students to reflect and continuously build their teacher identity; deploying peer learning instructional methods with in- and out-of-classroom mechanisms, providing mentors' support and recognition of students' learning progress; and organizing formal and non-formal settings between the university, teacher training schools, and the community where student teachers can enact teaching practices embedded with theoretical discussions. These suggestions can support student teachers in beginning their careers to be better prepared to engage in continuous professional development.

This curriculum (re)design should have STPA development at its core, and the understanding that teaching needs to be conceptualized as a routine-innovative expert profession (Bransford et al., 2005; Leite et al., 2020; Nóvoa, 2017). Future teachers need to be positioned during teacher education programs as reflective practitioners (Magalhães Júnior & Cavaignac, 2018) and autonomous learning professionals (Korthagen, 2010), whose practices are grounded on a research-oriented attitude (Nóvoa, 2017). Ultimately, they can act as critical and creative agents of social change (Freire, 1996) and curriculum producers and decision-makers (Melo et al., 2022).

As a direction for future research, it is worth noting the resonance between the STPA framework proposed by Soini et al. (2015) and the principles encapsulated in Freire's (1996) "Pedagogy of Autonomy." Freire's groundbreaking pedagogical framework, developed in impoverished Brazilian educational settings, aims to cultivate critical awareness ("conscientização") among both teachers and students, steering toward social transformation. The Freirean principles that harmonize with the elements of STPA, listed in a way akin to the STPA framework in the theoretical session, include the following: 1) Teaching requires professional competence, generosity, and commitment. 2) Educators need to be open and available for dialog while respecting the knowledge possessed by learners. 3) Teaching involves critical reflection on one's own practice. 4) Effective teaching requires a commitment to research and curiosity and fostering discussions among peers.

Exploring the similarities and distinctions between Brazilian and Finnish teacher education programs and adopting a qualitative approach guided by these quantitative results presents an opportunity to scrutinize how STPA can be further examined in both contexts. Future studies could focus on the acquisition of in-depth qualitative data to open up these quantitative results, using cross-national theoretical frameworks as references to enhance the understanding of STPA within these distinct educational landscapes.

References

Azorín, C. (2020). Beyond COVID-19 supernova. Is another education coming? *Journal of Professional Capital and Community*, *5*(3–4), 381–390. https://doi.org/10.1108/JPCC-05-2020-0019

Beauchamp, C., & Thomas, L. (2009). Understanding teacher identity: An overview of issues in the literature and implications for teacher education. *Cambridge Journal of Education*, *39*(2), 175–189. https://doi.org/10.1080/03057640902902252

Biesta, G., Priestley, M., & Robinson, S. (2015). The role of beliefs in teacher agency. *Teachers and Teaching: Theory and Practice*, *21*(6), 624–640. https://doi.org/10.1080/13540602.2015.1044325

Bransford, J., Derry, S., Berliner, D., Hammerness, K., & Beckett, K. L. (2005). Theories of learning and their roles in teaching. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 40–87).

Bronkhorst, L. H., Meijer, P. C., Koster, B., & Vermunt, J. D. (2014). Deliberate practice in teacher education. *European Journal of Teacher Education*, *37*(1), 18–34. https://doi.org/10.1080/02619768.2013.825242

Brown, A. L., Lee, J., & Collins, D. (2015). Does student teaching matter? Investigating pre-service teachers' sense of efficacy and preparedness. *Teaching Education*, *26*(1), 77–93. https://doi.org/10.1080/10476210.2014.957666

Canrinus, E. T., Bergem, O. K., Klette, K., & Hammerness, K. (2017). Coherent teacher education programmes: Taking a student perspective. *Journal of Curriculum Studies*, *49*(3), 313–333. https://doi.org/10.1080/00220272.2015.1124145

Canrinus, E. T., Klette, K., & Hammerness, K. (2019). Diversity in coherence: Strengths and opportunities of three programs. *Journal of Teacher Education*, *70*(3), 192–205. https://doi.org/10.1177/0022487117737305

Chung, J. H. (2017). Exporting Finnish teacher education: Transnational pressures on national models.

Nordic Journal of International and Comparative Education, 1(1), 36–52. https://doi.org/10.7577/njcie.2129

Cong-Lem, N. (2021). Teacher agency: A systematic review of international literature. *Issues in Educational Research, 31*(3), 718–738. http://www.iier.org.au/iier31/cong-lem.pdf

Collier, J. (2020). Applied structural equation modeling using AMOS: Basic to advanced techniques. Routledge.

Cruz, G. B. D. (2017). Teaching didactics and learning to teach in initial teacher training. *Cadernos de Pesquisa, 47*, 1166–1195. https://doi.org/10.1590/198053144323

Daboín, M. M. G., & Ribeiro, M. L. (2019). The Profile of Students Entering the Pedagogy Course. *Nuances: Estudos Sobre Educação, 30*(1), 312–326. https://doi.org/10.32930/nuances.v30i1.6765

Deschênes, M., & Parent, S. (2022). Methodology to study teacher agency: A systematic review of the literature. *European Journal of Educational Research, 11*(4), 2459–2474. 10.12973/eu-jer.11.4.2459

Ebersöhn, L., & Loots, T. (2017). Teacher agency in challenging contexts as a consequence of social support and resource management. *International Journal of Educational Development, 53*, 80–91. https://doi.org/10.1016/j.ijedudev.2016.11.005

Edwards, A. (2005). Relational agency: Learning to be a resourceful practitioner. *International Journal of Educational Research, 43*(3), 168–182. https://doi.org/10.1016/j.ijer.2006.06.010

Edwards, E., & Burns, A. (2016). Language teacher-researcher identity negotiation: An ecological perspective. *TESOL Quarterly, 50*(3), 735–745. https://doi.org/10.1002/tesq.313

Epskamp, S., Cramer, A. O. J., Waldorp, L. J., Schmittmann, V. D., & Borsboom, D. (2012). Qgraph: Network visualizations of relationships in psychometric data. *Journal of Statistical Software, 48*(4), 1-18. https://doi.org/10.18637/jss.v048.i04

Freire, P. (1996). *Pedagogy of autonomy. Necessary knowledge to educational practice.* Paz e Terra.

FUC (2013). Undergraduate course in pedagogy: Pedagogical project. [Curso de Graduação em Pedagogia: Projeto Pedagógico.] Retrieved September 19, 2023, from https://faced.ufc.br/wp-content/uploads/2018/09/versao-final-de-31-jan-2014-ppc-pedagogia-jan2014-1.pdf

Goh, P. S. C., & Canrinus, E. T. (2019). Preservice teachers' perception of program coherence and its relationship to their teaching efficacy. *Pertanika Journal of Social Sciences and Humanities, 27*(T2), 27–45. https://api.semanticscholar.org/CorpusID:218672143

Gonçalves, S. D. R. V., Mota, M. R. A., & Anadon, S. B. (2020). Resolution CNE/CP N. 2/2019 and Setbacks in Teacher Training. *Revista Formação em Movimento, 2*(4), 360–379.

Hammerness, K., & Klette, K. (2015). Indicators of quality in teacher education: Looking at features of teacher education from an international perspective. *International Perspectives on Education and Society, 27*(2), 239–277. https://doi.org/10.1108/S1479-367920140000027013

Heikonen, L., Pietarinen, J., Pyhältö, K., Toom, A., & Soini, T. (2017). Early-career teachers' sense of professional agency in the classroom: Associations with turnover intentions and perceived inadequacy in teacher–student interaction. *Asia-Pacific Journal of Teacher Education, 45*(3), 250–266. doi.org/10.1080/1359866X.2016.1169505

Heikonen, L., Pietarinen, J., Toom, A., Soini, T., & Pyhältö, K. (2020). The development of student teachers' sense of professional agency in the classroom during teacher education. *Learning: Research and Practice, 6*(2), 114–136. https://doi.org/10.1080/23735082.2020.1725603

Hu, L. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://www.tandfonline.com/doi/abs/10.1080/10705519909540118

Jenset, I. S., Hammerness, K., & Klette, K. (2019). Talk about field placement within campus coursework: Connecting theory and practice in teacher education. *Scandinavian Journal of Educational Research, 63*(4), 632–650. https://doi.org/10.1080/00313831.2017.1415968

Klette, K., Hammerness, K., & Jenset, I. S. (2017). Established and evolving ways of linking to practice in teacher education: Findings from an international study of the enactment of practice in teacher education. *Acta Didactica Norge*, *11*(3), 9.

Korthagen, F. A. (2010). Situated learning theory and the pedagogy of teacher education: Towards an integrative view of teacher behavior and teacher learning. *Teaching and Teacher Education, 26*(1), 98–106. https://doi.org/10.1016/j.tate.2009.05.001

Kwakman, K. (2003). Factors affecting teachers' participation in professional learning activities. *Teaching and Teacher Education, 19*(2), 149–170. https://doi.org/10.1016/S0742-051X(02)00101-4

Le Cornu, R. (2009). Building resilience in pre-service teachers. *Teaching and Teacher Education*, *25*(5), 717–723. https://doi.org/10.1016/j.tate.2008.11.016

Leite, L. O., Go, W., & Havu-Nuutinen, S. (2020). Exploring the Learning Process of Experienced Teachers Focused on Building Positive Interactions with Pupils. *Scandinavian Journal of Educational Research, 66*(1), 28–42. https://doi.org/10.1080/00313831.2020.1833237

Leite, L. O., Havu-Nuutinen, S., & Sointu, E. (2022). How environmental and individual factors dynamically influence student teacher professional agency during teacher education. *Scandinavian Journal of Educational Research*, *68*(2), 273–288. https://doi.org/10.1080/00313831.2022.2127879

Magalhães Júnior, A. G. & Cavaignac, M. D. (2018). Formação de professores: Limites e desafios na Educação Superior. *Cadernos de pesquisa*, *48*, 902–920. https://doi.org/10.1590/198053145405

Melo, M. J. C. D., Almeida, L. A. A. D., & Leite, C. (2022). Teacher training curricula: the power of agency in question. *Educação e Pesquisa*, *48*. https://doi.org/10.1590/S1678-4634202248247432por

Muthén, L., & Muthén, B. O. (1998–2010). *Mplus users guide* (6th ed.). Muthén & Muthén.

Nóvoa, A. (2017). Establish your position as a teacher, affirm your teaching profession. *Cadernos de pesquisa*, *47*(166), 1106–1133. https://doi.org/10.1590/198053144843

Nunnally, B. H., & Bernstein, J. C. (1994). *Psychometric theory*. McGraw-Hill.

Orland-Barak, L., & Wang, J. (2021) Teacher mentoring in service of preservice teachers' learning to teach: Conceptual bases, characteristics, and challenges for teacher education reform. *Journal of Teacher Education, 72*(1), 86–99. https://doi.org/10.1177/0022487119894230

Pyhältö, K., Pietarinen, J., & Soini, T. (2015). Teachers' professional agency and learning – from adaption to active modification in the teacher community. *Teachers and Teaching: Theory and Practice, 21*(7), 811–830. https://doi.org/10.1080/13540602.2014.995483

Roldão, M. C. (2007). Teaching role: nature and construction of professional knowledge. *Revista Brasileira de Educação*, *12* (34). https://doi.org/10.1590/S1413-24782007000100008

Ruohotie-Lyhty, M., & Moate, J. (2016). Who and how? Preservice teachers as active agents developing professional identities. *Teaching and Teacher Education, 55*, 318–327. https://doi.org/10.1016/j.tate.2016.01.022

Schmittmann, V. D., Cramer, A. O. J., Waldorp, L. J., Epskamp, S., Kievit, R. A., & Borsboom, D. (2013). Deconstructing the construct: A network perspective on psychological phenomena. *New Ideas in Psychology*, *31*(1), 43–53. https://doi.org/10.1016/j.newideapsych.2011.02.007

Soini, T., Pietarinen, J., Toom, A., & Pyhältö, K. (2015). What contributes to first-year student teachers' sense of professional agency in the classroom? *Teachers and Teaching: Theory and Practice, 21*(6), 641–659. https://doi.org/10.1080/13540602.2015.1044326

Toom, A., Pietarinen, J., Soini, T., & Pyhältö, K. (2017). How does the learning environment in teacher education cultivate first year student teachers' sense of professional agency in the professional community? *Teaching and Teacher Education, 63*, 126–136. https://doi.org/10.1016/j.tate.2016.12.013

Turnbull, M. (2005). Student teacher professional agency in the practicum. *Asia-Pacific Journal of Teacher Education, 33*(2), 195–208.

UNESCO. (2022). *Reimagining our futures together: A new social contract for education*. United Nations. https://unesdoc.unesco.org/ark:/48223/pf0000379707

Vähäsantanen, K., Räikkönen, E., Paloniemi, S., Hökkä, P., & Eteläpelto, A. (2019). A novel instrument to measure the multidimensional structure of professional agency. *Vocations and Learning, 12*(2), 267–295. https://doi.org/10.1007/s12186-018-9210-6

Zeichner, K., Payne, K. A., & Brayko, K. (2015). Democratizing teacher education. *Journal of Teacher Education, 66*(2), 122–135. https://doi.org/10.1177/0022487114560908