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The role of the 2023 earthquakes in the competencies and critical thinking skills of teacher candidates in Türkiye

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Abstract

Background The impact of natural disasters on the professional development of teacher candidates has, to date, primarily been investigated in relation to psychological well-being and trauma. Nevertheless, the association between these extreme events and teacher candidates' personal and professional competencies, as well as their critical thinking skills, remains insufficiently addressed in the literature. In particular, for teacher candidates who directly experienced the 2023 earthquakes in Türkiye, there exists a distinct need for comprehensive research that integrates both quantitative and qualitative methodologies.

Methods This study employed a sequential explanatory mixed-methods design. In the quantitative phase, the Personal-Professional Competencies Perception Scale (PPCPS) and the Critical Thinking Standards Scale (CTSS) were administered to 304 teacher candidates at İnönü University who directly experienced the 2023 earthquakes. In the qualitative phase, semi-structured interviews were conducted with 37 purposively selected participants to contextualize and deepen the quantitative findings.

Results A positive, significant, and strong correlation was found between critical thinking skills and personal and professional competency ($r = .657$, $p < .01$). Qualitative findings revealed that in the post-earthquake period, teacher candidates developed positive perceptions of critical thinking, particularly under the themes of developing different perspectives, empathy, and increased awareness; however, the inefficiency of distance education, communication problems, and psychological difficulties negatively affected their perceptions of professional competence.

Conclusion Research findings indicate that the earthquakes had a bidirectional impact on teacher candidates' perceptions of competence and critical thinking. Among these İnönü University teacher candidates, traumatic experiences appeared to enhance cognitive and critical awareness consistent with Post-Traumatic Growth (PTG) theory, while simultaneously weakening teacher candidates' perceptions of professional competence, owing to distance learning disruptions and psychological challenges. These findings highlight that post-disaster teacher education processes should focus not only on academic sustainability but also on structural arrangements that support critical thinking, psychological resilience, and professional competencies.

Keywords Earthquake, Critical thinking, Personal and professional competencies

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Introduction

Large-scale earthquakes, such as the February 6, 2023 disaster in Türkiye, can profoundly disrupt the psychological and cognitive processes of directly affected individuals [49]. A review of the literature reveals that these effects are mostly discussed in the context of trauma, anxiety, and mental health [10, 31, 33]. However, recent studies suggest that natural disasters can have transformative effects on individuals' thought patterns and cognitive skills [12, 57]. These transformations are consistent with the broader framework of Post-Traumatic Growth (PTG) theory [72], which posits that individuals who undergo highly challenging life crises can experience positive psychological transformation, encompassing new personal strengths, enriched relationships, and revised life philosophy. Within this theoretical framework, research indicates that traumatic experiences may contribute to positive developments in individuals' thought patterns and cognitive-emotional orientations [25, 45]. A study conducted with university students in Türkiye after the 2023 earthquakes revealed a significant positive correlation between perceived social support and psychological resilience and PTG [73].

Research has identified a range of positive changes that individuals can experience after natural disasters: personal empowerment, awareness of new possibilities, increased appreciation of life, and deepened relationships [72]. These positive transformations are typically accompanied by cognitive changes — including revised assumptions about safety, institutional reliability, and meaning — that vary considerably across individuals [44, 65, 75]. Notably, the deliberate questioning of prior assumptions that drives PTG-related meaning-making shares its cognitive architecture with critical thinking — both require the capacity to interrogate taken-for-granted beliefs and construct alternative frameworks of understanding.

Empirical support for this overlap comes from disaster-affected populations, where post-traumatic cognitive engagement has been associated with higher-order reasoning outcomes [15, 17]. Whether this pattern holds within formal higher education — particularly where distance education mediates the post-disaster learning environment — remains largely unexplored, and constitutes the theoretical gap this study addresses.

Trauma-informed teacher education research highlights the importance of equipping teacher candidates with the knowledge and skills to support students who have experienced adversity [78]. Yet when teacher candidates themselves are among those who have experienced traumatic events, they occupy a particularly complex position: they must simultaneously process their own adversity while developing the professional competencies required to support students in similar circumstances. In navigating this dual burden, critical thinking serves not only as a general cognitive competency but as a professionally situated tool for making sense of extraordinary experiences. Its development is contingent on individual differences, institutional support, and the quality of educational conditions available during recovery [1, 43].

Critical thinking is not only an individual cognitive competence but also a fundamental professional skill that can be developed through education [63]. It plays a vital role in classroom problem-solving, evaluating students' learning processes, and pedagogical decision-making [54]. Building on this, increasing critical thinking practices in teacher education can contribute to teachers' ability to make sense of both their own experiences and the similar processes of their students [53, 59]. Critical thinking is therefore of particular importance for teacher candidates whose professional identity and pedagogical thinking are still in the developmental stage, and whose CT dispositions remain open to systematic cultivation through teacher education [13, 83].

Teacher education programs aim to equip graduates with the capacity to navigate complex, uncertain educational environments [34, 40]. Critical thinking thus functions not merely as a subject-matter competency but as a metacognitive resource that enables teacher candidates to monitor their own learning and ground their pedagogical decisions in evidence [19, 22].

The development of teacher candidates' critical thinking skills is considered a process closely related to the structuring and strengthening of their professional competencies [18, 61]. Teacher competencies encompass multidimensional structures beyond subject matter knowledge and pedagogical skills, including communication, problem-solving, managing learning, and pedagogical judgment [62]. Critical thinking may thus function as an integrative cognitive dimension that underpins and connects these competency domains.

The February 6, 2023 earthquakes in Türkiye profoundly reshaped the learning processes of teacher candidates, along with their cognitive awareness, professional decision-making, and reflective capacities [36]. Beyond its affective consequences, the earthquake constitutes a significant context for examining the cognitive and professional transformation of teacher candidates under conditions of acute institutional disruption.

Although the literature documents the psychological effects of earthquakes on individuals and the impact of distance education on teacher candidates separately, studies directly addressing the relationship between critical thinking skills and professional competency perceptions among earthquake-exposed teacher candidates remain scarce. Existing research focuses primarily on the affective consequences of earthquakes on educators [7, 24] or on the professional adaptation of teacher candidates in post-disaster contexts [38], without examining

the specific relationship between critical thinking skills and professional competency perceptions. The absence of mixed-methods research examining how teacher candidates make sense of disaster experiences through the lens of critical thinking and professional development creates a gap that the present study aims to address.

Addressing this gap, this study examines the relationship between critical thinking skills and personal and professional competencies of teacher candidates who experienced the February 6, 2023 earthquakes in Türkiye. Quantitatively, it investigates the relationships between critical thinking skills and competency perceptions; qualitatively, it explores how teacher candidates interpret their earthquake experience through the lens of critical thinking and professional development.

Critical thinking

Although definitions of critical thinking vary across theoretical traditions, a consensus has emerged around its core components: reasoned analysis, systematic evaluation of evidence, and the capacity to question one's own assumptions [28, 30]. What distinguishes contemporary conceptualizations from earlier cognitive-skills models is the recognition that critical thinking also encompasses epistemological dispositions — an individual's orientation toward knowledge as provisional, contestable, and context-dependent [41]. This dispositional dimension is particularly relevant to the present study: teacher candidates who experienced the 2023 earthquakes were confronted with conditions that directly challenged taken-for-granted assumptions about safety, institutional reliability, and professional roles, potentially activating precisely these epistemological orientations. Consistent with this framing, adversity-exposed individuals have been shown to engage in intensified meaning-making and cognitive re-evaluation in the aftermath of trauma [17].

Meta-analytic evidence consistently demonstrates that critical thinking is teachable and that pedagogical context significantly shapes its development [2]. Notably, Huber and Kuncel [42] find that while CT improves substantially over a normal college experience, curriculum-wide interventions do not necessarily produce incremental long-term gains — a finding that underscores the importance of contextual and instructional conditions for CT development. Importantly, Tiruneh et al. [74] found that gains are substantially larger when instruction is embedded within disciplinary content rather than taught as a standalone skill — a finding that raises questions about how the fragmentation of content delivery through post-earthquake distance education may constrain or redirect critical thinking development among the present study's participants. At the teacher education level specifically, Brookfield [11] argues that critical thinking is not merely an academic outcome but a foundational professional competency: teachers who cannot critically examine their own pedagogical assumptions are ill-equipped to support students navigating uncertainty — precisely the condition that post-earthquake schooling created. Andreucci-Annunziata et al. [5] demonstrate that critical thinking is a higher-order cognitive process amenable to training, and that instructional strategies vary considerably in their effectiveness across disciplinary contexts — suggesting that the abrupt shift to distance education in the post-earthquake period may have differentially affected participants depending on their prior exposure to discipline-embedded CT instruction.

Empirical evidence indicates that embedding critical thinking within practice-based learning experiences contributes to more effective development of higher-order cognitive skills [53]. While these findings establish what optimal conditions for critical thinking development look like, they simultaneously highlight the gap this study addresses: post-disaster teacher education is rarely examined as a site where such integration is tested under duress. The importance of systematically embedding critical thinking in the teaching-assessment cycle of educational programs [52, 58] takes on new theoretical significance when that cycle is disrupted — as it was for the İnönü University teacher candidates in this study. Notably, holistic approaches that strengthen critical inquiry and judgment in complex situations [55] presuppose institutional continuity and face-to-face interaction — conditions whose absence in the post-earthquake context transforms teacher education itself into an object of critical inquiry.

The relationship between teacher competencies and critical thinking

Teacher competencies are considered an integrated construct of cognitive, pedagogical, and reflective capacities necessary for teachers to effectively carry out their professional practice. These competencies are not limited to subject matter knowledge and teaching techniques; they also include teachers' ability to interpret complex situations, evaluate pedagogical options, and make informed decisions [23]. Higher-order thinking skills, especially critical thinking, are therefore argued to play an important role in the development of teacher competencies [52, 80].

Critical thinking provides the reflective backbone of teacher competencies: it enables practitioners to interrogate pedagogical assumptions, evaluate practices against evidence, and restructure professional routines in response to contextual demands [11, 50]. Under conditions of adversity, this relationship is expected to be bidirectional — disrupted contexts may simultaneously erode routine competencies while activating higher-order

critical reflection [8, 38]. Under such conditions, critical thinking demands shift from routine pedagogical application toward epistemic flexibility — the capacity to navigate uncertainty, revise assumptions, and construct new professional meaning in the absence of familiar institutional structures.

Empirically, teachers with stronger critical thinking skills report higher professional competency perceptions [4, 82] and adopt more flexible, reflective approaches to classroom decision-making [27]. Within teacher training programs, critical thinking functions as a superstructure that connects professional knowledge to practice — grounding pedagogical judgment, as Loughran [56] argues, in reasoned inquiry rather than unreflective routine.

Extraordinary circumstances and teacher training

Extraordinary events such as large-scale earthquakes and pandemics do not merely disrupt teacher training logistically — they fundamentally alter the pedagogical conditions and learning environments under which teacher candidates develop their professional practice [7, 14]. The restructuring of practice areas in teacher education and the urgent revision of pedagogical approaches documented in the literature [77] reflect a broader pattern: crises force teacher candidates to engage with professional demands that pre-service programs rarely simulate. From a PTG perspective, this forced engagement can constitute a site of psychological and professional transformation — but only under conditions where adequate support, meaning-making resources, and institutional continuity are available [72]. The mandatory shift to distance education in post-earthquake contexts illustrates this double-edged character: it preserved educational access while simultaneously eliminating the face-to-face interaction, mentoring, and embodied professional practice that are most generative for both critical thinking and competency development [47], [39].

Studies consistently demonstrate that extraordinary circumstances not only create limitations in teacher training but also present opportunities to test and develop cognitive and professional capacities [8, 68]. This tension between limitation and opportunity is precisely what PTG theory seeks to explain: positive psychological transformation does not emerge from the traumatic event itself, but from the cognitive and emotional struggle to rebuild a coherent worldview in its aftermath [72]. When applied to teacher education, this framework suggests that extraordinary circumstances can, under specific conditions, serve as catalysts for the kinds of reflective, questioning, and adaptive thinking that constitute critical professional competence [77]. However, PTG is neither automatic nor universal: the extent of post-traumatic growth depends critically on perceived social support, psychological resilience, and individual coping resources [26], [73] — all of which varied substantially among the İnönü University teacher candidates in this study, providing the theoretical rationale for examining both positive and negative outcomes in the analyses that follow.

Purpose of the research

The aim of this research is to examine the relationship between critical thinking skills and personal and professional competencies of teacher candidates who experienced the earthquakes that occurred in Türkiye on February 6, 2023. To realize this objective, the study sought answers to the following questions:

1. What are the personal and professional competencies and critical thinking skills of teacher candidates who experienced the earthquakes?
2. Is there a significant relationship between the personal and professional competencies and critical thinking skills of teacher candidates who experienced the earthquakes?
3. What effect do the post-earthquake conditions have on the personal and professional competencies and critical thinking skills of teacher candidates?

Method

Research design

This study employed a sequential explanatory mixed-methods design, in which quantitative data were collected and analyzed first, followed by qualitative data to explain and contextualize the quantitative findings [21]. This design was selected because the relationships between critical thinking skills and professional competencies in a post-earthquake context cannot be adequately captured through quantitative data alone — the extraordinary circumstances of the 2023 earthquakes required a contextually grounded examination of how teacher candidates experienced and interpreted these relationships.

In the quantitative phase, the relationships between teacher candidates' critical thinking skills and their personal and professional competency perceptions were examined using standardized scales. In the qualitative phase, semi-structured interviews were conducted with 37 teacher candidates who experienced the February 6, 2023 earthquakes, exploring how participants evaluated their critical thinking skills and professional competencies in the post-earthquake period. Quantitative findings informed the selection of qualitative participants and the development of interview questions; qualitative themes were then used to explain patterns that statistical analysis alone could not account for.

Sample

The quantitative sample consisted of 304 teacher candidates enrolled in the Faculty of Education at İnönü University during the 2022–2023 academic year. Participants were selected via simple random sampling [32]. Inclusion criteria required enrollment in a teacher education program, direct experience of the 2023 earthquakes, voluntary participation, and completion of all instruments.

Sample size was determined through power analysis using a moderate effect size (r = 0.30), α = 0.05, and 80% power, yielding a minimum of 250 participants; the achieved sample of 304 exceeded this threshold [20]. Approximately 10% of the participants were first-year students, 15% were second-year students, 47% were third-year students, and 28% were fourth-year students. Regarding gender distribution, 76% of the participants were female and 24% were male.

The qualitative phase included 37 teacher candidates — 23 women and 14 men — drawn from the quantitative sample: 9 were second-year, 18 third-year, and 10 fourth-year students. Participants were selected through criterion sampling, with the primary criterion being enrollment at the Faculty of Education at İnönü University during the February 6, 2023 earthquakes. Accordingly, only second-, third-, and fourth-year students from the 2023–2024 academic year were eligible, as first-year students had matriculated after the earthquakes and therefore lacked direct experience of the event. Additional inclusion criteria were: prior participation in the quantitative phase and voluntary agreement to participate in semi-structured interviews.

Data collection tools

Quantitative data collection tools

Three instruments were used for quantitative data collection: a Demographic Information Form (gender and grade level), the Personal-Professional Competencies Perception Scale (PPCPS), and the Critical Thinking Standards Scale (CTSS).

The PPCPS, developed by Kazu and Demiralp [46], comprises 18 items that assess four competency dimensions: Competency to Work Independently and Take Responsibility (4 items), Field-Specific Competence (5 items), Learning Competency (5 items), and Communication-Social Competence (4 items). Confirmatory factor analysis (CFA) indicated acceptable fit (GFI = 0.90, CFI = 0.95, RMSEA = 0.064, SRMR = 0.039). Internal consistency reliability coefficients were as follows: Independent Work = 0.78, Field-Specific = 0.86, Learning = 0.85, and Communication = 0.67.

The CTSS [6] consists of 42 items across three dimensions: Depth, Breadth and Adequacy (α = 0.91),Precision and Accuracy (α = 0.82); and Importance, Relevance and Clarity (α = 0.68). CFA indicated acceptable fit (GFI = 0.85, CFI = 0.90, RMSEA = 0.052, SRMR = 0.056). Although the GFI value falls slightly below the conventional 0.90 threshold, CFI, RMSEA, and SRMR values indicate acceptable model fit. The scale's multidimensional coverage of critical thinking aligned with this study's theoretical framework. To address the sub-dimensional reliability limitations, total scores rather than sub-dimension scores were prioritized in the analyses, and findings were triangulated with qualitative data.

Qualitative data collection tool

Semi-structured interviews were used in the qualitative phase to explore how post-earthquake conditions affected teacher candidates' professional competencies and critical thinking skills. The interview form consisted of 4 open-ended questions alongside 2 demographic items (gender and grade level). It was developed in consultation with field experts in education and aligned with the quantitative scales to ensure conceptual coherence across the two phases. The questions were designed to be broad in scope, each addressing multiple dimensions of participants' post-earthquake experiences. Qualitative data were analyzed using thematic analysis, with themes subsequently used to explain and contextualize the quantitative findings.

Analysis of data

For analyzing the data collected from teacher candidates, the normal distribution of the data was examined prior to selecting appropriate statistical tests. The Skewness values ranged from −1.120 to 1.171, and the Kurtosis values ranged from 0.880 to 1.507. Since both values fell within the acceptable range of −1.5 to + 1.5, the data exhibited a distribution close to normal with no significant deviation [35]. Given the sample size (n = 304), the central limit theorem further supports the use of parametric tests.

Descriptive statistics (mean, standard deviation) were calculated for competency and critical thinking scores (Research Question 1). Pearson correlation analysis was used to examine the relationships between these variables (Research Question 2).

For Research Question 3, qualitative data were analyzed using content analysis. Interview transcripts were read repeatedly to ensure familiarization, after which preliminary codes were generated in relation to the theoretical framework and research questions. Similar codes were grouped into sub-themes and higher-order themes, which were then systematically presented and interpreted. Emerging themes were interpreted in relation to the study's theoretical framework, connecting participants' experiences to the constructs of critical thinking and professional competency development.

To ensure reliability, coding was conducted independently by two researchers. Inter-coder agreement was

Table 1 Descriptive statistics for teacher candidates' PPCPS scores

Dimensions	N	x̄	Ss
Competency to Work Independently- Responsibility (CWIR)	304	4.21	.58
Competency related to field	304	4.15	.63
Learning Competency (LC)	304	4.22	.54
Communication and Social Competency (CSC)	304	3.87	.75
Mean	304	4.12	.49

Table 2 Descriptive statistics for teacher candidates' CTSS scores

Dimensions	N	x̄	Ss
Depth, Breadth and Adequacy (DBA)	304	4.22	.48
Precision and Accuracy (PA)	304	3.80	.57
Importance, Relevance and Clarity (IRC)	304	3.99	.46
Mean	304	4.03	.38

calculated using Cohen's kappa coefficient (κ = 0.75), indicating high agreement [51]. Discrepancies were resolved through discussion and consensus. Methodological triangulation was employed to strengthen validity: data saturation was monitored during collection [37], themes were reviewed by field experts, and findings were grounded in direct participant quotations [60].

Findings

Findings on the personal and professional competencies and critical thinking skills of teacher candidates who experienced the earthquakes

The first sub-problem examined teacher candidates' personal and professional competencies and critical thinking skills. Findings are presented in Tables 1 and 2.

According to Table 1, sub-dimension scores ranged from $\bar{X} = 3.87$ (Communication and Social Competence) to $\bar{X} = 4.22$ (Learning Competence), with Field-Specific Competence ($\bar{X} = 4.15$) and Competency to Work Independently and Take Responsibility ($\bar{X} = 4.21$) also indicating high perceived competency. The overall mean score was $\bar{X} = 4.12$, indicating high perceived competency across all sub-dimensions. The lowest mean was observed for Communication and Social Competence ($\bar{X} = 3.87$), suggesting relatively lower perceived competency in interpersonal and social dimensions compared to the other sub-scales.

According to Table 2, sub-dimension scores ranged from $\bar{X} = 3.80$ (Precision and Accuracy) to $\bar{X} = 4.22$ (Depth, Breadth and Adequacy), with Importance, Relevance and Clarity ($\bar{X} = 3.99$) also indicating high perceived critical thinking competency. The overall mean score was $\bar{X} = 4.03$, indicating that teacher candidates perceived themselves as having high critical thinking skills across all dimensions. Among the sub-dimensions, Precision and Accuracy returned the lowest mean ($\bar{X} = 3.80$), indicating that participants felt comparatively less confident in this aspect of critical thinking.

Table 3 The relationship between critical thinking skills and personal and professional competence

		Personal and Professional Competence
Critical Thinking Skills	r	.657**
	p	.000
	N	304

**$p < .01$

Table 4 Pearson correlation coefficients between the subdimensions of the CTSS and the PPCPS

		Subdimensions of CTSS		
		DBA	PA	IRC
Subdimensions of PPCPS	Competency to Work Independently- Responsibility (CWIR)	.615**	.229**	.544**
	Field-Specific Competence	.548**	.163**	.536**
	Learning Competency (LC)	.623**	.149**	.659**
	Communication and Social Competency (CSC)	.267**	.050	.270**

DBA Depth, Breadth and Adequacy, *PA* Precision and Accuracy, *IRC* Importance Relevance and Clarity

**$p < .01$

Findings on the relationship between personal and professional competencies and critical thinking skills

In the second sub-problem, a Pearson correlation analysis was conducted to examine whether a significant relationship exists between the personal and professional competencies and critical thinking skills of teacher candidates who experienced the earthquakes. Results are presented in Tables 3 and 4.

Pearson correlation analysis results show a positive, significant, and strong correlation between teacher candidates' critical thinking skills scores and their personal and professional competency scores ($r = 0.657$, $p < 0.01$). The literature indicates that correlation coefficients of 0.60 and above indicate a strong relationship [20], [69]. This finding reveals that teacher candidates' personal and professional competency levels and critical thinking skills co-vary,however, this association does not allow for the establishment of a causal relationship between the variables. Teacher candidates with high personal and professional competency scores tended to have relatively high critical thinking skill scores as well.

To examine whether the relationship between critical thinking and professional competency was consistent across sub-dimensions, the interactions between the subdimensions of each scale were also analyzed. Detailed findings are presented in Table 4.

Table 4 shows that no statistically significant relationship was found between Communication and Social

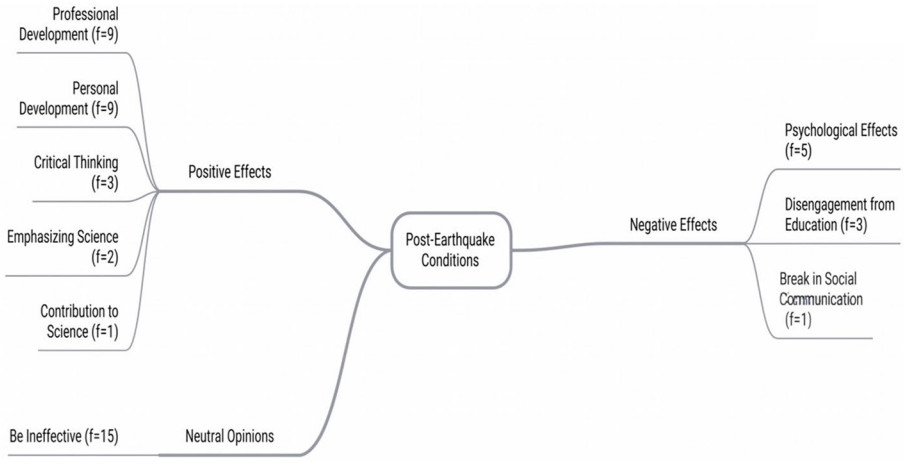

Fig. 1 Opinions on the effects of post-earthquake conditions on the personal and professional competencies of teacher candidates

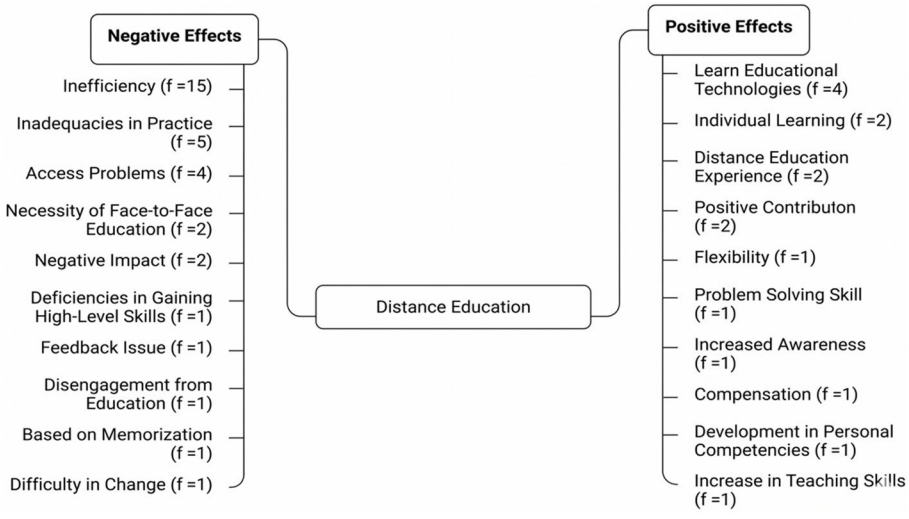

Fig. 2 Opinions on the effects of distance education on the personal and professional competencies of teacher candidates

Competency and the Precision and Accuracy sub-dimension of critical thinking ($r = 0.050$, $p > 0.01$). The Precision and Accuracy sub-dimension exhibited weak but significant correlations with the remaining competency sub-dimensions. Similarly, Communication and Social Competency showed weak significant correlations with Depth ($r = 0.267$, $p < 0.01$) and Importance, Relevance and Clarity ($r = 0.270$, $p < 0.01$). The remaining sub-dimension pairs showed positive, significant, and strong correlations. The strongest correlation was observed between Learning Competency and Importance, Relevance and Clarity ($r = 0.659$, $p < 0.01$).

These findings indicate that, with the exception of the Communication and Social Competency — Precision and Accuracy pairing, teacher candidates' personal and professional competency sub-dimensions and critical thinking sub-dimensions co-vary positively and significantly. Teacher candidates with higher competency scores tended to score higher across most critical thinking sub-dimensions; however, no causal relationship can be established between the variables.

Qualitative findings: effects of post-earthquake and distance education conditions

This section presents findings on the effects of post-earthquake and distance education conditions on teacher candidates' personal and professional competencies and critical thinking skills. Findings are organized across four figures: Figs. 1 and 2 address professional competencies, and Figs. 3 and 4 address critical thinking skills, examining post-earthquake and distance education conditions respectively.

Figure 1 shows that the most prevalent theme in teacher candidates' perspectives on post-earthquake conditions and professional competencies was Positive Effects ($f = 24$), followed by Neutral Views ($f = 15$) and Negative Effects ($f = 9$). Within the Positive Effects theme, the most frequently cited codes were professional

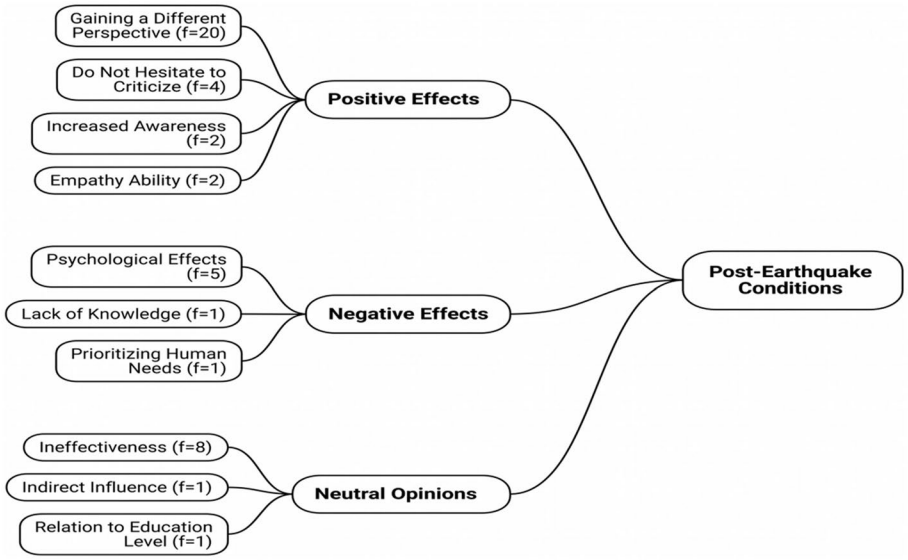

Fig. 3 Opinions on the effects of post-earthquake conditions on teacher candidates' critical thinking skills

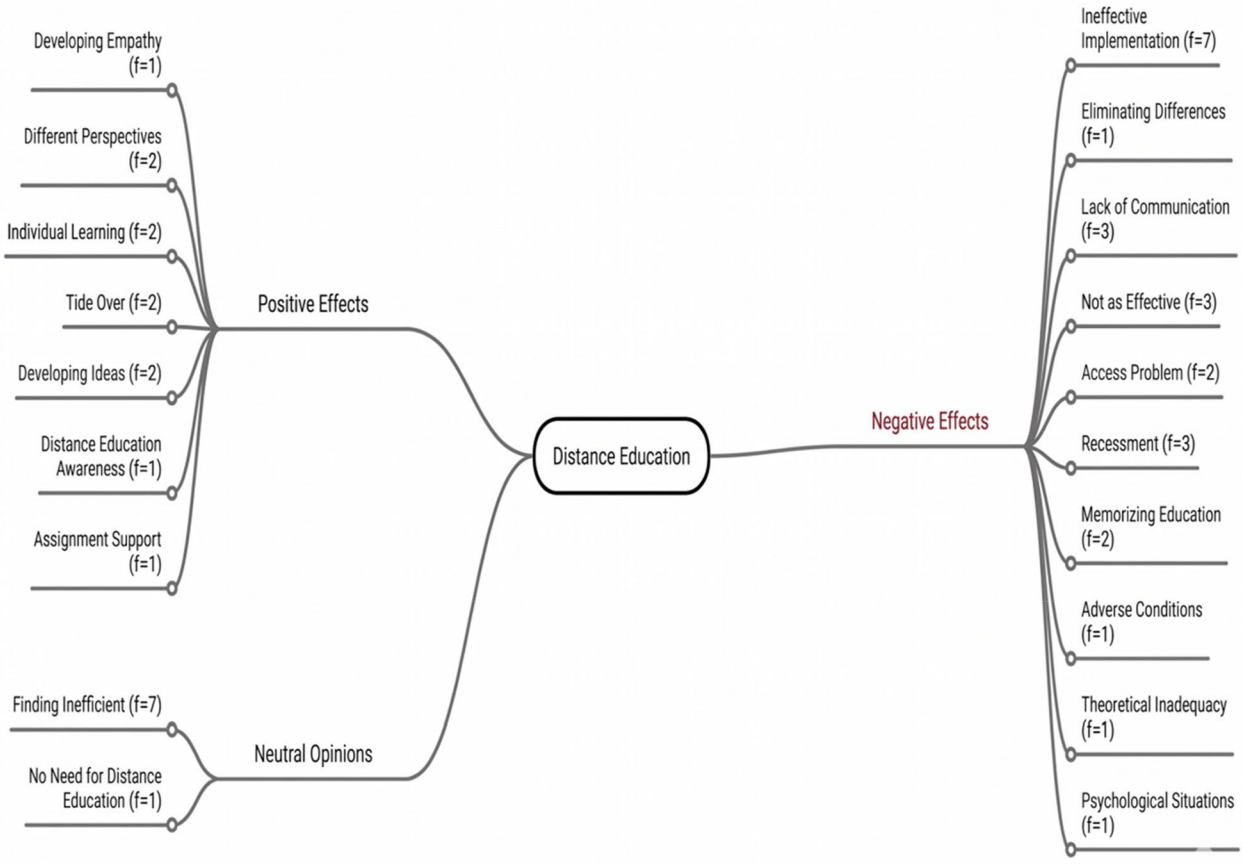

Fig. 4 Opinions on the effects of distance education on the critical thinking skills of teacher candidates

development and personal development (f = 9 each). Within the Negative Effects theme, psychological effects was the most frequently cited code (f = 5). Among Neutral Views, the most frequently cited code was the perception that post-earthquake conditions had no discernible effect on personal and professional competencies (f = 15).

Within the Positive Effects theme, participants reported gains in professional and personal development.

S29 reported: "*I saw the students in the tents. I thought about what I could do there. I have seen many different aspects of how teaching is carried out in the event of a disaster such as an earthquake. This was useful for me. Education is everywhere.*" S9 stated: "*Personally, I learned to remain calm and cautious and the importance of scientific information, and professionally, I realized that we are in an important place in informing our students.*"

Negative and neutral views were also expressed. S28 stated: "*The need to be more sensitive to the emotional needs of students and support them is more evident in cities where earthquakes occurred, but I do not think that the earthquake directly affected the personal and professional skills of teacher candidates.*" S4 reported: "*Since teaching is a practical profession, we had difficulties after the earthquake. At this point, the earthquake also affected people's psychology and we were completely disconnected from classes.*" S37 provided the most detailed account: "*Earthquake is a difficult and traumatic situation, and as teacher candidates, we are also human beings, and the simplest effect is the fear of earthquakes, which occurs in both teachers and students, and this is a trauma that causes serious changes in our personalities. After the earthquake, the duration of the lessons was shortened to 30 min. The reduction in time may have caused teachers to develop different professional methods in order to complete the lessons. The fear of earthquakes and the panic situations that occur as a result may change the personality of the teacher.*"

Figure 2 presents findings on how distance education affected teacher candidates' personal and professional competencies.

Figure 2 shows that the most prevalent theme in teacher candidates' perspectives on the impact of distance education on personal and professional competencies was Negative Effects (f = 34), followed by Positive Effects (f = 16). Within the Negative Effects theme, the most frequently cited code was inefficiency (f = 15), followed by inadequacies in practice (f = 5). Within the Positive Effects theme, the most frequently cited code was learning educational technologies (f = 4).

Among negative views, S29 reported: "*It was not very productive for me in terms of professional competence. Because sometimes I couldn't even see the teacher, the person I would take as a role model in the future.*" S30 offered a more nuanced perspective: "*Although the education I received during the distance education period did not develop my competencies as effectively as face-to-face education in terms of personal competence, I can say that it brought me to a better level in terms of professional competence.*" Among positive views, S10 stated: "*If I have to do distance education professionally in the future, I learned what to pay attention to and what to do to make the education more efficient.*" S21 reported: "The most important contribution of the distance *education period was learning the educational practices we used during that period.*"

The effects of post-earthquake and distance education conditions on teacher candidates' critical thinking skills are presented in Figs. 3 and 4, respectively.

Figure 3 shows that Positive Effects was the dominant theme regarding the impact of post-earthquake conditions on critical thinking skills (f = 28), followed by Neutral Views (f = 10) and Negative Effects (f = 7). Within the Positive Effects theme, the most frequently cited code was gaining a different perspective (f = 20), followed by not hesitating to criticize (f = 4). Within the Negative Effects theme, psychological effects was the most frequently cited code (f = 5). Among Neutral Views, the most frequently cited code was ineffectiveness (f = 8).

Among positive views, S6 stated: "*The earthquake has a lot of negative effects, but it also has a small positive effect. We experienced painfully that there should not be a society that does not speak out against the injustices experienced during the earthquake, and we also understood the importance of critical thinking and education level.*" S13 reported: "*The February 6 earthquake caused me to look at everything around me with a questioning eye. Witnessing that we live our lives in such a fragile world allowed me to look at people and the environment with a more critical eye.*" In contrast, S18 reported: "*Yes, it definitely happened because people were afraid and unfortunately they are not very healthy psychologically.*" S22 stated: "*I had hesitation in expressing critical opinions because it was a more emotional period.*" S17, representing neutral views, reported: "*The conditions that emerged after the earthquake did not have any effect on my critical thinking skills.*"

Figure 4 presents findings on the effects of distance education conditions on teacher candidates' critical thinking skills, with responses organized according to positive, neutral, and negative effect themes.

Figure 4 shows that the impact of distance education on critical thinking skills was perceived predominantly negatively (f = 24), followed by Neutral Views (f = 8) and Positive Effects (f = 11). Within the Negative Effects theme, the most frequently cited code was the ineffective implementation of distance education (f = 7), followed by lack of communication, regression, and being less effective than face-to-face education (f = 3 each). Within the Positive Effects theme, responses were distributed across multiple codes, with approaching events from different perspectives, individual learning, learning from difficulties, and developing different ideas being the most frequently cited (f = 2 each). Among Neutral Views, the most frequently cited code was perceiving no effect (f = 7).

Among negative views, S12 stated: "*I think my critical thinking skills have decreased during the distance*

education period. Because I think being deprived of interactive learning opportunities such as discussion and group work due to the decrease in face-to-face interaction is a disadvantage in terms of critical thinking." S30 reported: "*I think that the undergraduate education I received during the distance education period dulled my critical thinking skills. Considering the possibilities and the current situation, I have an opinion that it is not a healthy process. However, I can say that we tried to compensate for the situation to some extent by doing research, obtaining accurate information, analyzing and synthesizing this information, thanks to project assignments that can be given even remotely. However, face-to-face education affects critical thinking skills more positively.*" Among positive views, S37 stated: "*Distance education is a difficult and troublesome process, so the problems that occurred in this process had an impact on my critical thinking.*" S7 reported: "*I could see that even those who knew very well that not everything was true were wrong or incomplete*." S25, representing neutral views, stated: "*It didn't have much of an impact*." S27 reported: "*I can't say it affected me positively.*"

Discussion

The findings presented above are discussed below in relation to the existing literature and the theoretical framework of the study. Teacher candidates in this study generally perceived their personal and professional competencies as sufficient, consistent with prior research reporting moderate-to-high competency perceptions [16, 67, 70]. Studies conducted during the COVID-19 pandemic found significant declines in both professional and digital competency perceptions among teacher candidates [29, 66], suggesting that the nature and duration of extraordinary circumstance — rather than crisis exposure per se — shapes its impact on professional self-perception.

The convergence of quantitative and qualitative findings indicates that distance education had predominantly negative effects on both competency and critical thinking perceptions. This aligns with Turkish studies conducted during the COVID-19 period, which consistently found that online delivery offers a more limited contribution to teacher candidates' professional development compared to face-to-face education — particularly in practice-based courses [39, 48].

However, distance education should be evaluated not only in terms of its limitations but also in terms of its function in ensuring educational continuity under extraordinary circumstances. Distance education has been identified as a mechanism for maintaining educational continuity during large-scale crises [3, 81]. At the same time, it offers opportunities for individual learning responsibility and flexibility in time and place [76].

The qualitative findings of this study similarly show that some teacher candidates viewed distance education as a tool for ensuring educational continuity in the uncertain and chaotic environment created by the earthquakes. However, the intense emotional burden experienced by faculty and students, physical and technological deficiencies, and communication problems also negatively affected the distance education experience. These findings underscore the importance of higher education institutions being prepared not only pedagogically but also psychosocially and technologically in the aftermath of large-scale disasters. The current findings thus support recommendations that universities develop holistic preparedness plans for disaster and crisis situations [79].

One of the study's striking findings is that teacher candidates perceived their critical thinking skills as high. This finding diverges from studies reporting that teacher candidates generally demonstrate insufficient critical thinking skills [9, 64, 71]. This divergence may reflect the role of contextual factors: the earthquake experience itself may have prompted forms of critical questioning and assumption-revision that teacher candidates interpreted as heightened critical awareness, even in the absence of structured CT instruction.

Qualitative findings indicate that a large proportion of teacher candidates stated they did not take courses directly targeting critical thinking during their undergraduate education. This is consistent with evidence that curriculum-wide interventions do not necessarily produce incremental gains in critical thinking [42], suggesting that perceived high levels of critical thinking may have been shaped through individual experiences, personal awareness, and life events rather than structured pedagogical processes. The earthquakes of February 6, 2023, may thus have triggered processes of critical questioning, reviewing assumptions, and re-evaluating professional roles among teacher candidates.

These results are consistent with PTG theory's proposition that post-traumatic cognitive engagement — the effort to make meaning of disruptive events — can itself become a mechanism of growth [65, 72]. In this study, the earthquake appears to have functioned not only as a traumatic event but as a context that prompted questioning of prior professional assumptions and re-evaluation of pedagogical values. This interpretation is constrained to the specific population and institutional setting examined,it does not imply that earthquake exposure universally enhances critical thinking.

Taken together, these results suggest that teacher candidates' critical thinking skills and their perceptions of personal and professional competencies can be reshaped in the context of extraordinary circumstances. CT development in teacher education cannot be adequately understood outside of the contextual conditions

— including crisis, uncertainty, and institutional disruption — in which it unfolds. This points to the need for trauma-informed, context-sensitive approaches to CT instruction in pre-service teacher education.

Conclusion

This study reveals that the 2023 earthquakes had significant and multifaceted effects on teacher candidates' perceptions of personal and professional competencies and critical thinking skills. While quantitative findings indicated generally high competency perceptions, qualitative data documented substantial disruption to professional confidence — a pattern consistent with the bidirectional character of traumatic experience and PTG theory's core insight that struggle with highly challenging circumstances can yield growth alongside continued distress [72].

Distance education played a decisive yet ambivalent role in mediating these outcomes: it ensured educational continuity where face-to-face instruction was impossible, while simultaneously constraining the conditions most generative for professional learning through communication deficiencies, inadequate infrastructure, and psychological burden.

These findings point to the need for teacher education programs to develop systematic frameworks for supporting professional learning under extraordinary conditions — not as an exceptional measure, but as a structural feature of crisis-ready teacher preparation.

Recommendations

Based on the findings of this study, the following recommendations are offered for teacher education policy and practice.

Teacher education programs should incorporate dedicated coursework on disaster preparedness and crisis pedagogy — whether as compulsory modules or structured electives. Such courses should address crisis management, psychological resilience, post-traumatic pedagogical approaches, and educational continuity planning under disaster conditions.

Instructional approaches that develop critical thinking in high-stakes contexts — including problem-based learning, scenario analysis, and disaster-based case studies — should be systematically embedded in teacher training curricula. Such methods strengthen analytical reasoning and decision-making under conditions of uncertainty.

Universities should develop institutional emergency distance education protocols prior to crisis events. These protocols should specify flexible assessment mechanisms, psychosocial support pathways, and crisis pedagogy guidelines for instructors, enabling more adaptive and equitable educational delivery when disasters occur.

Future research should employ longitudinal and mixed-methods designs to examine how teacher candidates' resilience, professional competency perceptions, and critical thinking develop over time following disaster exposure. Tracking these trajectories across recovery periods would clarify the mechanisms through which adverse conditions either constrain or catalyze professional growth.

Finally, universities and the Ministry of National Education (MoNE) should establish structured collaboration to develop field-based training and internship models that systematically convert disaster-period experiences into recognized professional learning. Such frameworks would position teacher candidates not merely as disaster-affected learners, but as emergent professionals gaining practical competencies under genuinely challenging conditions.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, both the competency and critical thinking data were collected through self-report instruments administered under post-earthquake conditions. Self-report measures are susceptible to social desirability bias and retrospective distortion, and these concerns are amplified when participants complete scales in the immediate aftermath of a traumatic event. Although trauma can sometimes heighten self-awareness and reflective capacity — consistent with PTG theory — it may equally distort self-perception in ways that are difficult to detect or control.

Second, the study used a cross-sectional design with a single-institution sample (İnönü University Faculty of Education), with data collected at a single time point during the post-earthquake recovery period. This limits both temporal and geographic generalizability. The qualitative sample, though purposively selected to ensure variation, comprised 37 participants from a single institution, which further limits the transferability of thematic findings to other contexts. The findings reflect the perceptions of teacher candidates at one university in an earthquake-affected region at a specific point in time; they cannot be assumed to represent the experiences of teacher candidates at unaffected institutions or across different disaster contexts. Future studies should employ longitudinal designs, include comparison groups from non-disaster-affected universities, and triangulate self-report data with observational or performance-based measures of competency and critical thinking.

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Authors' contributions

D.G.: Conceptualization, writing, supervision. M.C.: Data collection. M.D.: Analysis. C.S.: Editing/reviewing.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was conducted in compliance with local regulations and institutional guidelines. Written informed consent was obtained from all participants prior to their involvement in the research.
The authors affirm that this work is original and adheres to the principles of scientific ethics at every stage, including study design, data collection, analysis, and reporting. All external sources of data and information have been properly cited and included in the references. No alterations were made to the collected data, and the study strictly follows the ethical guidelines set forth by the Committee on Publication Ethics (COPE). Additionally, ethical approval for this research was granted by the Bayburt University Ethics Committee (Decision No: 204, Date: 26/05/2023).

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