SUPPORTING PRE-SERVICE PRIMARY TEACHER WELL-BEING AND RESILIENCE: RESULTS FROM A THREE-WAVE STUDY IN INITIAL TEACHER EDUCATION

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Our aim was to explore how pre-service teachers' study-related exhaustion and resilience developed over one semester and how these developments were associated with engagement with resilience-related topics. We compared two subgroups of a full cohort of second-year pre-service primary teachers at the University of Teacher Education in Bern. While $n = 101$ completed regular coursework, $n = 154$ used an online platform integrated into regular coursework. Complete data across three timepoints (before the course; immediately after the course; 12-week follow-up) were available for $n = 36$ (coursework 12-week) and $n = 45$ (platform users). A repeated-measures one-way multivariate analysis of variance (MANOVA) showed a significant increase in pre-service teachers' levels of exhaustion during the semester (t1-t2) in both subgroups. At follow-up (t3), platform users reported significantly lower exhaustion and higher resilience than the coursework-only subgroup. Our study contributes to the body of empirical research aiming to understand the potential of digitally supported learning environments in teacher education.

Keywords: emotional exhaustion, resilience, well-being, pre-service teachers, initial teacher education

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INTRODUCTION

Although fruitful and rewarding, teaching is a challenging profession. Teachers encounter high societal demands and parental expectations, students struggling in school, competing tasks such as supporting the individual child while selecting among students, and a heavy workload (e.g., Cooper et al., 1996; Pyhältö et al., 2021). Given the high demands of the teaching profession, the Swiss initial teacher education (ITE) is expected to go beyond subject-specific training and foster generic, domain-unspecific skills such as pre-service teacher resilience (e.g., care about own resources; Steiner, 2023). Few ITE programmes explicitly address the development of resilience and well-being in pre-service teachers as evidenced in the systematic review by Mu (2024). He summarised that resilience is considered an important skill for (pre-service) teachers (e.g., Gu & Day, 2007), yet resilience education (e.g., Mansfield et al., 2012a; Mansfield et al., 2012b; Mansfield et al., 2016) to be still poorly integrated into ITE.

This shortcoming calls for empirical research aimed at developing and investigating learning settings tailored to foster pre-service teachers' well-being and resilience. The aim of our project 'Fostering Resilience in Teacher Education (FoResT)' is to design, implement, and evaluate the effects of an ITE course aiming to support the development of pre-service teachers' well-being and resilience. In this quasi-experimental study, we compare the changes in self-reported emotional exhaustion and resilience in two learning settings within the full cohort of 3rd semester pre-service teachers: regular coursework (subgroup A) and coursework that included engagement with an online learning platform (subgroup B).

PRE-SERVICE TEACHER EMOTIONAL EXHAUSTION

Emotional exhaustion can be understood as physical and psychological fatigue and a loss of energy (Kristensen et al., 2005). According to Edú-Valsania et al. (2022, p. 3), emotional exhaustion "manifests in the form of feelings and sensation of being exhausted by the psychological efforts made at work. It is also described in terms of weariness, tiredness, fatigue, weakening, and the subjects who manifest this type of feelings show difficulties in adapting to the work environment since they lack sufficient emotional energy to cope with work tasks." Empirical research consistently shows that teachers are particularly affected (e.g., Garcia-Carmona et al., 2019; Ghasemi, 2021, 2022; Squillaci, 2020). Emotional exhaustion in teachers is linked to symptoms such as headaches, sleep disturbances, and increased irritability, which likely occur more frequently than in other professions (Maslach et al., 1996; Schaufeli & Enzmann,

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1998). Beyond negative consequences for mental and physical health, teacher emotional exhaustion can negatively affect student educational outcomes (Klusmann et al., 2022), classroom climate, and students' psychological well-being (e.g., Dreer, 2023). These findings highlight the importance of scientific knowledge on the prevention of emotional exhaustion early in a teacher's professional stage.

While teacher emotional exhaustion is well-researched, far less is known about its prevalence among pre-service teachers. However, this knowledge is important to inform practice and prevent future teacher health deterioration and attrition. It is increasingly recognised that studying at a university is challenging and can impede young adults' (mental) health (Rosales-Ricardo et al., 2021). For example, Lesener et al. (2020) found in a large sample of German university students that high study demands – such as time pressure, excessive mental effort, and multitasking – are linked to student burnout. ITE study programmes likely add pressure to pre-service teachers. ITE not only involves high academic demands but also requires pre-service teachers to prepare within a relatively short time for a challenging profession that entails significant responsibilities upon entering the workforce (e.g., Hanly & Heinz, 2022). Empirical studies have identified early signs of burnout symptoms, including emotional exhaustion, during ITE (Madigan & Curran, 2021; Salmela-Aro & Upadyaya, 2017; Shankland et al., 2019). These alarming findings emphasise the urgent need for research on how emotional exhaustion can be prevented and reduced during ITE. However, studies that investigate the potential of ITE courses on health, well-being, and resilience remain scarce (Kangas-Dick & O'Shaughnessy, 2020; Mu, 2024).

PRE-SERVICE TEACHER RESILIENCE

Resilience refers to an individual's ability to cope with risk factors and overcome adverse situations (e.g., Luthar et al., 2000; Masten, 2014). It involves an adaptive interaction between the individual and their environment, supported by both individual and contextual resources when facing challenges, demands, and adversity (Gu & Day, 2013; Mansfield et al., 2012a). Resilience is considered as a dynamic process that enables (pre-service) teachers to sustain their professional well-being, teaching effectiveness, and job motivation despite challenges (Beltman, 2015; Beltman et al., 2011; Lu & Chen, 2025; Mansfield et al., 2016; Ungar, 2012; Zhang & Luo, 2023). Risk and protective factors – often conceptualised as demands and resources (see e.g., the Job Demands-Resources Theory; Bakker & de Vries, 2021) – are key to understanding how (pre-ser-

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vice) teachers navigate difficult situations (e.g., Duan et al., 2023; Mansfield et al., 2012a; Peixoto et al., 2018).

Recent approaches to pre-service teacher resilience emphasise its dynamic character (e.g., Hascher et al., 2021). Resilience is not understood as a fixed trait but an aspect of professional competence (e.g., Duan et al., 2023; Mansfield et al., 2012a; Pretsch et al., 2012) that can be learned during ITE. Pre-service teacher resilience is seen as a multidimensional construct involving emotional, motivational, professional, and social dimensions (Beltman, 2021; Mansfield et al., 2012a), reflecting the complexity of the individual's ability to cope with risk factors. However, still little is known about how to effectively foster resilience early in teachers' professional trajectories (Kangas-Dick & O'Shaughnessy, 2020; Mansfield et al., 2020).

In ITE, pre-service teachers face specific challenges to their resilience. During their university studies, they must meet high demands across multiple subjects while simultaneously developing a professional identity (e.g., Amponsah et al., 2020; Gardner, 2010; Mansfield et al., 2016). During field experiences, pre-service teachers must balance the discrepancy between societal expectations and job reality, manage stress in preparing instruction, and cope with issues in classroom management (Klassen et al., 2013; Ng & Bull, 2018; Squires et al., 2022). These demands can negatively affect pre-service teachers' well-being (e.g., Corcoran & O'Flaherty, 2022; O'Brien et al., 2020; Squires et al., 2022), yet research also highlights the protective role of resources such as resilience (Mu, 2024). For example, peer support was linked to fewer health issues among German teacher students (Lesener et al., 2020). Similarly, the few existing resilience interventions have shown positive effects on reducing perceived stress and enhancing self-efficacy in ITE (Beltman et al., 2025; Hepburn et al., 2021).

Accordingly, it can be expected that fostering resilience in pre-service teachers may support their transition into the teaching profession and reduce early career teacher attrition. Novice teachers in Switzerland leaving the profession within the first few years, often report a lack of readiness for the teaching profession, inflated expectations of colleagues, and the overwhelming challenges of real-world teaching (Federal Statistics Office, 2023). International research also shows that attrition is linked to maladaptive coping strategies (Marais-Opperman et al., 2021; Wang et al., 2022) and lower emotional intelligence (Mérida-López et al., 2020). Therefore, early resilience-building measures in ITE may help buffer against challenges and ease the transition into professional practice.

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FOSTERING RESILIENCE IN INITIAL TEACHER EDUCATION (ITE)

Given the high demands of the teaching profession, supporting pre-service teachers' resilience early in their training might be a promising approach. Several strategies exist to foster resilience in ITE. A general strategy involves holistic health promotion at universities, such as Health Promoting Universities (Dooris, 2001; Tsouros et al., 1998) or Healthy Campus Initiatives (e.g., Okanagan Charter, 2015), which aim to enhance individual and collective physical, social, and emotional well-being for learning and work on campus.

Another strategy is the integration of resilience topics into regular ITE curricula. For example, Mansfield et al. (2012b) introduced the online programme 'Keeping Cool', and Thompson (2022) proposed dedicated courses for resilience education to support pre-service teachers' well-being and prevent burnout. Another approach involves offering targeted resilience programmes. A leading example is the Australian BRiTE (Building Resilience in Teacher Education) online platform (Mansfield et al., 2016), which features five interactive learning modules on resilience, emotions, and well-being and is open to all (pre-service) teachers. Research suggests evidence for its effectiveness (Beltman et al., 2018; Beltman et al., 2025; Mansfield et al., 2020), encouraging the implementation of BRiTE in other countries such as the USA (Sikma, 2021) and the Netherlands (Fokkens-Bruinsma et al., 2021). Despite different approaches, a key aspect of fostering pre-service teacher resilience relates to strengthening individual resources that can be activated during the study programme and in the school context (Bordás, 2023; Thompson, 2022). However, empirical research that investigates the effectiveness of those programmes seems still scarce (Kangas-Dick & O'Shaughnessy, 2020; Le Cornu, 2009; Mansfield et al., 2020; Mu, 2024).

THE GENERAL RESEARCH CONTEXT: SWISS TEACHER EDUCATION

The Swiss teacher education is legally regulated at the national level by the Swiss Conference of Cantonal Ministers of Education (EDK) but shows a high level of heterogeneity among the Swiss states (cantons). Universities of teacher education are primarily responsible for training teachers for primary school level (including kindergarten), lower secondary level, baccalaureate schools, upper secondary specialised schools, and teaching professions in the field of special needs education. Teacher education follows a concurrent model that integrates theory and practice. Programmes are practice-oriented, with a strong focus on occupational relevance. They include courses for professional and scientific qualifications, teaching-specific competencies, educational science knowledge, and

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practical training skills. For example, in the Bern University of Teacher Education six mentored field placements in schools are integrated covering about 25% of the overall study time. In these field placements, pre-service teachers are mentored by university teachers and school teachers.

Primary teachers receive a Bachelor's degree after three years of studies and are trained as generalists, not subject specialists. Primary education in Switzerland includes two years of kindergarten and six grades of primary school. Grade-level differentiation occurs by grouping teachers into two cycles: Kindergarten to Grade 2 (Cyclus 1), and Grade 3 to 6 (Cyclus 2). In the 2023/2024 academic year, a total of 1084 pre-service teachers were enrolled in the primary teacher programme at the Bern University of Teacher Education.

THE ITE COURSE 'PROFESSIONAL IDENTITY DEVELOPMENT AND PERSONAL RESOURCES'

The mandatory ITE course 'Professional Identity Development and Personal Resources' for pre-service primary school teachers at the Bern University of Teacher Education awards three ECTS (90 working hours) with 10 face-to-face sessions. It focuses on the demands of the teaching profession and key individual resources, such as resilience, emotion regulation, and relationship-building with students and parents. For example, pre-service teachers are introduced to the Job Demands-Resources Theory (Bakker et al., 2021) and the BRiTE project (Mansfield et al., 2016). The main learning outcomes of the course include: (a) understanding and reflecting on stressful aspects in the teaching profession; (b) learning about communication and interaction theories to manage challenging situations (e.g., conflicts with students or parents); and (c) broadening personal resources by applying new communication skills, personal skills such as resilience, and conflict management strategies.

THE FoResT LEARNING PLATFORM

Strongly inspired by the Australian BRiTE online platform developed by Caroline Mansfield and colleagues (e.g., Mansfield et al., 2016; Mansfield et al., 2021), we designed six online modules that were closely aligned with the regular coursework of the mandatory ITE course 'Professional Identity Development and Personal Resources' at the Bern University of Teacher Education. The FoResT online learning platform addressed key areas of teacher knowledge, self-regulation, and self-care: understanding resilience, maintaining relationships, establishing well-being, showing initiative, perceiving emo-

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tions, and practising mindfulness. The main topics were adapted from existing programmes – particularly BRiTE – to fit the Swiss context. This adaptation followed a design thinking process involving diverse stakeholders – pre-service teachers, teachers, researchers, lecturers, and health professionals (see Krummenacher et al., 2024a).

Pre-service teachers engaged with six online modules integrated into regular coursework by instructors. Modules included multimedia contents (videos, audios, texts), interactive elements, evidence-based strategies, practical case studies, and reflection exercises. After each module, pre-service teachers filled out a 'Wish, Outcome, Obstacle, Plan' (WOOP)-based logbook ('Your Plan') to document their goals. The research team conducted three in-person sessions to support pre-service teachers' active engagement with the platform: a kickoff, a reflection session (need-finding), and a future focus session, with self-assessments administered during the first and last sessions (for more details about the online platform see Supplements and Figure S1-S3).

RESEARCH QUESTIONS AND HYPOTHESES

Fostering pre-service teachers' resilience during ITE is seen as a promising approach to prevent future teacher stress and burnout and support their well-being (Beltman et al., 2018; Beltman et al., 2025; Mansfield et al., 2020). The central aim of our study was to examine changes in pre-service teachers' level of emotional exhaustion and resilience over the course of a semester in which they were enrolled in the mandatory ITE course 'Professional Identity Development and Personal Resources'. We aimed to understand whether engagement with the FoResT online learning platform – designed to support pre-service teachers' resilience – has a positive effect on pre-service teachers compared to regular coursework. In our work, we followed the Transparent Reporting of Evaluations with Nonrandomised Designs (TREND) statement (des Jarais et al., 2004). Based on a quasi-experimental design with an intervention and a control group, we analysed whether pre-service teachers' using the platform would report lower emotional exhaustion (RQ1) and enhanced resilience (RQ2) after course completion.

METHOD

Participants

In the autumn semester of 2023, N=255 pre-service primary teachers from the Bern University of Teacher Education (79.2% female, 20.4% male, 0.4% unspecified) were enrolled in the mandatory ITE course 'Professional Identity Development and Personal Resources'. Most participants were in their third se-

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mester (78.5%; fifth semester: 12.5%; other semesters: 9.0%), with a mean age of 23.35 years (SD = 5.01, range = 19–51 years). At the beginning of the semester (mid-September), 83% had an additional employment to their university studies, primarily at ≤ 50% workload (71.9%), and 24.3% were engaged in intensive care work or volunteering. In terms of teaching experience along with studying, 57.4% had no teaching position, 7.8% taught fewer than six lessons per week, 25.0% taught more than six lessons per week, and 9.4% worked as substitute teachers.

Given the high numbers of pre-service teachers, the mandatory ITE course 'Professional Identity Development and Personal Resources' was run in 10 parallel study groups. The courses were taught by different university teachers. Like previous third-semester cohorts, pre-service teachers self-enrolled in one of 10 study groups based on their individual time preferences some weeks before the semester started. Random assignment was not possible due to pre-service teachers' individual study-work programmes. However, self-selection bias based on the course version was avoided by two strategies. First, *upon* enrollment, the pre-service teachers were only informed about the title and the main learning outcomes of the course not about the version (with or without the learning platform). Second, the pre-service teachers were informed whether they would participate in the version of the course with or without engagement in the FoResT online learning platform *after* enrollment. No pre-service teacher changed the course after being informed about the specific version they were assigned to.

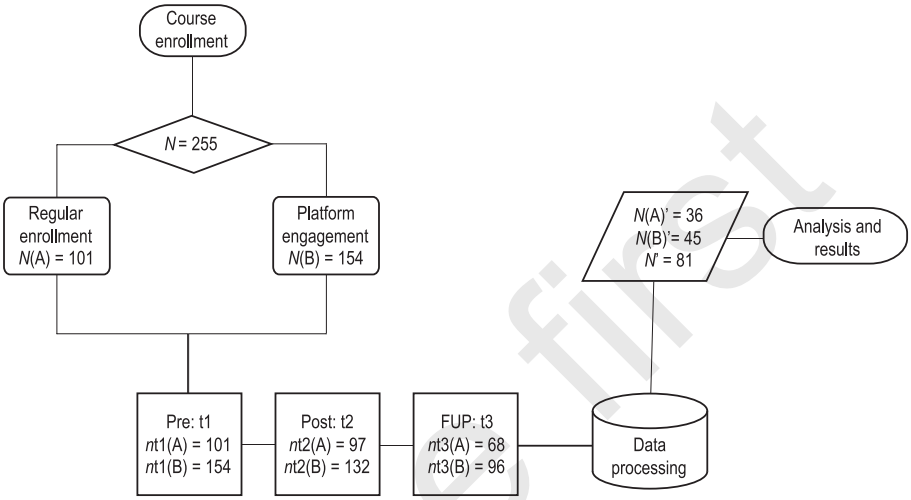
Regarding the study programme, all pre-service teachers faced the same workload, i.e., engagement with the platform was fully integrated into the coursework, avoiding additional workload. For example: When pre-service teachers in courses without the platform engaged with texts about resilience, pre-service teachers in courses with the platform engaged with the online module on resilience. Both formats of the course (with and without platform use) included interactive components such as discussions, sharing examples, reading texts and answering questions. For ethical reasons, platform engagement was not monitored through learning analytics, but course completion was monitored, and pre-service teachers received a reminder to complete the module if not having finished before course deadlines. As both formats of the coursework were mandatory, the study design did not allow controlling the outcomes of the course enrollment against a comparable sample without course participation.

At the three measurement timepoints, participant numbers were as shown in Figure 1. Response rates per timepoint

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were 100% at t1, 90% at t2 and 64% at t3. The final sample, including participants with both pre- and post-assessments, comprised $N = 141$ ($n = 58$, subgroup A: regular coursework and $n = 83$, subgroup B: engagement with the learning platform), resulting in an average completion rate of 55%. A subset of participants completed all three waves ($n = 36$, subgroup A; $n = 45$, subgroup B), resulting in a longitudinal sample of $N = 81$ and an average completion rate of 32%.

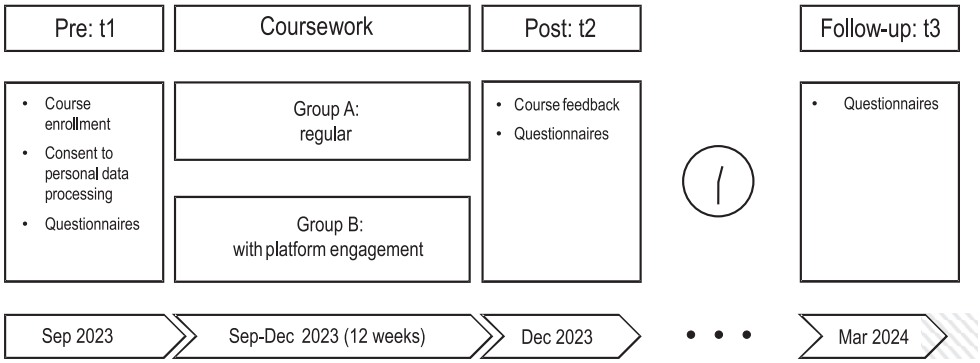
FIGURE 1
Flowchart of participant numbers from enrollment to analysis



Study design and procedure

Our study was approved by the Ethics Commission of the Faculty of Human Sciences of the University of Bern. Participation in the course 'Professional Identity Development and Personal Resources' was mandatory (full cohort of the third semester in autumn 2023). Pre-service teachers were informed about the learning goals of the course. Only pre-service teachers who provided informed consent to participate in our study were included.

FIGURE 2
Study design



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Data were collected at three measurement points (Figure 2): At the start of semester 3 (pre: t1) in September 2023 (DIN 39-2023), at the end of semester 3 (post: t2) in December 2023 (DIN 49-2023), and at the start of semester 4 (follow-up: t3) in March 2024 (DIN 10-2024). Anonymous self-assessment data were collected via online questionnaires using unique participant IDs during university courses. All three data collection sessions were facilitated by trained project staff in the study groups.

Measures

Emotional exhaustion was measured using five items from the exhaustion subscale of the Maslach Burnout Inventory – Student Survey (MBI-SS) (Gusy et al., 2016; Schaufeli et al., 2002). Items were rated on a 7-point Likert scale from 0 (never) to 6 (daily), with higher scores indicating greater exhaustion. A mean score was computed per individual across items.

Resilience was assessed using the German version of the Resilience Scale (RS-25) (Schumacher, 2005), consisting of 25 items rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating greater resilience. The scale comprises two subscales: personal competence (17 items), measuring self-confidence, independence, self-control, and perseverance; and acceptance of self and life (8 items), capturing adaptability, tolerance, and a flexible perspective on oneself and one's life path. Mean scores were calculated for each subscale.

Data analyses

All statistical analyses were conducted using RStudio (Version 2024.12.1+563). Both subgroups were compared in their gender-distribution (chi-square test), mean age, and baseline values of all scales (*t*-tests). Attrition analyses tested possible differences between completers and non-completers across the three measurement points regarding scores in emotional exhaustion and resilience. Prior to model calculation, (sub)scales were assessed for adequate internal consistency using Cronbach's alpha. Short-term changes were investigated using data from t1 and t2, while long-term effects were analysed comparing data from t1, t2, and t3.

To understand whether the two subgroups differed in the changes in their emotional exhaustion and resilience, we applied a repeated measures multivariate analysis of variance (rm-MANOVA), with *timepoint* as a within-subject factor and *group* as a between-subject factor. Post hoc analyses included rm-ANOVAS and paired-samples *t*-tests per outcome variable. Sensitivity analyses included the covariate gender.

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RESULTS

Descriptive statistics

All scales showed adequate internal consistency in both subgroups and the total sample (Table 1, Table 2). For both the short-term changes (t1-t2 sample, Table 1) and long-term changes (t1-t2-t3 sample, Table 2), there were no significant differences in gender distribution and age between the subgroups. Completers and non-completers did not differ in gender and baseline levels of emotional exhaustion and resilience but slightly differ regarding age (non-completers on average about 1.5 years older, see Supplementary Tables S1 and S2).

TABLE 1
Scale reliability and descriptive data for participants with complete data at pre and post

A / Internal consistency

		Time	Subgroup A α	Subgroup B α	Total
Scale	Emotional exhaustion	Pre	0.82	0.86	0.85
		Post	0.89	0.85	0.87
	Resilience competence	Pre	0.82	0.88	0.86
		Post	0.86	0.89	0.88
	Resilience acceptance	Pre	0.78	0.79	0.78
		Post	0.75	0.76	0.76

B / Sample characteristics

	Time	Subgroup A	Subgroup B	Total	A vs. B	*p*
Sample size (*N*)	Pre	83	58	141		
Gender (f %)	Pre	73.5	87.9	79.4	$\chi^2 = 3.517$	0.061
Age (*M*(*SD*))	Pre	23.1 (5.5)	22.4 (3.1)	22.8 (4.7)	$t = 0.957$	0.341

C / Group comparison of scales per timepoint (independent *t*-tests)

Scale	Time	Subgroup A *M* (*SD*)	Subgroup B *M* (*SD*)	Total *M* (*SD*)	*t*	*p*	*d* 95% CI [LL, UL]
Emotional exhaustion	Pre	3.42 (0.98)	2.99 (1.05)	3.16 (1.04)	-2.496	0.014*	-0.42 [-0.76, -0.08]
	Post	3.90 (1.12)	3.31 (1.03)	3.55 (1.10)	-3.154	0.002*	-0.55 [-0.89, -0.21]
Resilience competence	Pre	5.23 (0.61)	5.31 (0.78)	5.28 (0.71)	0.622	0.535	0.10 [-0.23, 0.44]
	Post	5.19 (0.69)	5.34 (0.75)	5.28 (0.73)	1.186	0.238	0.20 [-0.14, 0.54]
Resilience acceptance	Pre	4.82 (0.90)	4.82 (0.93)	4.82 (0.92)	0.012	0.991	0.00 [-0.33, 0.34]
	Post	4.74 (0.90)	4.97 (0.85)	4.88 (0.87)	1.499	0.137	0.26 [-0.08, 0.60]

Note. Emotional exhaustion is rated on a 7-point Likert scale (0 = never, 6 = daily); Resilience competence and acceptance are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Subgroup A = regular coursework; Subgroup B = engagement in learning platform.
*$p < 0.05$

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A baseline difference in emotional exhaustion between the subgroups was found, with subgroup A (regular coursework) reporting higher exhaustion levels than the subgroup B (platform users). Hence, comparisons of emotional exhaustion between subgroups were controlled for baseline emotional exhaustion.

TABLE 2
Scale reliability and descriptive data for participants with complete data at all three timepoints

A / Internal consistency

		Time	Subgroup A α	Subgroup B α	Total
Scale	Emotional exhaustion	Pre	0.78	0.82	0.81
		Post	0.89	0.83	0.88
		Follow-up	0.91	0.92	0.93
	Resilience competence	Pre	0.80	0.84	0.83
		Post	0.83	0.89	0.87
		Follow-up	0.88	0.88	0.89
	Resilience acceptance	Pre	0.74	0.74	0.74
		Post	0.73	0.71	0.72
		Follow-up	0.85	0.87	0.87

B / Sample characteristics

	Time	Subgroup A	Subgroup B	Total	A vs. B	*p*
Sample size (N)	Pre	36	45	81		
Gender (f %)	Pre	88.9	75.6	81.5	$\chi^2 = 1.556$	0.212
Age (M(SD))	Pre	22.1 (2.5)	22.1 (2.5)	22.1 (2.5)	$t = -0.146$	0.885

C / Group comparison of scales per timepoint (independent *t*-tests)

Scale	Time	Subgroup A *M* (*SD*)	Subgroup B *M* (*SD*)	Total *M* (*SD*)	*t*	*p*	*d* 95% CI [LL, UL]
Emotional exhaustion	Pre	3.44 (0.84)	2.97 (0.95)	3.18 (0.93)	-2.359	0.021*	-0.52 [-0.96, -0.07]
	Post	3.93 (1.05)	3.24 (0.94)	3.55 (1.05)	-3.102	0.003*	-0.70 [-1.15, -0.25]
	Follow-up	3.73 (1.20)	2.53 (1.24)	3.06 (1.35)	-4.401	< 0.001*	-0.98 [-1.44, -0.51]
Resilience competence	Pre	5.24 (0.54)	5.37 (0.66)	5.31 (0.61)	0.939	0.351	0.21 [-0.23, 0.64]
	Post	5.16 (0.59)	5.34 (0.76)	5.26 (0.69)	1.185	0.240	0.26 [-0.18, 0.70]
	Follow-up	5.23 (0.70)	5.60 (0.66)	5.44 (0.70)	2.408	0.019*	0.54 [0.09, 0.99]
Resilience acceptance	Pre	4.87 (0.83)	4.76 (0.82)	4.81 (0.82)	-0.579	0.564	-0.13 [-0.57, 0.31]
	Post	4.77 (0.83)	4.95 (0.78)	4.87 (0.80)	0.960	0.340	0.22 [-0.22, 0.66]
	Follow-up	4.79 (1.00)	5.24 (1.02)	5.04 (1.03)	1.970	0.053	0.44 [-0.01, 0.88]

Note. Emotional exhaustion is rated on a 7-point Likert scale (0 = never, 6 = daily); Resilience competence and acceptance are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Subgroup A = regular coursework; Subgroup B = engagement in learning platform.
*$p < 0.05$

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Inferential statistics

Regarding the short-term outcomes over a semester, we found the following results: Including group as a predictor and controlling for emotional exhaustion at t1, the rm-MANCOVA (shown in Table 3, Figure 3) revealed significant main effects of both time and group. Separate rm-ANOVAs indicate that emotional exhaustion exhibited significant main effects of both time and group. In contrast, resilience competence showed no effects and resilience acceptance displayed a small but significant interaction effect, driven by a slight increase in subgroup B, which engaged with the learning platform. Paired *t*-tests for emotional exhaustion indicated that both subgroups experienced an increase from t1 to t2, with subgroup B showing a significant increase and subgroup A experiencing an even stronger increase.

FIGURE 3
Short-term changes from pre to post in emotional exhaustion, resilience competence, and resilience acceptance in subgroup A (reg. coursework) and B (platform)



Note. Emotional exhaustion is rated on a 7-point Likert scale (0 = never, 6 = daily); Resilience competence and acceptance are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Lines represent the subgroups: Subgroup A (regular coursework) = dashed line, Subgroup B (additional engagement in learning platform) = solid line. Timepoints: t1 = pre, t2 = post. Significance is indicated for paired *t*-tests for each subgroup. *$p < 0.05$

When considering long-term group outcomes in the t1-t2-t3 sample (Table 4, Figure 3), the rm-MANCOVA revealed significant main effects of time and group as well as a significant interaction effect. For emotional exhaustion (controlled for emotional exhaustion at t1), all three effects – time, group, and interaction – were significant. While subgroup A showed an increase from t1 to t2, subgroup B exhibited a decrease from t2 to t3, suggesting a reversal of the earlier pattern. Further analyses revealed that resilience competence showed a significant main effect of time, with subgroup B experiencing a notable increase from t2 to t3.

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A / rm-MANCOVA

	Pillai	Num *df*, den *df*	Approx. *F*	*p*	Partial eta²	Partial eta² 95% CI [LL, UL]
Emotional exhaustion t1	0.853	3, 136	263.170	< 0.001*	0.85	0.81, 0.88
Group	0.315	3, 136	20.894	< 0.001*	0.30	0.17, 0.41
Time	0.213	3, 137	12.351	< 0.001*	0.20	0.08, 0.30
Group x time	0.037	3, 137	1.739	0.162	0.02	0.00, 0.06

B / rm-ANCOVA und rm-ANOVAs

	Sum of squares	Mean square	*df*	*F*	*p*	Partial eta²	Partial eta² 95% CI [LL, UL]
Emotional exhaustion							
Emotional exhaustion t1	222.320	222.320	1, 138	791.050	< 0.001*	0.85	0.81, 0.88
Group	17.670	17.670	1, 138	62.880	< 0.001*	0.31	0.19, 0.42
Time	10.650	10.649	1, 139	34.086	< 0.001*	0.19	0.09, 0.30
Group x time	0.40	0.405	1, 139	1.296	0.257	0.00	0.00, 0.04
Resilience competence							
Group	0.810	0.810	1, 139	0.914	0.341	0.00	0.00, 0.00
Time	0.000	0.000	1, 139	0.000	0.986	0.00	0.00, 0.00
Group x time	0.089	0.089	1, 139	0.598	0.441	0.00	0.00, 0.00
Resilience acceptance							
Group	0.880	0.877	1, 139	0.629	0.429	0.00	0.00, 0.00
Time	0.220	0.220	1, 139	1.080	0.300	0.00	0.00, 0.03
Group x time	0.849	0.849	1, 139	4.171	0.043*	0.02	0.00, 0.09

C / paired *t*-tests

	Subgroup	Pre *M* (*SD*)	Post *M* (*SD*)	*t*	*p*	d_z	d_z 95% CI [LL, UL]
Emotional exhaustion	A	3.42 (0.98)	3.90 (1.12)	4.744	< 0.001*	0.61	0.34, 0.89
	B	2.99 (1.05)	3.31 (1.03)	3.683	< 0.001*	0.40	0.18, 0.62
Resilience competence	A	5.23 (0.61)	5.19 (0.69)	-0.711	0.480	-0.09	-0.35, 0.16
	B	5.31 (0.78)	5.34 (0.75)	0.460	0.647	0.05	-0.16, 0.26
Resilience acceptance	A	4.82 (0.90)	4.74 (0.90)	-0.929	0.357	-0.12	-0.38, 0.13
	B	4.82 (0.93)	4.97 (0.85)	2.064	0.042*	0.22	0.01, 0.44

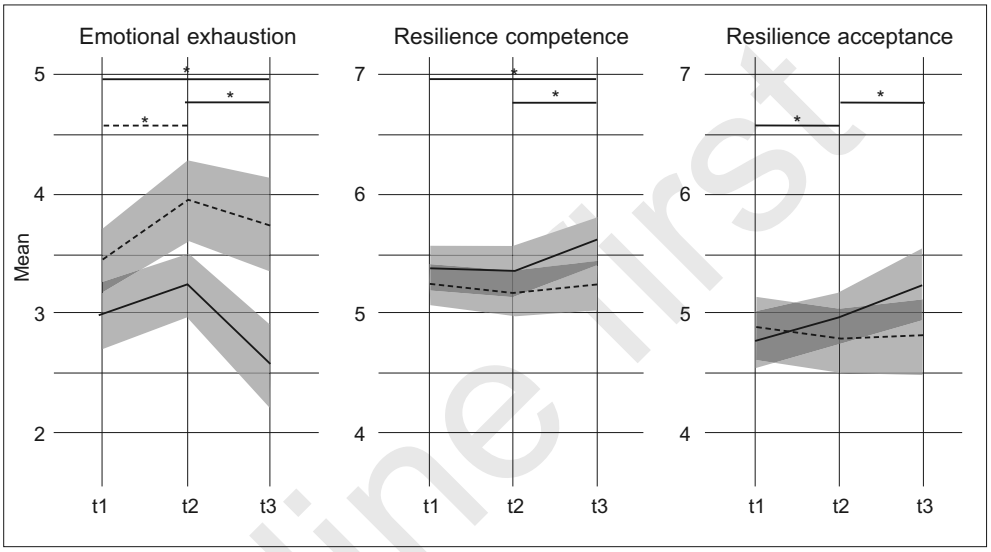
TABLE 3 Rm-MANCOVA and rm-AN(C)OVAs with main and interaction effects of group (between-subject factor) and two timepoints (within--subject factor), with post hoc paired *t*-tests

Note. (A) For the rm-MANCOVA, effects of emotional exhaustion at pre-measurement (t1), group, timepoint, and group x time interaction on emotional exhaustion, resilience competence, and resilience acceptance were assessed. (B) For rm-ANCOVA and rm-ANOVAs, individual effects of group, timepoint, and their interactions on emotional exhaustion, resilience competence, and resilience acceptance were analysed. (C) Results of paired *t*-tests, comparing differences between timepoints (pre, post). *$p < 0.05$ indicates significance

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Resilience acceptance showed both a significant main effect of time and an interaction effect, with subgroup B increasing from t1 to t2 and further from t2 to t3. When focusing on changes across the entire measurement period (t1-t3), subgroup B showed significant reduction in emotional exhaustion as well as increases in resilience competence and resilience acceptance with effects sizes ranging from small to moderate, whereas subgroup A showed no significant change. Sensitivity analyses showed no effect of gender on the results (see Supplementary Tables S3 and S4).

FIGURE 4
Long-term changes from pre to post and follow-up in emotional exhaustion, resilience competence, and resilience acceptance in subgroup A (reg. coursework) and B (platform)



Note. Emotional exhaustion is rated on a 7-point Likert scale (0 = never, 6 = daily); Resilience competence and acceptance are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Lines represent the subgroups: Subgroup A (regular coursework) = dashed line, Subgroup B (additional engagement in learning platform) = solid line. Timepoints: t1 = pre, t2 = post, t3 = follow-up. Significance is indicated for paired *t*-tests for each subgroup.
*$p < 0.05$

TABLE 4
Rm-MANCOVA and rm-AN(C)OVAs with main and interaction effects of group (between-subject factor) and three timepoints (within-subject factor) with post hoc paired *t*-tests

A / rm-MANCOVA
Partial eta^2

	Pillai	Num *df*, den *df*	Approx. *F*	*p*	Partial eta^2	95% CI [LL, UL]
Emotional exhaustion t1	0.684	3, 76	54.949	< 0.001*	0.67	0.55, 0.75
Group	0.417	3, 76	18.127	< 0.001*	0.39	0.22, 0.52
Time	0.189	6, 314	5.471	< 0.001*	0.08	0.02, 0.13
Group x time	0.121	6, 314	3.368	0.003*	0.04	0.00, 0.08

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Continues

Continued B / rm-ANCOVA and rm-ANOVAs

	Sum of squares	Mean square	*df*	*F*	*p*	Partial eta²	Partial eta² 95% CI [LL, UL]
Emotional exhaustion							
Emotional exhaustion t1	119.93	119.93	1, 78	164.32	< 0.001*	0.67	0.56, 0.75
Group	37.20	37.20	1, 78	50.970	< 0.001*	0.39	0.23, 0.52
Time	10.26	5.131	2, 158	9.796	< 0.001*	0.10	0.02, 0.19
Group x time	5.49	2.745	2, 158	5.240	0.006*	0.05	0.00, 0.12
Resilience competence							
Group	3.010	3.007	1, 79	2.908	0.092	0.02	0.00, 0.12
Time	1.325	0.663	2, 158	4.771	0.010*	0.05	0.00, 0.12
Group x time	0.651	0.325	2, 158	2.343	0.099	0.02	0.00, 0.07
Resilience acceptance							
Group	1.740	1.737	1, 79	0.882	0.350	0.00	0.00, 0.00
Time	2.294	1.147	2, 158	6.132	0.003*	0.06	0.00, 0.14
Group x time	3.041	1.520	2, 158	8.126	< 0.001*	0.08	0.01, 0.17

C / paired *t*-tests

Scale	Subgroup	*M* (*SD*)	*M* (*SD*)	*t*	*p*	d_z	d_z 95% CI [LL, UL]
		Pre	Post				
Emotional exhaustion	A	3.44 (0.84)	3.93 (1.05)	3.921	< 0.001*	0.49	0.23, 0.75
	B	2097 (0.95)	3.24 (0.94)	2.230	0.031*	0.28	-0.03, 0.53
Resilience competence	A	5.24 (0.54)	5.16 (0.59)	-1.584	0.122	-0.14	-0.31, 0.03
	B	5.37 (0.66)	5.34 (0.76)	-0.332	0.742	-0.04	-0.26, 0.18
Resilience acceptance	A	4.87 (0.83)	4.77 (0.83)	-0.889	0.380	-0.11	-0.35, 0.13
	B	4.76 (0.82)	4.95 (0.78)	2.222	0.031*	0.23	0.02, 0.43
		Post	FUP				
Emotional exhaustion	A	3.93 (1.05)	3.73 (1.20)	-1.331	0.192	-0.18	-0.44, 0.09
	B	3.24 (0.94)	2.53 (1.24)	-3.740	< 0.001*	-0.62	-0.98, -0.26
Resilience competence	A	5.16 (0.59)	5.23 (0.70)	0.795	0.432	0.10	-0.15, 0.36
	B	5.34 (0.76)	5.60 (0.66)	3.020	0.004*	0.35	0.12, 0.59
Resilience acceptance	A	4.77 (0.83)	4.79 (1.00)	0.178	0.860	0.02	-0.18, 0.22
	B	4.95 (0.78)	5.24 (1.02)	2.842	0.007*	0.30	0.09, 0.51
		Pre	FUP				
Emotional exhaustion	A	3.44 (0.84)	3.73 (1.20)	1.801	0.080	0.26	-0.03, 0.55
	B	2097 (0.95)	2.53 (1.24)	-2.358	0.023*	-0.38	-0.72, -0.05
Resilience competence	A	5.24 (0.54)	5.23 (0.70)	-0.102	0.920	-0.01	-0.30, 0.27
	B	5.37 (0.66)	5.60 (0.66)	2.895	0.006*	0.35	0.10, 0.59
Resilience acceptance	A	4.87 (0.83)	4.79 (1.00)	-0.871	0.391	-0.08	-0.25, 0.10
	B	4.76 (0.82)	5.24 (1.02)	4.903	< 0.001*	0.48	0.28, 0.69

Note. (A) For the rm-MANCOVA, effects of emotional exhaustion at pre-measurement (t1), group, timepoint, and group x time interaction on emotional exhaustion, resilience competence, and resilience acceptance were assessed. (B) For rm-ANCOVA and rm-ANOVAs, individual effects of group, timepoint, and their interactions on emotional exhaustion, resilience competence, and resilience acceptance were analysed. (C) Results of paired *t*-tests, comparing differences between timepoints (pre, post, FUP = follow-up). *$p < 0.05$ indicates significance

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DISCUSSION

This exploratory study investigated the changes in pre-service teachers' self-reported emotional exhaustion and resilience during their enrollment in the ITE course on 'Professional Identity Development and Personal Resources', which was designed to enhance their knowledge and practical skills for building professional resilience. Given that the ITE course was offered in two different formats – with and without the FoResT online learning platform focusing on resilience – we compared the outcomes in the two study subgroups (A and B) to assess potential benefits of the platform. We investigated whether pre-service teachers who engaged with the FoResT online learning platform would report significantly reduced emotional exhaustion (RQ1) and enhanced resilience (RQ2).

Short-term changes were observed when comparing pre-post scores within and between subgroup A (regular coursework) and subgroup B (with the learning platform). We found an unfavourable, significant increase in emotional exhaustion during the semester (pre-post) in subgroup A that was enrolled in the ITE course without the learning platform. Subgroup B also showed a significant change during the semester, but the increase was significantly weaker. The subgroups also differed in resilience acceptance leading to a significant but small difference in favour of the subgroup B enrolled with the learning platform. These findings may reflect the high workload of pre-service teachers during the semester (Bakker & Mostert, 2024) when they face high expectancies of succeeding with their studies and skill development while preparing for full teaching responsibilities immediately after graduation (Dicke et al., 2015; Tynjälä & Heik-kinen, 2011). Pre-service teachers also seem to struggle with the dual demands of being both learners and emerging professionals (e.g., Núñez-Regueiro et al., 2024). However, it must be noted that the entry levels of emotional exhaustion in subgroup A (without the learning platform) were already higher at the beginning of the semester (pre-scores), which likely indicates a higher vulnerability of this subgroup to intensified exhaustion. Considering that pre-service teachers freely self-enrolled in one of the ten courses based on their individual time preferences and were not informed about the course version (with or without the learning platform) before the semester started, the higher vulnerability observed in this subgroup was unexpected. The subgroup A increase in emotional exhaustion during the semester might contribute to this body of findings that ITE is a stressful period for pre-service teachers when they do not receive additional support. Research also shows that emotional exhaustion often increases during teachers' first

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year of service but that higher levels of professional knowledge and competencies are associated with lower emotional exhaustion (e.g., Dicke et al., 2015). Conversely, emotional exhaustion can hinder professional development (Skaalvik & Skaalvik, 2016), creating a vicious cycle. Online learning platforms like FoResT may help break this cycle by supporting resilience and fostering professional growth among pre-service and novice teachers.

Interestingly, long-term outcomes reveal a more pronounced picture. Comparing the start of Semester 3 (t1) with Semester 4 (t3), both subgroups show a decline in emotional exhaustion, but this decline was only significant for the platform users. One logical explanation seems the two-month semester break between the post- and follow-up assessments (post-measures took place at the end of the semester term, follow-up at the start of the following semester). However, during this break pre-service teachers were required to complete exams and participate in field placements which imposed considerable demands on pre-service teachers (e.g., Sturges et al., 2024). Thus, it seems unlikely that the observed decrease in emotional exhaustion was due to a reduction in workload (e.g., von Haaren-Mack et al., 2025). Rather, we assume that the observed improvements in both subgroups from the beginning of semester 3 (t1) to the beginning of semester 4 (t3) reflect delayed benefits of the ITE course contents on 'Professional Identity Development and Personal Resources'. Those benefits might unfold during pre-service teachers' engagement with more practical challenges during their field experiences. It is possible that pre-service teachers became more aware of the importance of their professional biography and resources when they were in the classroom. We also assume that acceptance of self and life could improve through field experiences, while personal competence seems to develop more gradually, as competence-building and the perception of increased competence require time to unfold (e.g., Baatz & Wirzberger, 2025). In general, delayed treatment effects are well-documented in intervention research and are typically observed when the target variable, like resilience, needs time to develop and manifest (e.g., Riley-Tillman et al., 2020). Future studies should control ITE course participation against non-participation and assess short-term and long-term effects more precisely.

It is of note, however, that the decline in emotional exhaustion is more pronounced in subgroup B (learning platform users) and even falls remarkably below their start level, suggesting more effective recovery of subgroup B compared to subgroup A. Also, the subgroups differed regarding long-

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term resilience development. The effect sizes suggest significant small to moderate benefits of the platform use (subgroup B) on resilience building. We interpret these effects as promising evidence for further integration of the learning platform into future coursework. Given the quasi-experimental design of our study, future research might improve the accuracy of results of field studies in ITE for example in using propensity score matching.

Further research is needed to more closely identify the factors and mechanisms influencing pre-service teachers' emotional exhaustion and resilience. Prior studies have shown that resilience is a skill that can be developed during ITE (Gu & Day, 2007; Mansfield et al., 2021). Possibly, pre-service teachers' coping strategies play a key role in this development, similar to the link between teachers' coping strategies and their resilience, stress, and burnout (Beltman & Poulton, 2019; Brouwers & Tomic, 2000; Lambert et al., 2009; O'Brennan et al., 2017). Coping strategies are considered fundamental adaptive processes (Lazarus & Folkman, 1991; Zimmer-Gembeck & Skinner, 2016) and are seen as being at the core of the teacher resilience process when individuals apply these strategies to maintain or improve their well-being (Hascher et al., 2021). Indeed, it was found that coping strategies help to understand the paradox between the high demands of the teaching profession and the high levels of satisfaction and well-being reported by teachers (Krummenacher et al., 2024b). For example, activating social support and collaboration seem adaptive responses to challenges and nourish teachers' resilience. Accordingly, future research that further elucidates the role of coping strategies for pre-service teachers can inform ITE research and practice (e.g., Beltman et al., 2018).

Limitations

Our quasi-experimental study comes with some limitations. First, we observed substantial participant dropout over the course of the study. High attrition can introduce bias, especially if those who withdrew were systematically different (e.g., more exhausted or less resilient) than those who remained. In such cases of non-random missingness, analyses may overestimate improvements by focusing on a potentially more resilient subset (Wolke et al., 2009). However, attrition analyss did not show significant differences between completers and non-completers regarding emotional exhaustion and resilience at baseline level. Second, the scheduling of measurements may have confounded the results. The post-measure was conducted at the end of the semester – a period typically associated with peak stress and workload in academic contexts (Jõgi et

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al., 2023). In contrast, the follow-up data was collected after a semester break, when some natural recovery likely occurred. However, the winter break is relatively short and generally perceived as stressful by pre-service teachers due to exam weeks and field placements. Third, emotional exhaustion and resilience were measured via self-report questionnaires, which are subject to biases and measurement limitations. Participants' perceptions may have been influenced by transient mood or by awareness of the study's aims (for instance, motivation to report improved resilience after the course). Moreover, resilience is a multifaceted construct (Beltman, 2021; Mansfield et al., 2012a), and a single survey instrument may not capture all its dimensions or subtle changes; for example, participants might have developed new coping behaviours that were not fully reflected in the resilience scale scores.

Regarding the internal and external validity, additional shortcomings need to be considered. Firstly, by investigating the full cohort we could not control for comparability of the two subgroups. Splitting the sample, however, would have lowered the power for data analysis even further. Secondly, we did not control for intervention fidelity as we did not measure how exactly the topics and the platform were integrated into the course and how the individual pre-service teacher engaged with the learning material. Thirdly, we refrained from collecting learning analytics due to ethical considerations and the intensively discussed challenges in assessing engagement and learning quality though learning analytics (Mian et al., 2022).

Practical implications

Teacher education is a very important societal task. Our study suggests that learning settings can make a difference for pre-service teacher skill development. We thus conclude that the integration of a digitally supported learning environment might be complex but seems also promising. We recommend implementing new learning settings using a participatory approach that incorporates the perspectives of both teacher educators and pre-service teachers, to better understand the facilitators and demands associated with innovative learning formats. The results of our study also underscore the importance of fostering resilience already during initial teacher education, allowing sufficient time for these skills to develop.

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DRUŠ. ISTRAŽ. ZAGREB
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Podržavanje dobrobiti i otpornosti budućih učitelja osnovnih škola: rezultati studije u tri vala o inicijalnom obrazovanju učitelja

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Naš je cilj bio istražiti kako se iscrpljenost i otpornost budućih učitelja razvijala tijekom semestra i kako je taj razvoj bio povezan s angažmanom oko tema vezanih uz otpornost. Usporedili smo dvije podskupine pune kohorte budućih učitelja razredne nastave druge godine, na Sveučilištu za obrazovanje učitelja u Bernu. Dok je n=101 pohađao redovni kolegij, n=154 koristilo je online platformu integriranu u redovni kolegij. Potpuni podaci u tri vremenske točke (prije kolegija; odmah nakon kolegija; 12-tjedno praćenje) bili su dostupni za n=36 (samo kolegij) i n=45 (korisnici platforme). Jednosmjerna multivarijantna analiza varijance (MANOVA) s ponovljenim mjerenjima pokazala je značajan porast razine iscrpljenosti budućih učitelja tijekom semestra (t1-t2) u obje podskupine. Prilikom praćenja (t3), korisnici platforme izvijestili su o značajno nižoj iscrpljenosti i većoj otpornosti u usporedbi s podskupinom koja je pohađala samo kolegij. Naša studija pridonosi skupu empirijskih istraživanja usmjerenih na razumijevanje potencijala kojeg u obrazovanju učitelja ima digitalno obrazovno okruženje.

Ključne riječi: emocionalna iscrpljenost, otpornost, dobrobit, budući učitelji, inicijalno obrazovanje učitelja

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