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Portion coherence: enhancing the relevance of introductory courses in teacher education

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Studies investigating coherence in teacher preparation often attempt to achieve comprehensive coherence across all components of training to optimize the educational process. Nevertheless, the pursuit of intense coherence presents notable challenges. To address these challenges, we propose the concept of *portion coherence*, exemplified by the Trio model, which guides pre-service teachers in integrating theories into their practices. Through a mixed-method study, we compared pre-service teachers' perceptions of the importance and relevance of introductory courses at the semester's outset and conclusion. While both groups reported a reduction in perceived importance, the intervention group noted a significantly smaller decline in perceived relevance compared to the control group. This suggests that models of portion coherence may enhance the perceived relevance of educational courses, while the perceived relevance of introductory education courses may serve as an indicator of cross-course coherence.

KEYWORDS

coherence, introductory courses, mixed-methods, relevance, teacher education, education theories, importance

Introduction

Studies on coherence in teacher preparation tend to focus on achieving comprehensive coherence across all components of training. This approach is based on the assumption that comprehensive coherence is an optimal way to improve the training process (Darling-Hammond et al., 2006; Hammerness, 2006; Grossman et al., 2008; Nguyen and Munter, 2024). However, the quest for intense coherence has been shown to involve many challenges (Hermansen and Mausethagen, 2023; Levine et al., 2023). As an alternative approach, the current study develops the concept of *portion coherence*, that is, promoting coherence only in a limited number of courses at every given stage. The study furthermore illustrates how portion coherence can be implemented through what is termed here the *Trio Model*, designed particularly for three introductory education courses.

These courses – specifically, philosophy, psychology and sociology of education – are widely believed to be the warp and the woof of teacher training programs (Foote and Vermette, 2001; Biesta, 2023). Each of these courses incorporates a wide body of theoretical and empirical knowledge. The introductory sociology course addresses social processes and their effects on education; the introductory philosophy course endeavors to promote in-depth, critical thinking about matters of education; the introductory psychology course analyzes the learners' cognitive, emotional and behavioral processes. These three courses are designed to give the

pre-service teachers (PSTs) a solid theoretical grounding that is also essential in the field practicum.

Yet, PSTs often regard the theories taught in the introductory courses as esoteric, marginal to training, and even unrelated to the teaching profession altogether. In other words, they tend to believe these courses are unimportant and irrelevant to their training as teachers (Ferguson et al., 2023). We posit that these challenges can be mitigated by strengthening the coherence across the three introductory courses and between them and the practicum. To this end, and in response to Flores (2018) and Wang Z. et al.'s (2023) call for continued exploration of initiatives for greater coherence in teacher preparation programs, along with Nguyen and Munter's (2024) suggestion to explore additional coherence measures from student teachers' perspectives, we developed the Trio model that is anchored in the notion of portion coherence. Thus, the current study sets out to test the Trio model designed by teacher educators in terms of its effect on PSTs' perception of the introductory courses. More specifically, it examines whether the implementation of this model enhances the importance and relevance of the courses in the minds' eye of the students. Such an effect is taken to be indicative of the coherence across these courses.

Literature review

The idea of coherence in teacher education

The issue of coherence in the context of teacher education has been explored in a wide range of studies (Darling-Hammond et al., 2006; Hammerness, 2006; Grossman et al., 2008). For all that, no comprehensive definition of this concept has so far been proposed in the literature. Following Tatto (1996), many scholars define coherence as a consensus among faculty staff regarding the nature and goals of the teacher preparation program, and the alignment of this understanding with the structure of the courses taught and with practicum.

Levine et al. (2023) regard coherence as a dynamic change, rather than a state, and define this concept accordingly, as "an ongoing process" whereby "stakeholders' various views regarding the ends of teacher education (conceptual elements)" are coordinated, and then aligned "with the means used to achieve those ends (structural elements)" (p. 4–5).

In defining coherence as a process, Levine et al. (2023) rely, *inter alia*, on Hammerness's (2006) distinction between two types of coherence: conceptual and structural. Conceptual coherence is a shared perception of the learning goals, the topics studied, and the skills required in the profession (e.g., social justice as an overarching principle of a training program). Structural coherence relates to organizing and connecting between the different courses that make up the training program so as to initiate sharing within the learning process (e.g., a joint activity that ties the courses together). For its part, conceptual coherence also requires cross-course organizational-logistical coordination, while a connection between the courses via a common learning experience must be based on a conceptual understanding of the contents and ideas thus shared. In sum, the distinction between conceptual and structural coherence is primarily a matter of emphasis – on the content and ideas versus design and organization, respectively.

Studies exploring trajectories for improving teacher training have often characterized these programs as a motley assemblage of courses from different disciplines, some theoretical and others applied, whose relationship to each other is unclear to the lecturers and even less so to the students (Ferguson et al., 2023; Levine et al., 2023). However, there is evidence that inconsistencies in teacher education are unnecessarily problematic, and that PSTs may learn from conflicting knowledge (Hebard, 2016). For example, Dack (2019) found that encountering examples where differentiated instruction was not effectively implemented in educational settings prompted PSTs to critically reflect on their own understanding, providing valuable lessons on ineffective instructional practices.

A range of studies have highlighted that incoherent teacher education may result in a lack of clarity, continuity, and integration in teacher preparation, impacting how PSTs approach teaching. For instance, Graus and Coppen (2018) found that inconsistencies in curriculum and teaching models can reinforce traditional pedagogical beliefs. In recent research, Nguyen and Munter (2024) identified two main inconsistencies among PSTs training to become mathematics teachers. First, they recognized equity as a unifying theme across their program but did not perceive it as conceptually integrated with other aspects of mathematics instruction. Secondly, PSTs noted both conceptual and structural inconsistencies between inquiry-based instruction (IBI) and direct instruction. Furthermore, PSTs viewed IBI and direct instruction approaches as conflicting, with direct instruction often perceived as contradictory to effective mathematics teaching. Research has also demonstrated that a lack of coherence between the various courses in a learning program impedes learning processes, and in the case in point, those involved in training teachers (Grossman et al., 2008). In addition, this state of affairs compromises the influence of these courses on the trainees' developing professional identity as teachers, which is relegated to the practicum field as a consequence (Zeichner and Tabachnik, 1981; Smagorinsky et al., 2004). In light of such evidence, recent decades have been marked by reforms in teacher training with a view to designing structurally coherent curricula that would render learning more profound and meaningful (Zeichner, 2010).

The purpose of many of these reforms is to enhance the comprehensive coherence of teacher training programs. For example, the coherence model proposed by Darling-Hammond et al. (2006) connects college-based courses in education and pedagogy to those in other disciplines, and between all of the above and practicum. This kind of coherence necessitates a rigorously chosen set of core concepts, ideas and tasks to linchpin the syllabi of all the courses in the program. It also requires a close collaboration of all the lecturers, who need to develop syllabi together, ensuring cross-course links.

Yet, a quest for comprehensive coherence across all the courses is fraught with numerous challenges. Among the possible hurdles and concerns in the way of such a sweeping transformation is a loss of autonomy, differing or conflicting theoretical premises, a need to redesign the entire training program, and a conflict between policies at the institutional and national levels (Levine et al., 2023). This study addresses these challenges relying on Levine et al.'s (2023) conceptualization of coherence as a process. It advocates a piecemeal strategy, whereby coherence is promoted only in some of the components of the training program. In other words, the idea of comprehensive coherence is supplanted by that of portion coherence. Promoting coherence step by step is a solution for a possible impasse – an "all or nothing" scenario – that may arise in pursuance of

comprehensive coherence. Consistent with this approach, the study illustrates the implementation of portion coherence via a Trio model, developed for the introductory education courses.

The Trio model

The Trio model is a unique framework developed by teacher educators within the Education Department of a teacher training college. According to Korthagen et al. (2006), teacher preparation programs typically emphasize three key components: theoretical, disciplinary, and practical. At the sampled college, the Education Department represents the theoretical component, offering courses that are predominantly theoretical and empirical. Introductory courses in the philosophy, sociology, and psychology of education, often termed "introductions to education," are mandatory for all PSTs regardless of their specialization (i.e., kindergarten, elementary, high school, special education). These courses focus on educational theories and research, fostering ongoing discussions among department lecturers on how best to narrow the gap between theoretical knowledge and practical application. Consequently, educators teaching these introductory courses developed the Trio Model to enable PSTs to engage with and apply theoretical and empirical knowledge to practical contexts. An important organizational aspect of the model is that the same group of students should be taking all three introductory courses. In addition, the Trio model requires the syllabi of each of the three introductory courses to include two shared sessions across the semester devoted to the common activity (see Table 1).

In light of Hermansen and Mausethagen's (2023) concept of 'epistemic relations,' which emphasizes relating knowledge resources to specific educational purposes or problems, the Trio model is based on the idea that cross-course coherence can be achieved through common activities. Specifically, each introductory course is taught separately, but the three lecturers collaborate in planning and carrying out common activities through which PSTs explore and assimilate the theories taught in each course. The common activities usually take place in small groups, and involve a stimulus and its analysis. The stimulus introduces an issue in education, whether by means of a short film, a short lecture, a text, or a case study. The cognitive process activated in the analysis of the stimulus invokes several perspectives, such that students are guided to incorporate and apply the rationales of all three disciplines to the same issue, as professional tools that are mutually complementary. All in all, the analysis promotes a holistic outlook on matters of education, with a view to translating theories into practice. Each activity results in a learning product, such as a short presentation, a creative poster, or a role-playing session to propose an optimal solution.

TABLE 1 The Trio model.

Weeks	Philosophy	Sociology	Psychology
1–5	Theories	Theories	Theories
6	Common activity		
7–10	Theories	Theories	Theories
11	Common activity		
12	Summary	Summary	Summary

Described below is one such common activity, called "Robinson's Ideas." The stimulus used was a short TED video entitled *"Do Schools Kill Creativity?"* in which Ken Robinson makes a case for cultivating and encouraging creativity in schools. The educational issue the film presents is inspiring, and forms a fertile ground for implementing concomitantly theories from the disciplines taught during the semester – thus, the students analyze the film from three disciplinary perspectives.

After watching the film, the students were divided into small working groups. Each group was asked to choose an aspect of the film that they found inspirational and discuss its connection to the theories they had learned as part of the three introductory courses. Thereupon, each group was instructed to design and present a creative poster reflecting the analysis and insights that arose during the discussion. Using graphics, text, or other representational means, the poster was to display a theory-based interpretation that integrates the three disciplines. While the students worked on the posters, the lecturers mediated and provided scaffolding as necessary. In creating the posters, the students were able to gain awareness as to how theories of the three disciplines can serve as analytic tools and be implemented in practice.

The posters were then exhibited on the walls of the lecture room, and both the students and the lecturers walked around viewing them. Next, the groups approached their respective posters and took turns to describe and explain them, and to answer questions. In the end, the students posted, in a communal blog, their reflections regarding the Trio model and their experiences of the activity.

Ultimately, the Trio model allowed the lecturers to elucidate to the PSTs the distinctive perspective of each discipline, thus enhancing their knowledge and appreciation of the latter and its contribution to their learning experience. At the same time, insofar as the common activities involved the application of the three disciplinary perspectives simultaneously, the model also promoted a holistic understanding of educational matters.

The perception of coherence within the Trio model

The Trio model is double-pronged. One of its foci, as is demonstrated by the above discussion, is structural coherence, as the proposed program involves activities common to all three courses. At the same time, the model is geared toward conceptual coherence, by fostering a connection between the theories taught and practicum, thereby sustaining the lecturers' academic freedom and ideological pluralism (Hermansen, 2020).

As already stated, the notion of portion coherence, which is at the heart of the Trio model, derives from the conceptual framework proposed by Levine et al. (2023), where it is conceived of as a process with three key elements: unity, conflict and fragmentation. Unity relates to coherence in the accepted sense of this term, namely, a shared vision and consensus regarding the goals of the training program. Conflict designates an opposite state of affairs, that is, a lack of a shared vision or consensus. Fragmentation addresses the possibility of diverging interpretations of the vision and goals by those involved in the training program. Focusing exclusively on unity while ignoring the possible conflict and fragmentation may create substantial problems in promoting coherence. For example, coherence is compromised when

the shared vision and goals are perfunctory, and in practice the parties diverge in their conduct or even act in a contradictory manner to one another. Notably, conflict is not necessarily undesirable; conversely, it could contribute to and enrich the training process through different perceptions of the educational vision. Thus, in the current study we adopted Hermansen's (2020) position that "coherence should rather be understood as a form of alignment which, in the case of teacher education, is conducive for supporting student learning." (p. 6).

In the proposed Trio model, the idea of unity is expressed in the common activities. In pursuit of the common aim to strengthen the connection between theory and practice and to foster multiple perspectives in dealing with any situation that may arise in practicum, the three lecturers discuss together the nature of the activities to be implemented. At the same time, the lecturers are aware that conflict and fragmentation are inevitable and hence an inherent aspect of the Trio model, which allows conceptual pluralism in the educational vision (Hermansen, 2020). They therefore feel free to present different educational theories, each according to the perspective and language specific to the discipline they teach. In factoring in conceptual pluralism as its important element, the Trio model prevents dysfunctional conflicts, in which only a semblance of coherence is maintained, with underlying discord seething below the surface. Concurrently, the model affords ample room for functional conflicts that ultimately enrich the trainees' educational vision and allow them freedom and scope to develop a professional identity. Last but not least, the model also emboldens the lecturers to open up to different educational ideas and thus refine their own perceptions.

The rationale is that a successful implementation of the Trio model in order to build portion coherence will gradually mitigate conflict and fragmentation, and consequently pave the way to extending the effort to other courses in the training program. Crucially, the view of conflict and fragmentation as integral elements in teacher training, makes it possible to broaden the scope of coherence to embrace more and more program components over time.

Enhancing the importance and relevance of the introductory education courses by promoting coherence

As elucidated above, the starting point for promoting portion coherence in teacher training is set to be the three introductory education courses, namely, in philosophy, sociology and psychology of education. According to Biesta (2023), "the idea of educational studies as the multidisciplinary study of education is more or less the common sense of the field" (p. 501). He argues that education, as an applied field, relies on theoretical and empirical insights derived from other academic disciplines. Consequently, educational studies are vulnerable, particularly with the increasing focus on empirical research methods aimed at identifying effective practices. This may lead PSTs to misunderstand or misconceive the essence and purpose of education and how its theories relate to educational practice. Biesta calls for enhancing the identity of the education field and exploring its distinctive voice. Korthagen and Kessels (1999) caution that, on encountering contradictions between theory and practice, a new teacher may discard the theories she or he had learned in the introductory courses and adhere to the practices and norms prevalent in practicum (see also Ferguson et al., 2023). They argue that, when the training courses are well integrated, part of the training can be relegated to the actual teaching. Morrish (2019) emphasizes that interfacing between the various courses conveys the message to the trainees that educational problems are almost never solved using a perspective of any one discipline. In other words, educational dilemmas do not have a purely philosophical answer or a purely psychological or sociological solution.

Rather paradoxically, the three introductory courses hold promise for promoting coherence due to special challenges they present. To begin with, these courses employ different terminologies and paradigms and are therefore taught by lecturers who specialize in the respective disciplines (Biesta, 2023). On the flipside, the substantive differences between the three disciplines are a reason that, within teacher training, they are perceived and structured as three separate courses, which in turn contributes to conceptual discontinuity and interpersonal disengagement. Thus, although the courses are studied concomitantly, they are divorced from each other in all aspects, and the trainees are somehow expected to connect intuitively the material covered (Canrinus et al., 2019b). Third, establishing links between the content of these courses and educational practice, or indeed allowing any room within them for issues related to education, is left entirely to the discretion of the lecturer, who in many cases has no training or expertise in matters of education. Fourth, such segregation of the introductory courses and their disconnection from practicum breeds misgivings regarding their importance and relevance to training as a whole, making the trainees wonder, "Why do I need to study these courses?" and "How do they help me to become a good teacher?" (Sjølie and Østern, 2021).

The present study dovetails with the work of Darling-Hammond et al. (2006), Canrinus et al. (2017), Canrinus et al. (2019a,b), and Goh et al. (2020) in that it evaluates coherence as it is perceived by the trainees. However, while Canrinus et al. (2017, 2019a) evaluated cross-course coherence directly, based on trainees' reports, we do this indirectly, by measuring the trainees' perceptions regarding the relevance and importance of the introductory courses, prior to and following their participation in the activities within the Trio model. The rationale behind this methodological strategy is twofold. First, the lack of coherence across the introductory courses appears to detract from their importance and relevance in the eyes of the trainees (Hermansen, 2020). Second, such an indirect measure could complement direct assessments gauging the effectiveness of strategies promoting coherence. The trainees may be unable to put their finger on the precise extent of coherence across the courses and between these and the practice. Yet, they can appraise and express authentically how such coherence affects the learning experience. Thus, in the case in point, coherence is measured as the change between trainees' evaluation of the importance and relevance of the three introductory courses before and after the implementation of the Trio model during the semester. We hypothesized that the model would augment coherence across the three introductory courses, and that the trainees would perceive them to be more important and relevant as a result.

In light of the above discussion, the following two research questions were formulated:

1. To what extent did participating in the Trio model affect the PSTs' perceptions of the importance and relevance of the introductory courses?
2. What are the PSTs' perceptions regarding the contribution of the Trio model to their training and how do they explain its effect?

Research hypothesis

With reference to the first research question, we hypothesized that, at the end of the semester, the intervention group, that is, the PSTs who had participated in the activities carried out within the Trio model, would perceive the introductory courses as more important and relevant than PSTs in the control group. Specifically, we expected to observe an interaction effect of group (intervention vs. control) and time (pre- vs. post-intervention) on both the perceived importance and relevance of the courses.

Method

The study follows a mixed-method approach (Johnson et al., 2007) and employs a quasi-experimental design. The quantitative component evaluates the effect of the Trio model on participants' perception of the importance and relevance of the introductory courses; such an effect is taken to indicate the extent of coherence across these courses. The qualitative component endeavors to elucidate this effect by analyzing PSTs' perceptions regarding the contribution of the model to their professional training (Johnson et al., 2007).

Participants

Between 2018 and 2022, we employed a convenience sampling strategy, reaching out to all freshman PSTs in their first semester at a public teacher training college located in a large city. These PSTs were enrolled in three mandatory introductory education courses. We achieved a return rate of 61%, resulting in a sample of 346 PSTs who anonymously completed both pre- and post-versions of the questionnaire (87% female; $M = 24.80$, SD = 6.41). Among these, 252 PSTs were taught using the Trio model and constituted the intervention group (92% female; $M = 23.32$, SD = 3.97). The remaining 94 PSTs were taught in the traditional format, with separate courses and no shared activities between them, serving as the control group (74% female; $M = 28.96$, SD = 9.38). Measurements were administered in the first and last weeks of the semester. Age and gender differences between the groups are detailed in the Results section. Regarding the qualitative aspect, 181 out of the 252 PSTs in the intervention group responded to the open-ended questions in the post-questionnaire (91% female; $M = 23.33$, SD = 4.09).

Instruments

Quantitative instrument

The quantitative instrument was a pre-post closed questionnaire with statements related to the importance and relevance of the introductory courses, and the contribution of the Trio model.

Description of the dependent variables

Importance of introductory courses

All participants were asked to rate the importance of learning the introductory courses on a 5-point Likert scale (1: not at all important, 5: very important). At the beginning of the semester, the question was phrased in general terms since PSTs were still unfamiliar with the material to be covered in the courses: "In your opinion, how important is it to take introductory courses in a teacher preparation program?" At the end of the semester, PSTs were asked to reflect on the importance of the introductory courses for their future work as teachers: "In your opinion, how important are the contents you have learned in the introductory courses in preparing teachers for their future work?"

Relevance of introductory courses

All the participants were asked to rate the relevance of the introductory courses on a 5-point Likert scale (1: not relevant at all, 5: very relevant). In the beginning of the semester, the question was phrased in general terms (see above): "In your opinion, how relevant are the contents of introductory courses for your future work as a teacher?" At the end of the semester, PSTs were asked to reflect on the relevance of the introductory courses they had taken for their future work as teachers: "In your opinion, how relevant are the contents you have learned in the introductory courses for your future work as a teacher?"

Contribution of the Trio model

Participants in the intervention group were also asked to rate the Trio model's contribution to the training process on a 5-point Likert scale (1: did not contribute at all, 5: contributed substantially).

Independent variables

Two independent variables were set: group and time.

Group

Intervention group: PSTs who took introductory courses via the Trio model.

Control group: PSTs who took introductory courses in their traditional format.

Time

The PSTs evaluated the importance and relevance of the introductory courses twice: first, during the first, and second, during the last session of one of these.

Qualitative instrument

The post version of the questionnaire administered to the intervention group also included an open question: "How did the Trio model contribute to the process of your training? Please explain in detail and provide examples."

Procedure

The questionnaire was filled online. All PSTs studying introductory courses in a teacher preparation program were asked to complete the survey voluntarily and were not reimbursed for their time (5 min on average). This study was approved by the Institutional Ethics Committee (Approval no. 2020071501).

TABLE 2 Means and standard deviations of importance and relevance by group and time.

Time	Group (N = 346)	Relevance	Importance
		M (SD)	M (SD)
Beginning of semester	Intervention (252)	4.56 (0.71)	4.56 (0.70)
	Control (94)	4.28 (0.89)	4.34 (0.86)
End of semester	Intervention (252)	4.34 (0.85)	4.45 (0.79)
	Control (94)	3.80 (1.07)	4.15 (0.95)

Data analyses

The quantitative data were analyzed using Pearson's correlations and repeated measures ANOVA, using SPSS version 25 software. The qualitative data analyses were based on a thematic analysis conducted on the answers of the PSTs in the intervension group to the open-question (Creswell et al., 2007). A theme, as conceptualized in line with Braun and Clarke (2019), is identified as a pattern of shared meaning across data items. We employed Nowell et al.'s (2017) six phases of inductive thematic analysis to ensure trustworthiness. In the first phase, each researcher familiarized themselves with the data by reading all the PSTs' responses to the open-ended questions as a single unit. During this stage, all responses were compiled into a single long Word file. In the second phase, each researcher independently read through all the interviews to gain an understanding of the content, then assigned initial emic codes. Based on this process, each researcher created a codebook detailing each code, supported by an excerpt from a response. The third phase involved identifying themes and understanding connections and hierarchies of concepts. Researchers held multiple meetings to discuss their findings and insights, resolving any discrepancies in categorizing themes. The fourth phase included a review of the themes by all researchers to achieve consensus. They discussed excerpts related to each coding category, reaching an intercoder agreement of 90%. To ensure validity, researchers shared passages that illustrated each category's interpretation. Passages where researchers disagreed on meaning were excluded from the final codebook and subsequent analysis after thorough discussion.

Results

Quantitative results

Prior to the main analyses, we established that age and gender differences between the two groups were not associated with the dependent variables. No differences in scores of relevance and importance were found between male ($M_{relevance}$ = 4.40, SD = 0.78, $M_{importance}$ = 4.51, SD = 0.66) and female PSTs ($M_{relevance}$ = 4.50, SD = 0.77, $M_{importance}$ = 4.51, SD = 0.76): respectively, $t(344) = -0.79$, $p = 0.430$, $t(344) = 0.04$, $p = 0.969$. Neither did significant correlations emerge between age and relevance ($r(344) = -0.01$, $p = 0.796$) or between age and importance ($r(344) = 0.02$, $p = 0.724$).

To test the hypothesis that, at the end of the semester, the intervention group would perceive the introductory courses as more important and relevant compared to controls, we conducted two-way repeated measures ANOVA. First, we examined the dependent variable of relevance. The analysis revealed a significant difference across time: $F(1,344) = 35.93$, $p < 0.001$, $\eta^2 = 0.095$. PSTs from both groups (intervention and control) perceived the relevance of the introductory courses as higher at the beginning of the semester compared to after studying them (see Table 2). A significant difference was also found between groups: $F(1,344) = 24.10$, $p < 0.001$, $\eta^2 = 0.065$. PSTs in the intervention group perceived the relevance of the introductory courses as higher compared to controls. Lastly, a significant interaction was found between group and time: $F(1,344) = 5.02$, $p = 0.026$, $\eta^2 = 0.014$. For PSTs in the intervention group, the decrease in relevance across time was significantly smaller than for PSTs in the control group (see Figure 1).

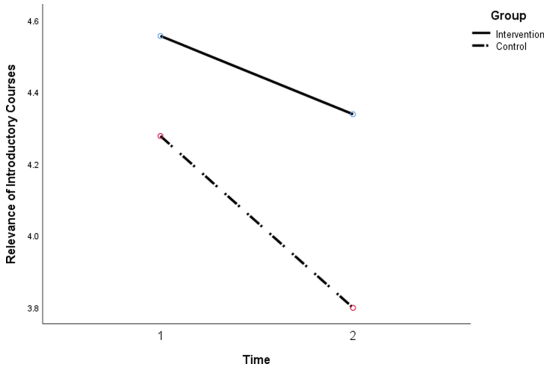

FIGURE 1
Interaction between time and group in their effect on relevance.

Next, we examined the dependent variable of importance. The analysis revealed a significant difference across time: $F(1,344) = 8.06$, $p = 0.005$, $\eta^2 = 0.023$. PSTs from both groups (intervention and control) perceived the importance of the introductory courses as higher at the beginning of the semester compared to after studying them (see Table 2). A significant difference was also found between the groups: $F(1,344) = 10.89$, $p = 0.001$, $\eta^2 = 0.031$, with the intervention group perceiving the importance of the introductory courses as higher compared to the control group. No significant interaction was found between group and time: $F(1,344) = 0.57$, $p = 0.451$, $\eta^2 = 0.002$. The decrease in perceived importance across time was similar in both groups. Notably, at the first time point, the mean score of importance in the intervention group was significantly higher than in the control group, which could have affected the interaction effect (see Figure 2).

The rating by the intervention group of the Trio model's contribution to their professional training stood at $M_{contribution}$ = 4.26, SD = 0.85. Although this aspect was addressed only descriptively, the

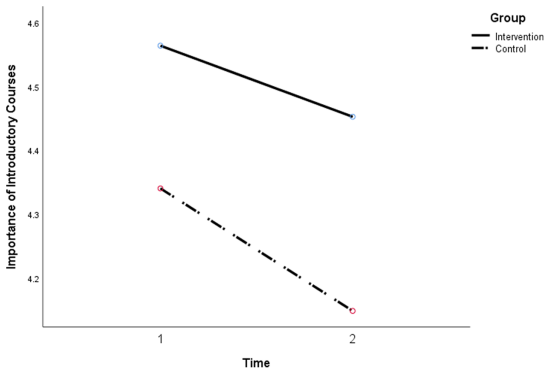

FIGURE 2
Interaction between time and group in their effect on importance.

high mean score provides initial evidence for the high estimation of the model and its effectiveness among the PSTs.

Qualitative results

The qualitative results pertain to the intervention group, as only PSTs in this group could appraise the contribution of the Trio model to their training process. Analysis of these PSTs' answers revealed four thematic supercategories: (1) relation to practice; (2) connecting between the courses and promoting multiple perspectives; (3) emotive and social pedagogical aspects; and (4) cultivating a professional identity – of which Category 3 can be divided to three sub-categories: (a) pedagogical modeling; (b) social interaction; and (c) the learning process.

Relation to practice

The answers in this theme can be taken to indicate an improvement in the coherence between the contents of the courses and practicum. A large proportion of students (45%) described having gained from the contents of the courses a profound understanding of situations from school life and of how to act in such scenarios. The phrases that the PSTs used in this connection included "*daily life*," "*what happens in the field*," "*situations in reality*," "*in the system*," "*occur in personal and professional life*." For example, students wrote:

> *The trio made the theory – the material studied – a palpable reality, and that's great because without the actual doing, theory is worthless.*

> *The trio sessions demonstrated how things we learn in theory can find expression in the field.*

Connecting theory to practice impelled the students to reevaluate the importance of the theoretical knowledge gained in the courses. Thus, a student wrote:

> *That thing* [the Trio activity] *proves that these courses stimulate thinking, make one think critically and from many different perspectives and angles, there is no black or white, there is no correct or incorrect, this is precisely the kind of critical thinking that should be instilled in future generations. In my humble opinion, these courses are extremely important!*

The students also reported having gained insights regarding the connection of the courses to personal life: *Suddenly I realized that what I learned is really part of every man's and woman's personal life, of my life.*

Connecting between the courses and promoting multiple perspectives

The answers in this theme pertained to coherence across the courses and understanding these connections: "*The trio meetings put my knowledge in order and made me understand the connection between the subjects of philosophy, sociology and psychology*." Such knowledge is conducive to gaining the cognitive and emotional skills to look at a situation from multiple angles – an advantage that was noted by 35% of the respondents. Put differently, the relationship between the three courses is understood not only at the content level, but necessarily involves cognitive skills and emotional insights. Cognitively, the students learned to analyze day-to-day school-life scenarios from different perspectives:

> *The Trio helps to connect the three subjects, and produces a much broader picture of a situation. The Trio cultivates and foregrounds the way of thinking that every educator should master: regarding each case in its multiple aspects.*

This multi-angle perspective also operates at the emotional level: "*It was important to present one subject and show how it can be viewed within the three disciplines*." That is, the students internalized that looking at the same event from different perspectives is not problematic, but rather helps one to understand it in depth. And conversely, in order to understand an event in a profound and holistic way, one must think about it and interpret it from different perspectives: "*The same video was chosen by several groups, and I saw both similarities and differences in the ways each group presented it. I loved hearing additional views on the same video*."

This skill is also linked to empathy for the other's point of view that is different from one's own, in the sense that people start out with different perceptions, but all seek to promote something positive: "*In the end, the three approaches benefit and help the child*."

Emotive and social pedagogical aspects

Twenty-two percent of the students in the intervention group believed that theTrio model had a considerable pedagogical-social benefit. First, the model enabled pedagogical modeling, that is, familiarizing oneself with and acquiring skills through diverse and advanced methods of teaching and learning. Second, participants reported considerable benefits pertaining to academic, emotive and social aspects. Academically, the Trio activities impelled the students to go over the theoretical course material and understand

it at greater depth. Emotionally, the students described these activities as fun and novel, and therefore exciting. Finally, the students relayed how the activities promoted communication and positive social interaction among themselves and between them and the lecturers:

> *I think it was experiential learning that combined emotional experience, social learning, and knowledge; in addition, the students were actively involved as the activities gave one an opportunity to take a personal stand.*

Pedagogical modeling

The objective of pedagogical modeling is twofold. On the one hand, in the joint activities, the lecturers acted as role models for the trainees by demonstrating the application of diverse and advanced pedagogies, such as collaborative teaching: "*It was a glimpse into a* variety *of teaching methods, including attitude exercises, discussion of dilemmas, role-playing and simulations*." On the other hand, the modeling helped internalize advanced pedagogies: "*The Trio has helped me to internalize and acquire tools that will really help me in the future*."

Social interaction

The PSTs believed the Trio activities to be valuable socially, in that they fostered the sense of familiarity and interpersonal interaction among the trainees, most of whom were freshmen, and promoted the values of tolerance and empathy:

> *I met peers I had not had a chance to meet before. I heard a lot of different opinions, learned cooperation and how to be mindful of others and respect others' views.*
>
> *The Trio meetings proved to be a real experience and added more points of view, voiced by different people, not necessarily my friends.*

Among some of the trainees, the Trio model evoked feelings of belonging, which in turn motivated them to take an active part in learning:

> *Working in a small study group helped me a lot in terms of concentration; I was able to participate more and felt part of the student community and of the class.*

In addition, some of the trainees felt that the Trio model promoted direct and unmediated contact among the students, and between them and the lecturers.

The learning process

The Trio activities enabled PSTs to go over the material in ways different from frontal presentation, through which it was covered in the courses, and thereby to better understand and internalize the theories learned: "It [The trio meetings] *helped me to understand the material. I felt as if I were going over the material taught in the courses*." Another PST wrote: "*The Trio helped me achieve a comprehensive understanding of the subject*."

Furthermore, PSTs described the Trio activities as enjoyable, refreshing and revitalizing: "*The lessons were fun and different from the usual classroom sessions*." Another trainee added: "*The Trio classes were engaging and experiential, and added interest and a personal connection to the course*."

The Trio activities enabled social interaction among the participants and between them and the lecturers, thereby also enhancing learning and the experience of novelty: "*I got to hear new opinions and perspectives from peers I had not talked to before, so I saw things in a new light, as I had never done before*."

Relatedly, other trainees also mentioned the relationship with the lecturers:

> *The benefit of the Trio activities is that they made it possible to have profound and broad discussions together with the three lecturers; the collaboration between the lecturers in real time helped to accentuate and hone the various aspects.*

Cultivating a professional identity

This theme was invoked by 14% of the trainees, who described how the activities prompted them to think about their role as educators, and about values they wished to adopt as part of their professional identity:

> *The Trio made me understand, through all the introductory courses, what kind of teacher I want to be in the future, what qualities and talents I would like to develop in children.* [It taught me] *to present myself in a different way that allows the children I will teach to achieve self-fulfillment, and not to oppress them through rigid teaching practices.*

The model appears to have helped some of the trainees to form insights about the importance of education and its influence at both the individual and societal levels:

> *Some aspects of the courses opened up before me different sides of society, how society operates, the importance of education and its effect on society. I also imagined what the consequences would be if there was no education – what could happen to us as a society. I also learned that teachers have a significant influence over what kind of citizens students will be in the future.*

These insights reinforced the students' confidence that they had chosen the right profession:

> "*The Trio activities reminded me why I chose this profession*"; "*The activities made me strive for greatness and want to give a lot of myself for my students*."

Students' professional identity seems to emanate, to a considerable degree, from the insight that a professional teacher makes intelligent use of his or her multidisciplinary knowledge:

> "*To be a good teacher you need to employ the three different aspects and angles*"; "*The trio meetings enabled me to combine all the tools I had learned in each course, and in this way to begin to build educational strategies and methods, and to chart out courses of action for my work as an educator.*"

The formation of the students' professional identity appears to have also been enhanced by the social interaction afforded by the model:

> *The meetings gave me the opportunity to listen to my friends and to observe how each of us interprets the topics taught in the courses and where they take them, and what they understood; and maybe even showed me more directions and ways to act in order to be the best teacher I possibly can for my future students.*

Discussion

The present study has examined the concept of portion coherence as exemplified by the Trio model designed within the context of three introductory education courses. Coherence was gauged as the importance and relevance of these courses in the eyes of the participating PSTs. The analysis of the quantitative findings revealed that PSTs in both the intervention and the control groups assessed the importance and relevance of the introductory courses as higher at the beginning compared to the end of the semester. However, among the PSTs in the intervention group, the decrease in the perceived relevance of the three courses was significantly smaller than among the PSTs in the control groupt. No difference emerged between the two groups in the perceived importance of the courses for professional training. These results lend partial support to the research hypothesis, insofar as the implementation of the model can be assumed to have enhanced the cross-course coherence. Nevertheless, supported by both the qualitative and quantitative results, it was found that PSTs in the intervention group rated the Trio model's contribution to their professional training highly. From psychological perspective, the overall decrease found in PSTs' perceptions thereof at the end of the first semester, may stand to reason, as before embarking on their studies, many of them may have held exaggerated, and even unrealistic expectations regarding the training program (Hassel and Ridout, 2018; Raaen and Thorsen, 2020).

The question that arises in light of above findings is, Why wasn't the decline in the perceptions regarding the importance of the introductory courses among the intervention group less steep than among the control group? A philosophical perspective may suggest discussing the difference between importance and relevance. The Oxford English Dictionary (2022) defines *importance* as "the quality of being important," and "*important*" as "having a great effect on people or things; of great value." This definition suggests that "importance" is an inclusive and amorphous concept. Furthermore, Frankfurt (1982) argues that assessments of importance are inherently subjective, a matter of personal preferences, and as as such, are less influenced by objective information and data. Thus, if a trainee considers, say, philosophy as unimportant from the outset, it is doubtful that her disposition in this regard will be affected by the introductory education course in that discipline.

On the other hand, "*relevance*," according to The Oxford English Dictionary (2022) denotes "a close connection with the subject you are discussing or the situation you are in." The concept of "relevance" is thus narrower, less vague, and moreover denotes connection. It can therefore be plausibly assumed that perceptions regarding relevance may be affected by an intervention designed to strengthen the connection in the case at hand. For example, if a trainee takes an introductory course in education philosophy that foregrounds the connection between philosophical theories and educational practices, she will perceive the material taught in the course as relevant to her professional training. The distinction between the concepts of "importance" and "relevance" outlined above could account for the finding that participation in the Trio activities impacted the perceptions of the latter, but not of the former.

Another explanation could be that the PSTs in the intervention group, being freshmen, were unable to evaluate the impact of the Trio model on their training process due to limited opportunities to compare this experience with other courses taught at the college. Thus, further study should examine these PSTs' perceptions from a retrospective point of view, after they have experienced and learned courses with less coherent strategies. Finally, although a variety of quasi-experimental studies have shown interventions that promote narrowing the gap between theory and practice in teacher education (e.g., Slavkin, 2002; Juarez, 2019; Risan, 2020; Martin et al., 2022; Mintz, 2022; Smeplass, 2023; Wang Y. et al., 2023), still a certain gap between theory and practice is system-inherent. Thus, applying theories into practice may remain the 'Achilles' heel' of teacher education (Korthagen and Kessels, 1999; Juarez 2019).

The qualitative results indicate that coherence between the courses was anchored in the relationship between them and practice that, in turn, rested on a multi-angle perspective. The answers of the PSTs in the intervension group described a change whereby, although the different theories learned in each course were felt to be in conflict with one another, they provide multi-angle perspective. This came to be experienced as insightful and conducive to developing mindfulness, attention and empathy towards views different from one's own (Cook-Sather, 2014; Hebard, 2016; Johnson et al., 2017). The relationship between coherence and the development of multiperspectivity was also documented by Abbey and Wansink (2022). Moreover, the qualitative results highlighted that PSTs who participated in Trio model activities found that these activities supported social interactions. This suggests that promoting coherence may be enhanced by collaborative and hands-on learning (Vygotsky, 1978). For instance, Lee (2019) examined a community project among six Hong Kong PSTs aimed at enhancing English grammar instruction. The PSTs were given opportunities in the project to connect theories with practical realities. By actively participating, PSTs improved their disciplinary knowledge and gained insights into teaching practices. Similarly, Smeplass (2023) argues that "as students become active contributors within these communities, they become able to bridge the gap between theory and practice, ultimately enhancing their learning outcomes" (p. 5). Considering the results of these studies and those related to the Trio model, one may conclude that interventions promoting hands-on

learning and collaboration among PSTs may act as scaffolds for translating theory into practice. However, it is worth noting that Csanadi et al. (2021), who conducted research related to problem-solving scenarios among German PSTs, found that if the goal is to encourage PSTs to reference scientific theories and evidence, collaboration alone may not be effective unless PSTs receive additional guidance on applying these theories and evidence to case information. The qualitative results also addressed this understanding, as the PSTs described how the collaboration among the three lecturers contributed to developing multiperspectivity regarding the given situation.

The qualitative results also revealed that the PSTs in the intervention group gained insights related to their professional identity. These results reinforce Rogers' (2011) conclusion that coherence in teacher education supports deep engagement in the learning process, and consequently, it influences the development of professional identities. In this regard, the Trio model may enhance among the PSTs the idea that educational theories should serve as part of their 'repertoire' for developing their professional identities (Hascher and Hagenauer, 2016). Interestingly, some of the trainees indicated that the Trio model also touched their personal lives, referring to situations and experiences outside the academic context that were brought up in the courses. Such impressions resonate with Whitehead's (1929) classic book *The Aims of Education and Other Essays*, in which meaningful learning is characterized in terms of day-to-day situational scenarios that the learner can use to understand reality by appying general theoretical concepts.

By and large, the findings of the present study lend themselves to two conclusions. First, implementing *portion coherence* as exampled by the Trio model could be a more modest, yet fully feasible alternative to seeking comprehensive coherence *en bloc*. This approach can follow two trajectories: (1) improving coherence through structural changes, and (2) promoting coherence in a process carried out in some of the courses or components of the training program. Second, in relation to Nguyen and Munter's (2024) call for exploring measures of coherence in teacher education, it may be possible to assess coherence indirectly by gauging PSTs' perceptions regarding the relevance of the courses. This conclusion could also be strengthened by Hermansen's (2020) demonstration that the relevance of knowledge discourses can serve as a unit of analysis for examining coherence. Additionally, since the findings indicated that PSTs in the intervention group perceived the relevance of the education courses higher compared to the control group, it may be cautiously implied that PSTs who participated in the Trio model intervention gained epistemic insights suggesting that educational theories should serve as a critical source of teaching knowledge. This conclusion is significant, given empirical evidence indicating that both PSTs and in-service teachers often prefer informal knowledge sources (e.g., experienced colleagues) over educational research in their professional decision-making (Ferguson and Bråten, 2022; Ferguson et al., 2023). Ferguson and Bråten (2022) also argued that the perceived irrelevance of educational research among PSTs should prompt teacher educators to consider initiatives that correct this misconception.

In this regard, our study offers implications for teacher educators seeking to integrate the concept of portion coherence (as a pragmatic piecemeal strategy) to enhance comprehensive coherence: 1. To recognize that coherence relies, to a significant extent, on educational-ideological pluralism; 2. To identify the specific and shared challenges of training courses and address PSTs' needs accordingly; 4. To include collaborative and hands-on learning in cross-course shared activities; 5. To model, mediate, and discuss with PSTs and colleagues how educational theories can be translated into practice and vice versa; and 6. To employ indirect measures to assess the success of strategies or initiatives aimed at promoting coherence.

Generalizing the findings of this study is subject to several limitations. First, as our study is quasi-experimental in design, its randomization may introduce selection bias. Secondly, the qualitative results indicate that PSTs in the intervention group generally expressed positive perceptions of the Trio model. However, this positivity may stem from the wording of the open-ended question, which focused solely on how the model contributed to PSTs' training. Notably, 30% of the PSTs in the intervention group did not respond to this open question, suggesting that some may not perceive the Trio model as beneficial to their training process. Therefore, we recommend that future research explore both the strengths and weaknesses of the model from the perspectives of both PSTs and teacher educators, incorporating more balanced questions to gain a comprehensive understanding of the model's role in implementing portion coherence in teacher preparation. Furthermore, the Trio model was designed expressly for the introductory courses, and needs to be adjusted if applied to other courses. In the current study, we assumed that the lack of cross-course coherence fostered among the PSTs a feeling that the education introductory courses were not relevant to the training process. Hence, we used the PSTs' relevance assessments as a proxy for the model's success in strengthening portion coherence. Future studies may suggest other indirect measures of coherence. Additionally, the present study sought to promote portion coherence by way of structural coherence. In relation to other courses, however, an optimal way to approach portion coherence could be conceptually. Future studies can undoubtedly offer additional models for promoting portion coherence. Finaly, the concept of portion coherence proposed in this study seem so to be more than a pragmatic strategy; it also offers insight into the charting of boundaries when promoting coherence in teacher training programs. Teacher training must necessarily involve conceptual pluralism, as this profession is grounded in diverse and sometimes mutually contradictory theoretical assumptions from a variety of disciplines – and this is what makes it one of a kind (Biesta, 2023). This angle of view requires from future research a critical reexamination of the idea that comprehensive coherence is of paramount importance in teacher preparation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by The Levinsky-Wingate Academic Ethic Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

LB-S: Writing – original draft, Writing – review & editing, Visualization, Validation, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. GP: Writing – original draft, Writing – review & editing, Visualization, Validation, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. AH: Writing – review & editing, Funding acquisition, Methodology, Formal analysis, Resources, Investigation, Validation. YN: Writing – review & editing, Funding acquisition, Methodology, Formal analysis, Resources, Investigation, Validation. OP: Writing – review & editing, Conceptualization, Funding acquisition, Resources, Investigation. YE: Writing – review & editing, Funding acquisition, Resources.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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