International Journal of Evaluation and Research in Education (IJERE)
Vol. 15, No. 6, December 2026, pp. 4767~4777
ISSN: 2252-8822, DOI: 10.11591/ijere.v15i6.39730

Prior knowledge and peatland disaster risk reduction pedagogical readiness among prospective elementary teachers

Eddy Noviana, Otang Kurniaman
Department of Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas Riau, Pekanbaru, Indonesia

Article Info

Article history:

Received Mar 29, 2026
Revised Jul 17, 2026
Accepted Aug 6, 2026

Keywords:

Cognitive entry point
Hazard pedagogy
Mental models
Place-based learning
Teacher education

ABSTRACT

This explanatory mixed-methods study examines whether prior knowledge serves as a cognitive entry point (CEP) for pedagogical readiness in peatland disaster risk reduction (DRR) among prospective elementary teachers in Riau, Indonesia. Survey data from 298 respondents across six teacher-education institutions were analyzed using SmartPLS 4, while 708 open-ended responses were examined using thematic analysis. Quantitative findings indicate that prior knowledge significantly predicted mental models (β=0.275, $p<0.001$), pedagogical perceptions (β=0.235, $p<0.001$), and pedagogical readiness (β=0.231, $p<0.001$). Qualitative findings reveal that respondents organized peatland risk as linked ecological and social processes and identified contextual teaching, learning media, training, and institutional support as necessary conditions for classroom enactment. This study contributes to the CEP model for constructivist and place-based teacher education by demonstrating that prior knowledge is a professional resource for transforming regional lived experience into sustainable DRR pedagogy.

This is an open access article under the CC BY-SA license.

Corresponding Author:

Eddy Noviana
Department of Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas Riau
Kampus Bina Widya, Simpang Baru, Pekanbaru 28293, Indonesia
Email: eddy.noviana@lecturer.unri.ac.id

1. INTRODUCTION

Disaster risk reduction (DRR) education has become a central concern in contemporary education, not merely for teaching emergency procedures but also for shaping how young people interpret hazards and participate in community resilience-building [1], [2]. In peatland regions, this responsibility is more complex: drainage, recurrent fire, haze, and ecosystem disturbance form a slow-onset, regionally embedded risk system. Studies reveal that fire susceptibility intensifies as peat dries and water tables decline, posing long-term risks to restoration and hydrological recovery [3], [4]. In teacher education, the central challenge is therefore a pedagogical translation gap: lived experience in fire-prone landscapes does not automatically translate into professional instruction that children can understand and use.

Prior knowledge provides a theoretically robust starting point for addressing the pedagogical translation gap. Constructivist learning theory emphasizes that new understanding emerges through the reorganization of existing cognitive resources rather than passive reception. Research in educational psychology reveals that prior knowledge shapes attention, inference, elaboration, and transfer, especially when learners must reason about complex causal systems rather than memorize isolated facts [5]–[7]. Mental-model research adds a complementary perspective, indicating that coherent internal representations enable students to explain hazard processes, anticipate consequences, and evaluate mitigation options [8]. In peatland contexts, stronger prior knowledge should therefore support clearer reasoning about drainage, drying, fire susceptibility, haze exposure, and restoration, with direct implications for teacher education.

Previous international studies have highlighted considerable regional variation in teacher preparation for DRR education. Studies across Asia, Europe, and Latin America have examined curriculum integration, preparedness resources, learner agency, program implementation, and school-community responsibilities [9]–[17]. Research from Pakistan, Türkiye, Argentina, Chile, and Iran shows that school-based DRR is most effective when teacher competence, local knowledge, community engagement, and child-appropriate strategies are deliberately integrated [18]–[22]. Despite this progress, the literature still tends to focus on generic DRR and sudden-onset hazards. Far fewer studies investigate slow-onset, regional disasters such as peatland degradation and fire-haze cycles, even though these risks directly affect health, mobility, school attendance, and long-term sustainability. This lack of attention defines the research gap addressed in the present study.

This limitation is not only empirical; it is pedagogical. Standardized one-size-fits-all teacher training often assumes disaster knowledge can be transferred through uniform modules, regardless of ecological setting. Such approaches neglect the eco-cognitive histories of regional educators, shaped by repeated exposure to haze, fire alerts, land-use change, and community adaptation. Disaster-memory studies in Japan, Aceh, and Italy underscore that lived experience becomes an educational resource when organized through situated learning and intergenerational narratives [23]–[25]. For peatland regions, this evidence highlights the need for teacher education that transforms lived experience into causal explanation, child-sensitive communication, and preventive action.

A parallel body of teacher-education research sharpens this rationale. Professional readiness in new instructional domains does not emerge from exposure alone; it develops through knowledge integration, competence-building, design opportunities, and sustained program support. Utility-value interventions can strengthen prospective teachers' integration of pedagogical knowledge [26]; meta-analytic evidence shows that teacher training improves global competence [27]; and competence-assessment research underscores that professional readiness is multidimensional, involving knowledge, judgment, and enactment [28]. Indonesian scholarship adds a place-based dimension: disaster education becomes meaningful when scientific and community knowledge are transformed into forms that children can understand. Teachers can enact culturally resonant and socially responsive pedagogy, as indigenous knowledge and inclusive DRR research highlight the importance of such approaches [29]–[31].

Against this background, the present study addresses a specific research gap: the lack of empirical studies explaining how prior knowledge shapes peatland DRR pedagogical readiness among prospective elementary school teachers in a slow-onset regional disaster context. Cognitive Entry Point (CEP) model is a novel research contribution of this study, which positions prior knowledge not as a descriptive background variable but as a theoretically specified entry condition for mental models, pedagogical perceptions, and pedagogical readiness in peatland DRR teacher education. Unlike generic DRR studies that often examine preparedness, attitudes, or curriculum exposure in broad hazard contexts, this study explains how ecological experience in a slow-onset peatland risk system can be reorganized into professional pedagogical reasoning for elementary education. This novelty is also methodological, as the study links prediction-oriented partial least squares-structural equation modeling (PLS-SEM) with thematic evidence from prospective teachers' written explanations, thereby enabling the proposed model to be interpreted both statistically and conceptually. Accordingly, the study tests whether prior knowledge positively predicts mental models, pedagogical perceptions, and pedagogical readiness, and it uses qualitative evidence to interpret how those relationships become meaningful for peatland DRR instruction.

2. METHOD

2.1. Research design

This study employed an explanatory mixed-methods design with quantitative priority [32]. The quantitative strand tested a prediction-oriented structural model in which prior knowledge was specified as the exogenous construct and mental models, pedagogical perceptions, and pedagogical readiness were specified as endogenous constructs. The qualitative strand was embedded in the same instrument and served an explanatory function by clarifying how respondents described peatland risk, educational responsibility, and perceived readiness to teach. The design was aligned with the study's constructivist and place-based orientation: statistical modeling estimated the strength of the proposed relationships, while narrative analysis explained how prospective teachers organized local risk knowledge into pedagogical meaning.

2.2. Research setting and participants

The study was conducted in Riau, Indonesia, a peatland province where recurrent fire, haze episodes, drainage disturbance, and ecosystem degradation shape the broader educational context. The dataset comprised 298 valid responses from prospective elementary teachers enrolled in six teacher-

education institutions. As shown in Figure 1, the sample was concentrated in three institutions: University 1 (n=122), University 2 (n=82), and University 3 (n=80), with female respondents constituting 96.0% of the sample. This gender distribution reflects the demographic profile of elementary teacher education in the participating setting, but it is also acknowledged as a limitation when interpreting the transferability of the findings. To preserve institutional confidentiality, all institutions are coded as University 1 through University 6. Rather than identifying campuses directly, the manuscript characterizes them using non-identifying analytic dimensions, namely institutional scale, governance category, and regional catchment. Sample adequacy was established through an a priori power analysis in G*Power 3.1 using the F-test family for linear multiple regression, one predictor, alpha=0.05, power=0.95, and a medium effect size (f2=0.15). The analysis indicated a minimum required sample of 87 participants; therefore, the achieved sample of 298 substantially exceeded the recommended threshold [33], [34].

The anonymized university labels preserve institutional confidentiality while still conveying meaningful sample heterogeneity. Universities 1–3 comprise the largest respondent groups, whereas Universities 4–6 contribute additional representation from smaller providers. Collectively, the six institutions capture variation in organizational scale, governance arrangements, and regional catchment, thereby strengthening the sample's contextual credibility without compromising institutional anonymity.

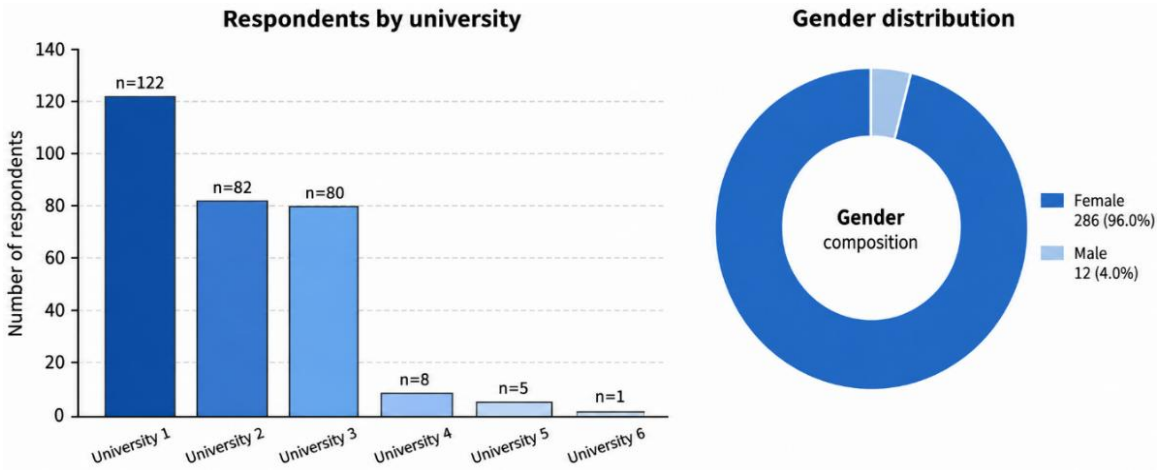


Figure 1. Distribution of respondents across anonymized universities and gender

2.3. Instrument development and construct operationalization

The questionnaire comprised demographic questions, closed-ended items, and three open-ended prompts. The closed-ended section initially contained 41 indicators distributed across four latent constructs: prior knowledge, mental models, pedagogical perceptions, and pedagogical readiness. Prior knowledge captured respondents' familiarity with peatland disaster issues and educational exposure. Mental models captured causal understanding of peatland characteristics, fire and haze processes, mitigation, and representational understanding. Pedagogical perceptions captured judgments about the value, feasibility, inclusion, and professional relevance of teaching peatland DRR. Pedagogical readiness captured preparedness to formulate objectives, select learning activities, choose media, assess learning, and facilitate age-appropriate classroom communication. The qualitative prompts were aligned with the same conceptual architecture and asked respondents to explain peatland disaster risk, the role of schools and teachers in reducing that risk, and their readiness to design, implement, and evaluate peatland DRR learning.

2.4. Data collection procedure and ethical safeguards

Data were collected via a self-report survey administered to eligible participants after obtaining free and informed consent. Participation was voluntary, and responses were analyzed in anonymized form. The study recruited university-level prospective teachers, not high school students or school-aged children; therefore, consent was obtained directly from the participating respondents in accordance with institutional approval. Only sufficiently complete responses were retained so that latent-variable estimates would remain comparable across constructs. No respondent names or institutional identifiers are reported in the manuscript, and all qualitative excerpts are presented as de-identified statements.

2.5. Quantitative analysis using SmartPLS

The quantitative data were analyzed in SmartPLS 4 using a staged measurement-to-structural procedure consistent with current PLS-SEM reporting expectations [35]. The measurement model was first examined through outer loadings, internal consistency, and convergent validity. Indicators with inadequate loadings were removed iteratively until the retained items met acceptable validity and reliability thresholds. The final model retained 22 indicators: three for prior knowledge, six for mental models, four for pedagogical perceptions, and nine for pedagogical readiness. The structural model was subsequently evaluated through path coefficients, coefficients of determination (R-squared), and predictive relevance (Q-square). This procedure provided empirical evidence supporting the reliability and convergent validity of the retained measures before their pedagogical meaning was interpreted.

2.6. Qualitative analysis using an NVivo workflow

The qualitative strand analyzed 708 narrative responses generated by the three open-ended prompts. Following Braun and Clarke's thematic analysis principles and an NVivo workflow [36], the analysis proceeded through data familiarization, open coding, theme clustering, cross-response comparison, and interpretive naming. Because the qualitative data consisted of concise survey narratives rather than long interviews, coding focused on recurring semantic patterns, causal explanations, value statements, perceived support, and perceived constraints. This procedure was especially important for the mental-model construct because it captured whether respondents described peatland risk as isolated facts or as linked causal relations among land, water, fire, haze, health, school responsibility, and mitigation.

2.7. Integration strategy and methodological rigor

Methodological rigor was strengthened in three ways. First, both strands were aligned at the instrument-design stage so that the qualitative prompts directly elaborated on the quantitative constructs. Second, SmartPLS and NVivo were used for different but complementary purposes: SmartPLS estimated the predictive strength of prior knowledge, whereas NVivo made the content of respondents' mental models and pedagogical reasoning visible. Third, integration was conducted through a joint-interpretive logic that compared statistical relationships with thematic patterns rather than reporting the two strands in parallel. Methodologically, the study examined the identification of the extent to which prior knowledge was consequential, how strongly it mattered, and what kind of reasoning made it pedagogically meaningful.

3. RESULTS AND DISCUSSION

3.1. Quantitative results: measurement model and structural estimates

The final measurement model met accepted thresholds for internal consistency and convergent validity. Composite reliability ranged from 0.863 to 0.953, and average variance extracted ranged from 0.608 to 0.741, indicating that the retained indicators satisfactorily represented their respective latent constructs. Table 1 summarizes the path coefficients, explained variance, and predictive relevance, while Figure 2 presents the structural model. All direct paths from prior knowledge to mental models, pedagogical perceptions, and pedagogical readiness were positive and statistically significant. These findings indicate that respondents with stronger prior knowledge also reported stronger pedagogical resources for peatland DRR.

As reported in Table 1, the strongest effect is observed for the path from prior knowledge to mental models (beta=0.275, $p<0.001$). This finding has substative theoretical implications because mental models are the bridge between knowing a hazard and being able to explain it. Prospective teachers who reported stronger prior knowledge are better able to connect drainage, peat drying, fire susceptibility, haze exposure, health consequences, and mitigation strategies into coherent explanatory systems. In constructivist terms, prior knowledge appears to organize the cognitive structure through which new DRR content can be understood. In place-based terms, it translates regional ecological experience into teachable causal relations. This interpretation is consistent with research showing that prior knowledge supports deeper learning and that coherent mental models are central to hazard explanation and risk communication [5]–[8].

Table 1. Structural path coefficients, explained variance, and predictive relevance

Paths	Beta	t-value	p-value	R-square	Q-square	Decision
Prior knowledge -> mental models	0.275	4.855	<0.001	0.076	0.042	Supported
Prior knowledge -> pedagogical perceptions	0.235	4.422	<0.001	0.055	0.037	Supported
Prior knowledge -> pedagogical readiness	0.231	4.728	<0.001	0.053	0.034	Supported

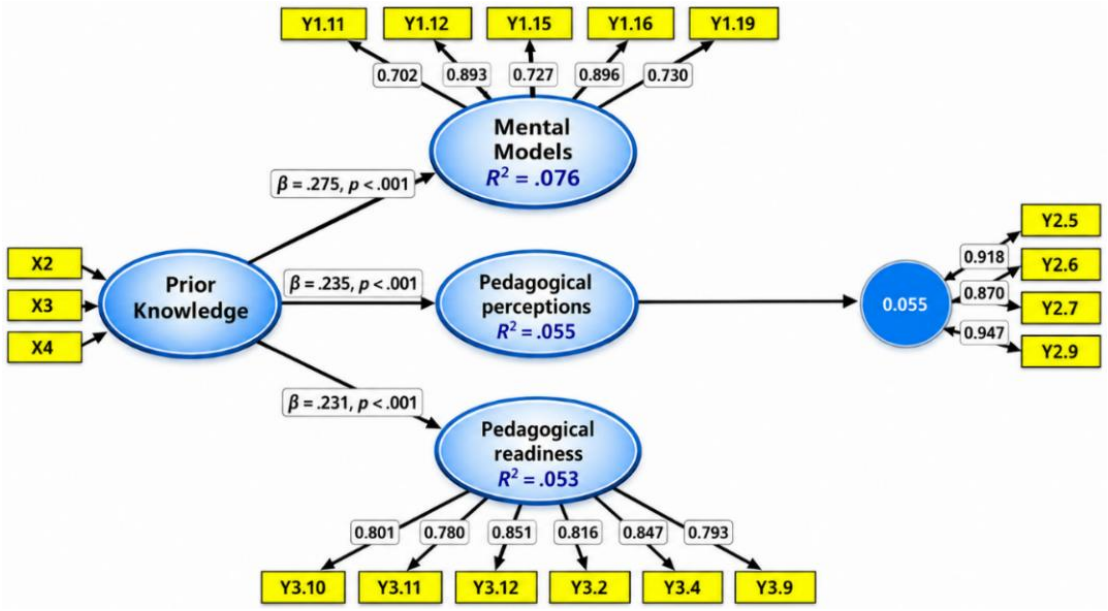


Figure 2. Structural model of prior knowledge, mental models, pedagogical perceptions, and pedagogical readiness

3.2. Qualitative results and mixed-method interpretation

The qualitative strand provided explanatory depth for these structural relationships. In the mental-model responses, 209 of 235 analyzable statements (88.9%) described peatland risk as a causal chain linking drainage, drying, fire, haze, and downstream harm. In the pedagogical-perception responses, 215 of 239 answers (90.0%) framed peatland DRR as early awareness-building and a shared responsibility of teachers and schools. In the pedagogical-readiness responses, 209 of 236 statements (88.6%) expressed willingness to teach the topic through contextual methods, while 196 of 236 also emphasized the continuing need for training, instructional materials, and institutional support. Figure 3 visualizes these dominant thematic relationships. The qualitative findings suggest that respondents did not merely repeat environmental keywords; many organized peatland risks as a connected pedagogical problem.

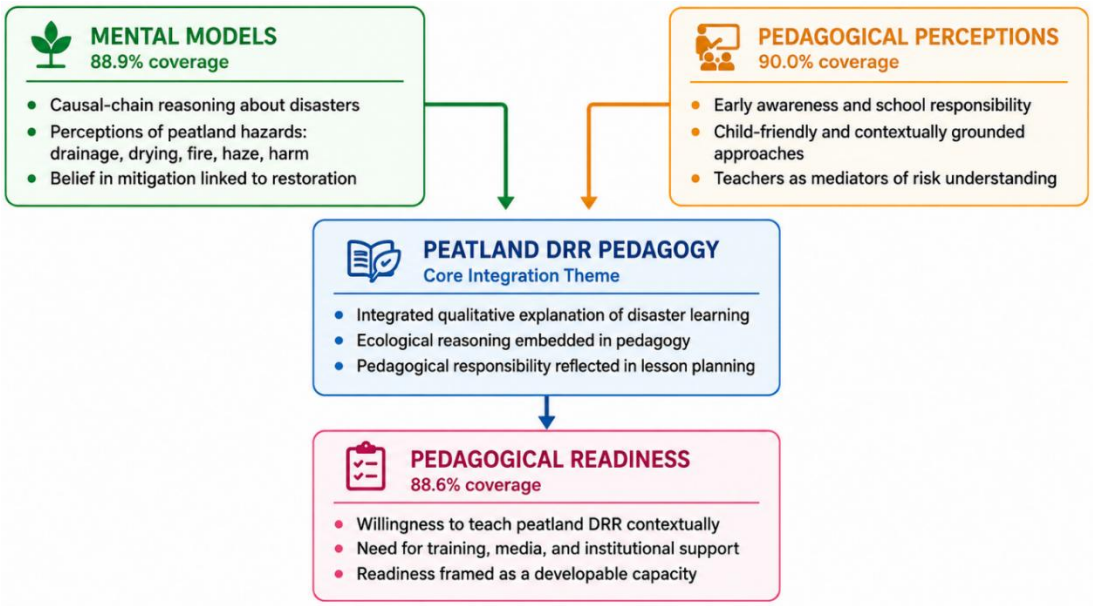


Figure 3. Map of dominant qualitative themes

Taken together, the quantitative and qualitative findings indicate that prior knowledge functions as explanatory scaffolding for peatland DRR pedagogy. The structural model demonstrates that prior knowledge predicts all three endogenous constructs, whereas the thematic findings clarify the mechanism behind those paths. Respondents with stronger knowledge were more likely to articulate causal explanations, assign educational responsibility to schools and teachers, and identify the supports needed for classroom enactment. Overall, the findings show that prior knowledge improves prospective teachers' understanding, perceptions, and readiness to teach DRR by providing a mental structure for translating lived regional risk into professional instruction.

3.3. Theoretical contribution

The proposed CEP model is grounded in prior knowledge and constructivist learning scholarship. Prior knowledge is treated not as a demographic background factor, but as the cognitive resource through which learners select information, make inferences, elaborate new material, and transfer understanding across contexts [5]–[7], [37], [38]. By translating this premise into teacher education, the CEP model specifies how existing ecological experience can be reorganized into professional knowledge for peatland DRR pedagogy. This consolidates constructivist theory by moving from a general claim about knowledge construction to a measurable model of how prospective teachers build readiness in a context-specific hazard domain.

The mental-model component of the CEP model is grounded in research that defines mental models as internal representations that support explanation, prediction, and problem-solving [8], [39]–[41]. In this study, mental models are not treated as generic cognitive images; they are causal representations of peatland hazard systems that include drainage, peat drying, fire susceptibility, haze, health risks, restoration, and school action. This interpretation also aligns with risk-communication scholarship, underscoring that educational interventions are more defensible when they begin from how learners already organize hazard processes in memory and reasoning [8], [41]. Therefore, the CEP model refines mental-model theory by showing how causal representations become a bridge between local environmental knowledge and pedagogical decision-making.

The pedagogical-perception component is grounded in scholarship on teacher beliefs and planned behavior. Teacher perceptions shape what future teachers consider relevant, teachable, feasible, and age-appropriate; thus, they influence the movement from knowledge to instructional intention [42], [43]. In peatland DRR, this means that prospective teachers must not only understand the hazard but also believe that it can be translated into elementary classroom language, activities, media, and assessment. The CEP model, therefore, integrates cognitive representation with pedagogical judgment, showing why beliefs about educational value and instructional feasibility must accompany prior knowledge.

The pedagogical-readiness component is rooted in teacher-competence scholarship that conceptualizes readiness as a continuum linking cognition, professional judgment, motivation, and enactment [44]–[50]. Within the CEP model, readiness is not reduced to self-confidence or willingness; it refers to the integrated capacity to formulate objectives, design learning activities, select media, communicate risk in child-sensitive ways, and evaluate learning. This position aligns with research indicating that professional competence and teacher efficacy influence instructional quality, while teacher professional learning depends on the interaction among individual knowledge, learning opportunities, and institutional support [45]–[50].

In addition, the CEP model refines place-based education theory by explaining the cognitive mechanism by which lived regional experience translates into pedagogical readiness. Place-conscious and sense-of-place scholarship emphasizes that learning becomes meaningful when it is anchored in local ecological, cultural, and community conditions [51]–[54]. The present study extends that argument by specifying prior knowledge as the entry point, mental models as the organizing mechanism, pedagogical perceptions as the interpretive filter, and pedagogical readiness as the instructional outcome. In doing so, the model challenges one-size-fits-all DRR training and argues that teacher preparation in peatland regions should begin from eco-cognitive resources that prospective teachers already possess.

3.4. Discussion

The results strengthen the study's rationale by addressing a question in DRR teacher education: why should prior knowledge be treated as more than a background variable? The relationship between prior knowledge and mental models provides relevant empirical evidence. Prior knowledge was the strongest predictor of mental models because peatland DRR requires causal explanation rather than simple recall. Teachers must be able to explain why water-table decline matters, how peat dries, why fire spreads below and above the surface, how haze affects children and schooling, and why restoration is preventive rather than merely remedial. Without an organized knowledge base, these relations can remain fragmented or become reduced to slogans. The finding supports a constructivist interpretation: readiness begins when learners reorganize existing knowledge into a coherent explanatory system [5]–[7]. It also supports place-based

education because the knowledge that matters is not abstract hazard information alone, but risk knowledge anchored in a particular ecological and social landscape [51], [52]. Theoretical grounding clarifies that the CEP model is not a free-standing label, but a synthesis of prior-knowledge research, mental-model theory, teacher-belief scholarship, teacher-competence frameworks, and place-based education [37]–[50], [53], [54].

The international comparison sharpens this contribution. Research from Indonesia and Pakistan shows that school DRR depends on curriculum integration, teacher competence, materials, and institutional support [10], [18]. Evidence from England, Rwanda, and Iran points to a similar challenge: resources and programs may exist, but their classroom value depends on coherence, evaluation, and implementation capacity [12], [13], [22]. Studies from Australia, Mexico, Argentina, Chile, Taiwan, Japan, and Türkiye add another layer by showing that effective disaster education is situated, participatory, child-sensitive, and connected to community engagement [14]–[17], [19]–[21]. The present study complements this work by identifying an earlier cognitive layer. Before prospective teachers can use modules, media, or school programs effectively, they need a mental model to interpret regional risk and convert it into age-appropriate pedagogy.

This is where the critique of one-size-fits-all teacher training becomes important. Generic DRR modules are useful as entry points, but they often overlook the eco-cognitive history of regional educators. Prospective teachers in fire-prone peatland regions may carry memories of haze, canceled outdoor activity, family health concerns, land-use debates, and community mitigation practices. These experiences can remain tacit unless teacher education makes them explicit. Disaster-memory research in Japan, Aceh, and Italy demonstrates that remembered risk can become a powerful educational resource when it is structured through narrative, situated learning, and intergenerational transmission [23]–[25]. Indonesian studies on didactic transposition, indigenous mitigation knowledge, and inclusive DRR education point in the same direction: local and scientific knowledge must be transformed carefully if it is to become equitable classroom learning [29]–[31].

The mixed-methods design adds methodological value to this argument. PLS-SEM showed that prior knowledge had significant predictive paths to mental models, pedagogical perceptions, and pedagogical readiness; The thematic analysis, supported by NVivo, provided contextual insights into respondents' interpretations of these constructs. This combination was especially useful for the mental-model construct. A quantitative coefficient alone could show that prior knowledge predicted mental models, but it could not show whether respondents understood peatland risk as a chain of drainage, drying, fire, haze, health, and mitigation. The qualitative analysis supplied that interpretive content. In this sense, the study demonstrates how structural modeling and thematic analysis can be combined to examine readiness as a cognitive, interpretive, and pedagogical construct rather than as a simple attitude score [32], [35], [36].

The curriculum implication is concrete. Teacher education institutions (TEIs) in peatland and other high-risk regions should integrate lived-experience mapping into DRR modules. At the beginning of a module, prospective teachers can map their personal and community experiences of haze, peat fires, health disruptions, school interruptions, land-use changes, and restoration efforts. These maps should therefore be connected to scientific explanations through peat hydrology diagrams, hotspot data, local case studies, and guided discussion. The subsequent step is pedagogical translation: students design lesson objectives, child-friendly explanations, local media, assessment tasks, and school-community communication activities based on the mapped experience. This sequence turns lived experience into teachable knowledge. It is especially relevant for Sumatra and Kalimantan, where repeated fire-haze cycles threaten children's learning conditions, regional health, ecological recovery, and long-term human capital.

3.5. Limitations and future research

This study has several limitations that should guide interpretation and future research. First, the quantitative model examined only direct effects from prior knowledge to mental models, pedagogical perceptions, and pedagogical readiness; therefore, it did not test mediation, moderation, reciprocal relationships, or longitudinal change. Second, the indicators relied on self-report measures, which are useful for capturing perceived readiness but could not fully establish how prospective teachers would perform in real classroom planning, microteaching, or school-based DRR practice. Third, the qualitative strand was based on concise written survey narratives rather than follow-up interviews; thus, respondents' reasoning could be identified thematically but not probed in greater depth. Fourth, the sample was concentrated in one Indonesian province and was strongly female, which means that transferability to other regions, teacher-education systems, gender compositions, and hazard contexts should be approached with caution. Future studies should test the CEP model in other peatland and non-peatland regions, examine indirect pathways through mental models and pedagogical perceptions, and combine survey data with lesson-plan analysis, observation, or intervention-based designs.

4. CONCLUSION

This study concludes that prior knowledge is a significant CEP for peatland DRR pedagogy among prospective elementary teachers. Stronger prior knowledge was associated with more coherent mental models, more educationally grounded pedagogical perceptions, and greater pedagogical readiness. The qualitative evidence explains why these relationships matter: respondents who articulated clearer causal explanations of peatland risk were also better able to discuss educational responsibility, contextual lesson design, learning media, training needs, and institutional support.

The study's contribution is not merely that prospective teachers need more information about disasters. Its stronger claim is that teacher education must help them transform regional lived experience into professional pedagogical reasoning. The CEP model offers one way to do this by diagnosing prior knowledge, strengthening mental models, and guiding prospective teachers toward place-based lesson design. For teacher-education institutions, this means integrating lived experience mapping, explanations of peatland risks, contextual media design, microteaching, and school-community communication into DRR modules. These findings provide essential practical implications for teacher education in disaster-prone regions: teachers are not peripheral actors in disaster resilience. In fire-prone regions such as Sumatra and Kalimantan, they contribute to children's disaster preparedness and community resilience who can help children understand risk, sustain preventive habits, and carry regional resilience knowledge into the future.

ACKNOWLEDGMENTS

The authors express their sincere appreciation to the prospective elementary teachers who participated in this study and to the participating teacher-education institutions in Riau, Indonesia, for their cooperation during data collection. The authors also acknowledge the support of individuals who assisted with participant coordination and survey administration.

FUNDING INFORMATION

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The authors state that no external funding was involved in this study. All stages of data collection, analysis, interpretation, and manuscript preparation were completed using institutional and author resources.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Eddy Noviana	✓	✓		✓	✓	✓		✓	✓					
Otang Kurniaman		✓			✓	✓		✓		✓				

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper. The authors also declare no competing academic, institutional, or non-financial interests related to this study. The interpretation of the findings, the writing of the manuscript, and the decision to submit the article were conducted independently by the authors.

INFORMED CONSENT

Free and informed written consent was obtained from all participants prior to their inclusion in the study. Participants were informed of the study's purpose, the voluntary nature of their participation, their right to decline or withdraw, and the confidential and anonymized use of their responses. Because the study

involved university-level prospective teachers rather than minors enrolled in school, parental or legal guardian consent was not required.

ETHICAL APPROVAL

The study involving human participants was formally reviewed and approved by the Faculty of Teacher Training and Education, Universitas Riau (protocol No. 1367/UN19.5.1.1.5/AK/2025; November 20, 2025). The study was conducted in accordance with institutional requirements, applicable national regulations, and the principles of the Declaration of Helsinki. All participants provided written informed consent prior to participation.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request. To protect participant privacy and confidentiality, the underlying data containing human participant information is not publicly available. De-identified and/or aggregated data may be shared where feasible, subject to ethical approval conditions and institutional policies.

REFERENCES

[1] R. A. Tyas, I. Wilujeng, D. Rosana, H. Kuswanto, and D. Purwasih, "A review of disaster risk reduction education implementation: Integration, trends, and trajectories," *Social Sciences & Humanities Open*, vol. 12, p. 102015, 2025, doi: 10.1016/j.ssaho.2025.102015.

[2] C. Mutch, "How schools build community resilience capacity and social capital in disaster preparedness, response and recovery," *International Journal of Disaster Risk Reduction*, vol. 92, p. 103735, Jun. 2023, doi: 10.1016/j.ijdrr.2023.103735.

[3] M. Taufik, M. T. Widyastuti, A. Sulaiman, D. Murdiyarso, I. P. Santikayasa, and B. Minasny, "An improved drought-fire assessment for managing fire risks in tropical peatlands," *Agricultural and Forest Meteorology*, vol. 312, p. 108738, Jan. 2022, doi: 10.1016/j.agrformet.2021.108738.

[4] T. W. Yuwati *et al.*, "Restoration of degraded tropical peatland in Indonesia: a review," *Land*, vol. 10, no. 11, p. 1170, Nov. 2021, doi: 10.3390/land10111170.

[5] B. A. Simonsmeier, M. Flaig, A. Deiglmayr, L. Schalk, and M. Schneider, "Domain-specific prior knowledge and learning: a meta-analysis," *Educational Psychologist*, vol. 57, no. 1, pp. 31–54, Jan. 2022, doi: 10.1080/00461520.2021.1939700.

[6] M. Schneider and B. A. Simonsmeier, "How does prior knowledge affect learning? A review of 16 mechanisms and a framework for future research," *Learning and Individual Differences*, vol. 122, p. 102744, Aug. 2025, doi: 10.1016/j.lindif.2025.102744.

[7] G. Brod, "Toward an understanding of when prior knowledge helps or hinders learning," *npj Science of Learning*, vol. 6, no. 1, p. 24, Aug. 2021, doi: 10.1038/s41539-021-00103-w.

[8] E. E. H. Doyle, S. E. Harrison, S. R. Hill, M. Williams, D. Paton, and A. Bostrom, "Eliciting mental models of science and risk for disaster communication: a scoping review of methodologies," *International Journal of Disaster Risk Reduction*, vol. 77, p. 103084, Jul. 2022, doi: 10.1016/j.ijdrr.2022.103084.

[9] N. M. W. Astuti, I. K. Werdhiana, and U. Wahyono, "Impacts of direct disaster experience on teachers' knowledge, attitudes and perceptions of disaster risk reduction curriculum implementation in Central Sulawesi, Indonesia," *International Journal of Disaster Risk Reduction*, vol. 53, p. 101992, Feb. 2021, doi: 10.1016/j.ijdrr.2020.101992.

[10] A. Amri, J. A. Lassa, Y. Tebe, N. R. Hanifa, J. Kumar, and S. Sagala, "Pathways to disaster risk reduction education integration in schools: insights from SPAB evaluation in Indonesia," *International Journal of Disaster Risk Reduction*, vol. 73, p. 102860, Apr. 2022, doi: 10.1016/j.ijdrr.2022.102860.

[11] T. Goswami and A. Ahmad, "A systematic review of school-based disaster risk reduction strategies in India," *Evaluation and Program Planning*, vol. 112, p. 102646, Oct. 2025, doi: 10.1016/j.evalprogplan.2025.102646.

[12] A. Hodson, J. M. Pearce, R. Amlôt, and M. B. Rogers, "Delivering extreme event preparedness education in schools: a systematic review of educational preparedness resources available in England," *International Journal of Disaster Risk Reduction*, vol. 100, p. 104171, Jan. 2024, doi: 10.1016/j.ijdrr.2023.104171.

[13] L. Nahayo *et al.*, "Extent of disaster courses delivery for the risk reduction in Rwanda," *International Journal of Disaster Risk Reduction*, vol. 27, pp. 127–132, Mar. 2018, doi: 10.1016/j.ijdrr.2017.09.046.

[14] E. A. Newnham, P. L. Dzidic, and L. M. Kelly, "Child disaster resilience in action: post-bushfire qualitative perspectives on a school-based preparedness program," *International Journal of Disaster Risk Reduction*, vol. 96, p. 103925, Oct. 2023, doi: 10.1016/j.ijdrr.2023.103925.

[15] G. R. C. Rodrigo *et al.*, "Theoretical and practical considerations in the creation of a disaster risk reduction educational strategy at the primary education level: a case study of Mexico City," *International Journal of Disaster Risk Reduction*, vol. 105, p. 104320, Apr. 2024, doi: 10.1016/j.ijdrr.2024.104320.

[16] J.-J. Wang and N.-Y. Tsai, "Factors affecting elementary and junior high school teachers' behavioral intentions to school disaster preparedness based on the theory of planned behavior," *International Journal of Disaster Risk Reduction*, vol. 69, p. 102757, Feb. 2022, doi: 10.1016/j.ijdrr.2021.102757.

[17] G. Nakano and K. Yamori, "Disaster risk reduction education that enhances the proactive attitudes of learners: a bridge between knowledge and behavior," *International Journal of Disaster Risk Reduction*, vol. 66, p. 102620, Dec. 2021, doi: 10.1016/j.ijdrr.2021.102620.

[18] A. A. Shah *et al.*, "Disaster risk reduction education (DRRE) in elementary education of Pakistan: challenges and scaling up endeavours," *International Journal of Disaster Risk Reduction*, vol. 114, p. 104962, Nov. 2024, doi: 10.1016/j.ijdrr.2024.104962.

[19] T. Gokmenoglu, E. D. Sonmez, İ. Yavuz, F. D. Cug, and N. Cemaloglu, "Measuring the effectiveness of a community engagement theory-driven training program," *International Journal of Disaster Risk Reduction*, vol. 116, p. 105128, Jan. 2025, doi: 10.1016/j.ijdrr.2024.105128.

[20] A. I. Rodríguez *et al.*, "Strategies for teaching natural hazards to children in rural communities," *International Journal of Disaster Risk Reduction*, vol. 116, p. 105033, Jan. 2025, doi: 10.1016/j.ijdrr.2024.105033.

[21] K. Palma *et al.*, "Interdisciplinarity and local knowledge to foster community resilience in disaster risk management: a community-based educational approach on the Chilean coast," *International Journal of Disaster Risk Reduction*, vol. 119, p. 105281, Mar. 2025, doi: 10.1016/j.ijdrr.2025.105281.

[22] H. Seddighi, M. L. Lopez, A. Zwitter, M. L. Muldoon, H. Sajjadi, and S. Yousefzadeh, "Non-formal disaster education programs for school students in Iran: a qualitative study of the challenges experienced by stakeholders," *International Journal of Disaster Risk Reduction*, vol. 86, p. 103531, Feb. 2023, doi: 10.1016/j.ijdrr.2023.103531.

[23] P. F. Pisa, "Understanding memory transmission in disaster risk reduction practices: a case study from Japan," *International Journal of Disaster Risk Reduction*, vol. 100, p. 104112, Jan. 2024, doi: 10.1016/j.ijdrr.2023.104112.

[24] A. Rahman, M. Nazaruddin, N. F. Januriyadi, and M. Affan, "Cross-generational Smong narratives in Aceh's tsunami resilience," *Asia-Pacific Journal of Regional Science*, vol. 8, no. 3, pp. 943–970, Sep. 2024, doi: 10.1007/s41685-024-00346-6.

[25] G. L. Piangiamore and A. Maramai, "When the past teaches the future: earthquake and tsunami risk reduction through episodes of situated learning (ESL)," *Geosciences*, vol. 14, no. 3, p. 65, Feb. 2024, doi: 10.3390/geosciences14030065.

[26] I. Backfisch, L. Sibley, A. Lachner, K. T. Kirchner, C. Hische, and K. Scheiter, "Enhancing pre-service teachers' technological pedagogical content knowledge (TPACK): utility-value interventions support knowledge integration," *Teaching and Teacher Education*, vol. 142, p. 104532, May 2024, doi: 10.1016/j.tate.2024.104532.

[27] Y. Zhang, S. Zhou, X. Wu, and A. C. K. Cheung, "The effect of teacher training programs on pre-service and in-service teachers' global competence: a meta-analysis," *Educational Research Review*, vol. 45, p. 100627, Nov. 2024, doi: 10.1016/j.edurev.2024.100627.

[28] R. González-Fernández, A. Ruiz-Cabezas, M. C. M. Domínguez, A. B. Subía-Álava, and J. L. D. Salazar, "Teachers' teaching and professional competences assessment," *Evaluation and Program Planning*, vol. 103, p. 102396, Apr. 2024, doi: 10.1016/j.evalprogplan.2023.102396.

[29] E. Noviana *et al.*, "Why is didactic transposition in disaster education needed by prospective elementary school teachers?" *Heliyon*, vol. 9, no. 4, p. e15413, Apr. 2023, doi: 10.1016/j.heliyon.2023.e15413.

[30] P. E. Suarmika, I. B. P. Arnyana, I. W. Suastra, and I. G. Margunayasa, "Reconstruction of disaster education: the role of indigenous disaster mitigation for learning in Indonesian elementary schools," *International Journal of Disaster Risk Reduction*, vol. 72, p. 102874, Apr. 2022, doi: 10.1016/j.ijdrr.2022.102874.

[31] K. Sheehy, P. Vackova, S. van Manen, S. S. Turnip, K. Rofiah, and A. Twiner, "Inclusive disaster risk reduction education for Indonesian children," *International Journal of Inclusive Education*, vol. 28, no. 11, pp. 2529–2545, Sep. 2024, doi: 10.1080/13603116.2022.2115156.

[32] J. Schoonenboom and R. B. Johnson, "How to construct a mixed methods research design," *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, vol. 69, no. S2, pp. 107–131, Oct. 2017, doi: 10.1007/s11577-017-0454-1.

[33] F. Faul, E. Erdfelder, A. Buchner, and A.-G. Lang, "Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses," *Behavior Research Methods*, vol. 41, no. 4, pp. 1149–1160, Nov. 2009, doi: 10.3758/BRM.41.4.1149.

[34] F. Faul, E. Erdfelder, A.-G. Lang, and A. Buchner, "G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences," *Behavior Research Methods*, vol. 39, no. 2, pp. 175–191, May 2007, doi: 10.3758/BF03193146.

[35] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "When to use and how to report the results of PLS-SEM," *European Business Review*, vol. 31, no. 1, pp. 2–24, Jan. 2019, doi: 10.1108/EBR-11-2018-0203.

[36] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006, doi: 10.1191/1478088706qp063oa.

[37] M. Yemini, L. Engel, and A. B. Simon, "Place-based education – a systematic review of literature," *Educational Review*, vol. 77, no. 2, pp. 640–660, Feb. 2025, doi: 10.1080/00131911.2023.2177260.

[38] A. Rahma, D. Mardiatno, and D. R. Hizbaron, "Developing a theoretical framework: school ecosystem-based disaster risk education," *International Research in Geographical and Environmental Education*, vol. 33, no. 1, pp. 6–23, Jan. 2024, doi: 10.1080/10382046.2023.2214041.

[39] F. Dochy, M. Segers, and M. M. Buehl, "The relation between assessment practices and outcomes of studies: the case of research on prior knowledge," *Review of Educational Research*, vol. 69, no. 2, pp. 145–186, Jun. 1999, doi: 10.3102/00346543069002145.

[40] V. Richardson, "Constructivist pedagogy," *Teachers College Record: The Voice of Scholarship in Education*, vol. 105, no. 9, pp. 1623–1640, Dec. 2003, doi: 10.1046/j.1467-9620.2003.00303.x.

[41] P. N. Johnson-Laird, "Mental models in cognitive science," *Cognitive Science*, vol. 4, no. 1, pp. 71–115, Jan. 1980, doi: 10.1207/s15516709cog0401_4.

[42] W. B. Rouse and N. M. Morris, "On looking into the black box: prospects and limits in the search for mental models," *Psychological Bulletin*, vol. 100, no. 3, pp. 349–363, Nov. 1986, doi: 10.1037/0033-2909.100.3.349.

[43] N. A. Jones, H. Ross, T. Lynam, P. Perez, and A. Leitch, "Mental models: an interdisciplinary synthesis of theory and methods," *Ecology and Society*, vol. 16, no. 1, p. art46, 2011, doi: 10.5751/ES-03802-160146.

[44] M. F. Pajares, "Teachers' beliefs and educational research: cleaning up a messy construct," *Review of Educational Research*, vol. 62, no. 3, pp. 307–332, Sep. 1992, doi: 10.3102/00346543062003307.

[45] I. Ajzen, "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179–211, Dec. 1991, doi: 10.1016/0749-5978(91)90020-T.

[46] L. S. Shulman, "Those who understand: knowledge growth in teaching," *Educational Researcher*, vol. 15, no. 2, pp. 4–14, Feb. 1986, doi: 10.3102/0013189X015002004.

[47] M. Tschannen-Moran and A. W. Hoy, "Teacher efficacy: capturing an elusive construct," *Teaching and Teacher Education*, vol. 17, no. 7, pp. 783–805, Oct. 2001, doi: 10.1016/S0742-051X(01)00036-1.

[48] M. Kunter, U. Klusmann, J. Baumert, D. Richter, T. Voss, and A. Hachfeld, "Professional competence of teachers: effects on instructional quality and student development," *Journal of Educational Psychology*, vol. 105, no. 3, pp. 805–820, Aug. 2013, doi: 10.1037/a0032583.

[49] S. Blömeke, J.-E. Gustafsson, and R. J. Shavelson, "Beyond dichotomies: competence viewed as a continuum," *Zeitschrift für Psychologie*, vol. 223, no. 1, pp. 3–13, Jan. 2015, doi: 10.1027/2151-2604/a000194.

[50] F. A. J. Korthagen, "In search of the essence of a good teacher: towards a more holistic approach in teacher education," *Teaching and Teacher Education*, vol. 20, no. 1, pp. 77–97, Jan. 2004, doi: 10.1016/j.tate.2003.10.002.
[51] V. D. Opfer and D. Pedder, "Conceptualizing teacher professional learning," *Review of Educational Research*, vol. 81, no. 3, pp. 376–407, Sep. 2011, doi: 10.3102/0034654311413609.
[52] L. Darling-Hammond, L. Flook, C. Cook-Harvey, B. Barron, and D. Osher, "Implications for educational practice of the science of learning and development," *Applied Developmental Science*, vol. 24, no. 2, pp. 97–140, Apr. 2020, doi: 10.1080/10888691.2018.1537791.
[53] D. A. Gruenewald, "Foundations of place: a multidisciplinary framework for place-conscious education," *American Educational Research Journal*, vol. 40, no. 3, pp. 619–654, Jan. 2003, doi: 10.3102/00028312040003619.
[54] S. Semken and C. B. Freeman, "Sense of place in the practice and assessment of place-based science teaching," *Science Education*, vol. 92, no. 6, pp. 1042–1057, Nov. 2008, doi: 10.1002/sce.20279.

BIOGRAPHIES OF AUTHORS



Eddy Noviana is a lecturer and teacher educator at the Faculty of Teacher Training and Education, Universitas Riau, Indonesia. He has been affiliated with Universitas Riau since 2009. He earned a bachelor's degree (S1) in Pancasila and Civic Education from Universitas Riau in 2004, a master's degree (S2) in Elementary Education from Universitas Pendidikan Indonesia in 2008, and a doctoral degree (S3) in Education from Universitas Riau in 2025. His academic interests include elementary education, media and learning resources, disaster literacy, ecological literacy, and teacher education. He can be contacted at email: eddy.noviana@lecturer.unri.ac.id.



Otang Kurniaman is a lecturer and researcher at the Faculty of Teacher Training and Education, Universitas Riau, Indonesia, since 2009. He earned his bachelor's degree (S1) in Indonesian language and literature education from Universitas Riau in 2005, his master's degree (S2) in elementary education from Universitas Pendidikan Indonesia in 2008, and his doctorate (S3) in education from Universitas Riau in 2025. His academic interests focus on elementary education, Indonesian language learning, literacy development, and teacher education. He can be contacted at email: otang.kurniaman@lecturer.unri.ac.id.