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# A new psychometrically validated questionnaire for assessing teacher agency in eight dimensions across pre-service and in-service teachers

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Teacher agency is an increasingly important area of research across different learning and professional development settings. In our study, we followed the ecological model of teacher agency and developed a questionnaire that allows us to differentiate eight dimensions of teacher agency. Confirmatory factor analysis showed an acceptable fit of the eight-factor model in two different domains where teachers often make decisions: planning of teaching and learning activities and using information and communication technologies in teaching. Comparisons of configural, metric, and scalar models revealed good metric invariance across pre-service and in-service teachers in both agency domains. However, scalar invariance was not supported. Therefore, the new questionnaire seems suitable and sensitive for assessing teacher agency in these groups separately, but comparisons of the groups should not be made.

## KEYWORDS

questionnaire, pre-service teachers, in-service teachers, teacher agency, ecological model of teacher agency

## Introduction

Contemporary approaches to teacher professionalism highlight the significance of fostering professional agency (see, e.g., Molla and Nolan, 2020). The agency is characterised by commitment, purpose, intentionality, influence, and the capability to resist or transform prevailing practices (Emirbayer and Mische, 1998; Archer, 2000; Eteläpelto et al., 2013) and is widely acknowledged as crucial for learning and participation in workplaces and other life domains (Billett, 2008; Pölda et al., 2021). The concept of teacher agency has been the subject of numerous empirical investigations across diverse sociocultural settings (see, e.g., Eteläpelto et al., 2015; Vähäsantanen, 2015; Erss, 2018; Kauppinen et al., 2020; Ruan et al., 2020; Tinn and Ümarik, 2022; Juutilainen et al., 2024) predominantly through qualitative research that offers detailed insights into its contextual nature. Empirical studies aimed at enhancing teacher agency through specific professional development activities are also emerging (see, e.g., Wallen and Tormey, 2019; Ukkonen-Mikkola and Varpanen, 2020). However, these are also mostly qualitative. Quantitative or mixed-methods studies scrutinising the effect of the intervention are rare (see, e.g., Leijen et al., 2022a). Such studies are greatly needed in order to identify especially beneficial practices in supporting teacher agency. Moreover, to evaluate such interventions at a large scale and to monitor the dynamics of teacher agency in quantitative

research settings, such as national monitoring studies or studies exploring the effect of teacher education programmes, it is essential to have a valid and reliable instrument. In this study, we introduce an original questionnaire designed to assess teacher agency among pre-service and in-service teachers. This questionnaire was developed based on the ecological model of teacher agency and is, to the best of our knowledge, one of the few questionnaires available that has been developed based on this framework. In this article, we will first describe different theoretical frameworks and related instruments to assess teacher agency. Following this, we will give an overview of the ecological model of teacher agency and describe the questionnaire development process utilised in this study.

## Teacher agency

Research on teacher agency is derived from multiple theoretical traditions, each with its own conceptualisation of agency. Psychological perspectives often regard agency as an individual trait or capability, highlighting the development of individual competencies in teachers (see, e.g., Bandura, 2009). In line with this theoretical framework, Soini et al. (2015) and Pietarinen et al. (2013) have utilised the *Teacher's Sense of Professional Agency Survey* (TPA) (Pietarinen et al., 2013) to explore pre-service and in-service teacher agency. This instrument concentrates on individual competencies such as motivation to learn, efficacy beliefs about learning, and intentional acts for facilitating and managing learning in the classroom. In contrast, socio-critical, sociocultural, and pragmatist traditions stress the interplay between individuals and their environments much more strongly, arguing that actions are influenced not only by personal factors but also by surrounding conditions. These diverse traditions generally employ qualitative methods. Advocates of the socio-critical approach aim to alter specific social structures and liberate individuals and groups from their impacts. Conversely, proponents of sociocultural and pragmatist perspectives view the human agency as enabled by environmental factors. For example, Juutilainen et al. (2018) and Lipponen and Kumpulainen (2011) focussed on the role of social and contextual elements in shaping student teachers' agency through qualitative lenses. One of the rare examples of a questionnaire designed to assess agency in line with sociocultural tradition is the *Agency of University Students* (AUS) Scale (Jääskelä et al., 2017). This questionnaire explores 10 factors that focus on different aspects of learning in the higher education setting. "Four of these—Interest and motivation, Self-efficacy, Competence beliefs, and Participation activity—are seen to represent individual resources of the agency. The other four factors—Equal treatment, Teacher support, Peer support, and Trust—represent relational sources of agency. Finally, Opportunities to influence and Opportunities to make choices represent contextual sources of agency" (Jääskelä et al., 2017, p. 2061). Although it is not specific to teacher education, it could be used to explore pre-service teachers' experiences and sense of agency in the higher education context. Similarly to sociocultural views, pragmatist-derived approaches, such as the ecological model of agency, focus primarily on the person's temporary constructed engagement with the environment and define agency as a potential to act by means of the environment (Biesta et al., 2015). Previous studies have utilised this framework to explore teachers' agency in qualitative studies (see, e.g., Priestley et al., 2015; Oolbekink-Marchand et al., 2017;

Oosterhoff et al., 2020) and in quantitative studies utilising questionnaires (Leijen et al., 2022a,b). All these studies focus on individual resources and environmental conditions as facilitators and inhibitors of agency, similar to the two questionnaires (TPA and AUS) described above. Additionally, the ecological model of agency stresses the importance of purposes regarding agency, and related questionnaires explore long-term and short-term purposes in relation to the agency as well. In this article, we will describe the ecological model of agency in more detail and explain how we developed a new questionnaire to assess teacher agency based on earlier studies.

## Ecological model of agency

Within the framework of the ecological model (Priestley et al., 2015; Leijen et al., 2020), teacher agency is conceptualised as a temporal-relational phenomenon comprising three interconnected dimensions: iterational, projective, and practical-evaluative. These dimensions are understood as constitutive components of the teacher agency as teacher decision-making always includes all three dimensions. The iterational dimension reflects the continuity and stability in a teacher's decision-making that is embedded in their knowledge base, personal life history, and prior professional experiences. This dimension enables teachers to draw on past successes and replicate effective practices, offering stability in their professional actions. The projective dimension of teacher agency is future-oriented, necessitating that teachers set both short- and long-term purposes when they are engaged in the decision-making process. We have elaborated elsewhere (Leijen et al., 2020) that long-term purposes of education could be viewed from the learner's viewpoint (e.g., qualification, socialisation, and subjectification as proposed by Biesta, 2009) and from the perspective of the personal aspirations of the teacher. Finally, the practical-evaluative dimension involves the teacher's capacity to make decisions in the present moment, taking into account the iterational and projective dimensions along with the current cultural, structural, and material conditions of a current situation. This decision-making process requires teachers to consider alternative courses of action and to select the most appropriate option based on their professional purposes and competency base. Conditions that support agency include a collaborative culture, horizontal relationships, and strong teacher connections, whereas teacher agency is hindered by competitive environments, performance-oriented culture, and hierarchical relations. Previous empirical studies (e.g., Priestley et al., 2015; Oosterhoff et al., 2020) have demonstrated that the iterational dimension tends to have a predominant role in teacher decision-making and behaviour, with the practical-evaluative dimension also contributing significantly. In contrast, evidence for the projective dimension's impact is more modest. For instance, Priestley et al. (2015) found that teachers often base their decisions on short-term objectives, such as fostering student engagement and maintaining a positive learning atmosphere, rather than on the long-term aspirations of education. These observations suggest that teacher agency cannot be taken for granted and requires deliberate support, especially regarding developing awareness of the importance of long-term purposes (see, e.g., Wallen and Tormey, 2019; Leijen et al., 2022a). In summary, the agency is achieved when all three dimensions are activated; a teacher can consider alternatives and make informed decisions for action and is not present when there

are no options for action or when a teacher follows routinised patterns of habitual behaviour (Priestley et al., 2015).

## Questionnaire development based on the ecological model of teacher agency

Based on the outlined model of agency, a 10-item questionnaire was previously developed by the authors (Leijen et al., 2022b). This self-report questionnaire captures teachers' perceptions of their experience related to three constitutive components of teacher agency (iterational, projective, and practical-evaluative). Moreover, the questionnaire was designed to assess pre-service teachers' agency across three specific domains: planning teaching and learning activities, teaching diverse-ability students in the same class, and using ICT in teaching (regarding each domain the same 10 questions were asked). These areas were chosen due to the domain-specific nature of the agency and aimed to reflect diverse areas of contemporary teaching responsibilities. Planning of teaching and learning activities is recognised as a traditional core task of teachers. Meanwhile, educating students with diverse abilities and employing ICT in instruction are seen as increasingly prevalent contemporary challenges that characterise teachers' work in different countries (OECD, 2019).

The properties of the three-factor questionnaire (iterational, projective, and practical-evaluative) were acceptable across the three domains. However, the formulation of items was somewhat too general (e.g., I have clear long-term purposes for planning teaching and learning activities), making us wonder whether the instrument captures general attitudes towards agency, which are difficult to interpret and change. Consequently, we further developed the initial questionnaire and added more specific statements, resulting in 20 items across eight dimensions, which operationalise three constitutive components of teacher agency. For example, we specified the item presented above to four different items for long-term purposes. This questionnaire was used to assess changes in teachers' agency related to planning teaching and learning activities during a long-term professional development programme (see Leijen et al., 2022a). We utilised the initial 10-item questionnaire (3 dimensions) alongside the 20-item questionnaire (8 dimensions), and only the longer questionnaire could detect changes in teacher agency dynamics. However, the longer questionnaire was not constructed to assess all eight dimensions independently. Consequently, we suggested that future research should expand on this by adding more items to each dimension, ensuring that each can be evaluated with a minimum of three or four items. Additionally, we noted that the instrument requires psychometric validation through studies involving larger samples of teachers. Therefore, we developed the 20-item questionnaire further, resulting in 24 items, and prepared the current study to assess the questionnaire's psychometric properties. The 24-item questionnaire has the following structure: A (iterational): a1. knowledge base related to personal life experiences, a2. knowledge base related to professional teacher education; B (projective): b1. short-term goals related to students, b2. short-term goals related to the teacher herself/himself, b3. long-term goals related to students, b4. long-term goals related to the teacher herself/himself; C (practical-evaluative): c1. classroom environment, c2. school environment. Three statements were formulated for each dimension in two domains: planning of teaching and learning activities and using information

and communication technologies (ICT) in teaching (see [Supplementary materials](#) as an example of questions related to the planning of teaching and learning activities; the same questions were also asked about the other domain). Each item is assessed on a 7-point Likert-type scale. We did not collect data regarding teacher agency related to teaching diverse-ability students in the same class as we did not want to overburden our participants. Agency related to planning and ICT use was more relevant as the study was conducted in the context of a larger project that explored the potential effect of ICT use on different aspects of teaching and learning (Pedaste et al., 2023). Finally, in our previous study (Leijen et al., 2022b), we explored differences regarding the agency among pre-service teachers with varying teaching experiences. However, the sample was not suitable for conducting invariance analysis. Establishing instrument invariance is important for monitoring agency dynamics across different professional development pathways. Therefore, we were interested in evaluating the developed questionnaire in two domains and conducted a study to find out:

1. What are the psychometric properties of the eight-factor questionnaire exploring teacher agency in two domains?
2. Is the questionnaire exploring the eight-factor structure invariant across pre-service and in-service teachers?

## Methods

Data were collected electronically from 354 teachers in two separate studies. One of them was a larger project DigiEfekt (see [Pedaste et al., 2023](#)), focusing on understanding how students' and teachers' characteristics might have an effect on students' learning outcomes. In this context, basic school teachers participated in the study ( $n=158$ ). The average experience of the teachers in this group was 19.6 years (variation from 0.1 to 48 years, mostly experienced teachers, 130 of 158 had at least 5 years of experience). This group represented in-service teachers. The other study was conducted among student teachers studying in one of the two major universities providing teacher education in Estonia ( $n=196$ ). The average teaching experience of this group was 3.8 years (variation from 0.2 to 34 years, mostly novices; only 25 of 120 had experience of at least 5 years). This group represented pre-service teachers. Data were collected anonymously; informed consent was received from all participants.

The theoretical model of agency in two domains was tested using confirmatory factor analysis (CFA). The model was considered acceptable if the fit indices were the following (see [Bowen and Guo, 2011](#)): root mean square error of approximation (RMSEA)  $\leq 0.05$  for close fit and 0.05–0.08 for reasonable fit, comparative fit index (CFI)  $\geq 0.95$ , and Tucker–Lewis index (TLI)  $\geq 0.95$ . We also used the normed chi-square index with an acceptable value below 3 and good value below 2 (see [Kline, 1998](#); [Ullman, 2001](#)). Composite reliability was used to measure the reliability of the scales. Comparisons of the configural, metric, and scalar models were carried out to test the invariance of the questionnaire across pre-service and in-service teachers. The resulting invariance models were compared with respect to their chi-square statistics, CFI, RMSEA, and standardised root mean square residual (SRMR) according to [Chen's \(2007\)](#) guidelines. These guidelines suggest a criterion of a 0.01 change in CFI to

be sufficient to show invariance, along with changes in RMSEA of up to 0.015 and SRMR of up to 0.030 for metric invariance or up to 0.015 for scalar or residual invariance. The statistical program Mplus (version 7.4) was used for all analyses.

## Results

CFA showed that teacher agency can be described through eight factors in both domains (see Figures 1, 2). Models had a good fit in both domains. Fit indices of the model for the planning-related agency were as follows:  $\chi^2=587.709$ ,  $df=224$ ,  $\chi^2/df=2.62$ ,  $RMSEA=0.068$ ,  $CFI=0.985$ ,  $TLI=0.981$ , and  $SRMR=0.042$ . Fit indices for ICT-related agency were as follows:  $\chi^2=750.969$ ,  $df=224$ ,  $\chi^2/df=3.35$ ,  $RMSEA=0.082$ ,  $CFI=0.974$ ,  $TLI=0.968$ , and  $SRMR=0.040$ . Regarding the planning-related agency model, factor loadings for all items were above 0.6 which is considered a satisfactory level, and correlations between latent variables ranged between 0.181 and 0.770. Regarding ICT-related agency, all factor loadings between items and dimensions were also higher than 0.6, and most of the correlations between latent variables were in an acceptable range (between 0.250 and 0.795); only one very high correlation (0.843) was noted—between environmental conditions related to using ICT in the classroom and at the school. This indicates that teachers perceived environmental conditions at the class and school levels as very similar; that is, it indicates that from a teacher's perspective, these two dimensions were difficult to distinguish. As these two dimensions were not so highly correlated in the case of planning, it is also possible that the high correlation could be specific to the ICT domain. The finding that dimensions related to class and school environmental conditions are somewhat more associated in the ICT domain than the planning domain might result from the fact that teacher agency in using ICT in the class depends more on the school environment than in the case of planning. However, as findings suggest that two dimensions are highly correlated, we also tested a model with seven dimensions (class and school environmental conditions were merged into one dimension). The analysis showed that the seven dimensions model had worse fit indices ( $\chi^2=766.396$ ,  $df=231$ ,  $\chi^2/df=3.32$ ,  $RMSEA=0.081$ ,  $CFI=0.973$ ,  $TLI=0.968$ , and  $SRMR=0.042$ ). Therefore, we decided to use the original eight-factor structure but see the need for further studies with revised and additional items in different domains to understand the structure with the best fit.

Then, composite reliability was calculated for all dimensions of the agency instrument applied in two domains. Composite reliability in the domain of planning-related agency varied from 0.793 to 0.960 and in the domain of ICT-related agency from 0.840 to 0.960. Thus, the analysis showed good reliability of the scales measured with the agency instrument.

For checking the invariance across pre-service and in-service teachers, we first tested for configural invariance, estimating all model parameters for both groups. This model resulted in an acceptable fit in the case of both domains studied—planning of teaching and learning activities and using ICT in teaching (Table 1). Next, the metric model was compared with the configural model and the scalar model with the metric model, and the difference in fit indices indicated good metric and scalar invariance of the questionnaire in the groups of pre-service and in-service teachers. The normed

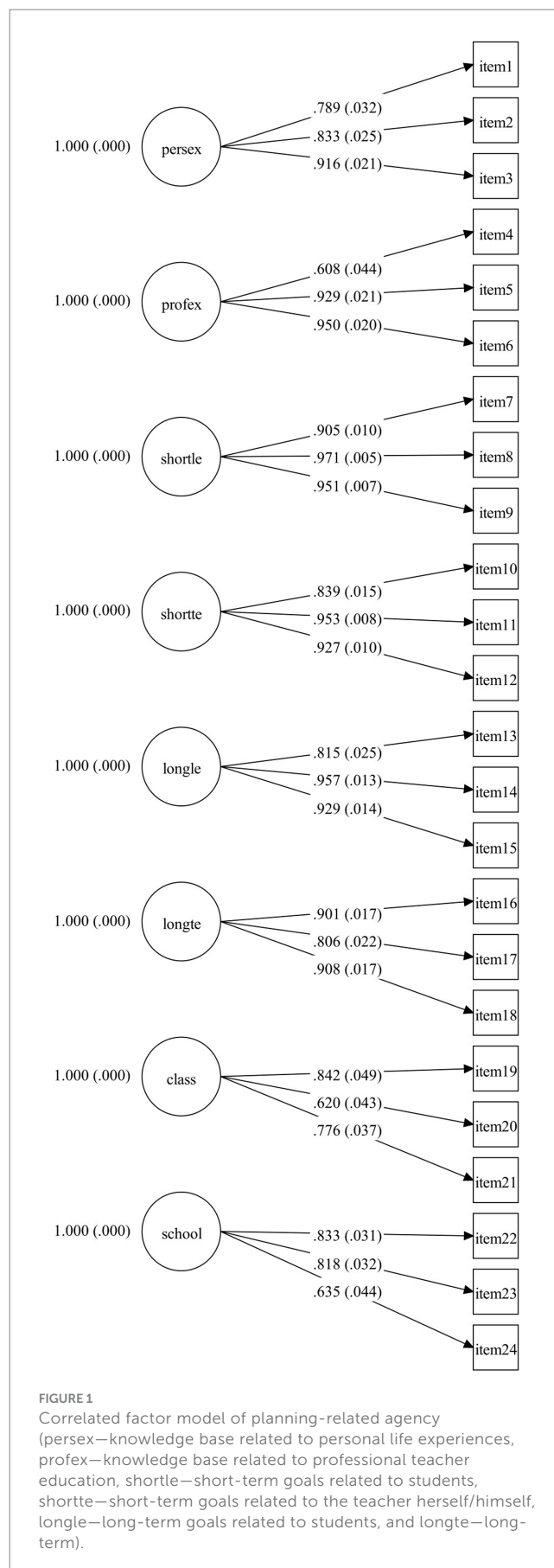
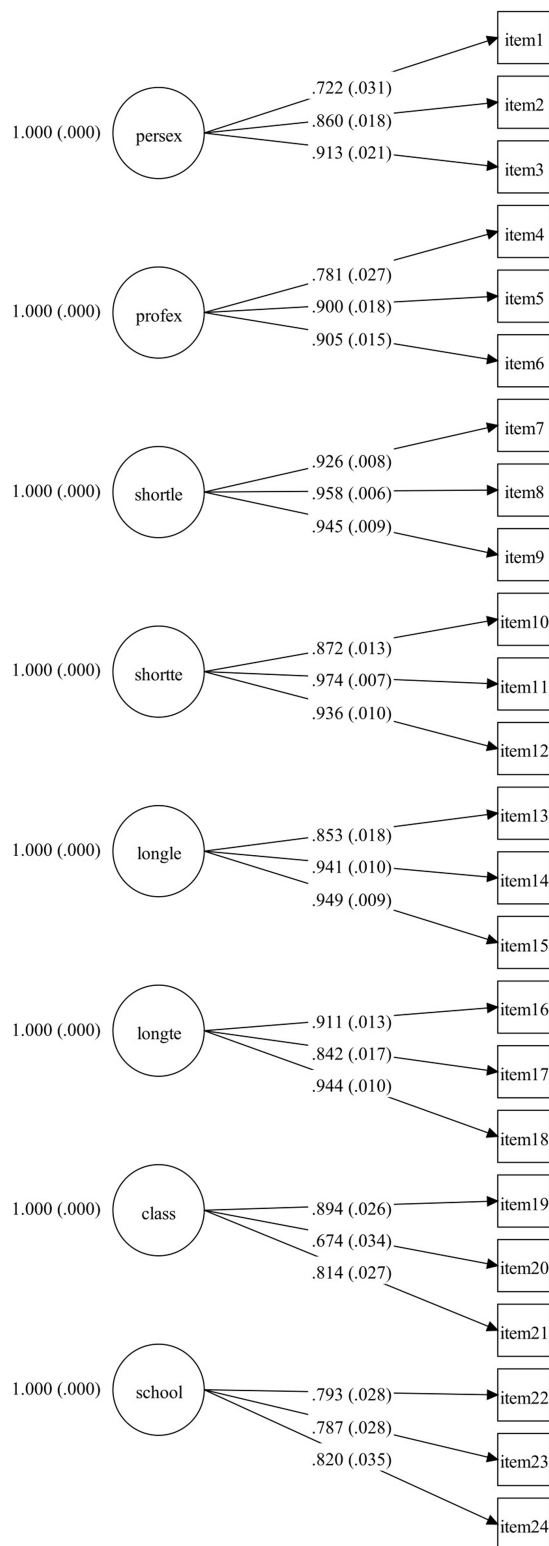


FIGURE 1  
Correlated factor model of planning-related agency (persex—knowledge base related to personal life experiences, profex—knowledge base related to professional teacher education, shortle—short-term goals related to students, shortte—short-term goals related to the teacher herself/himself, longle—long-term goals related to students, and longte—long-term).



**FIGURE 2**  
Correlated factor model of ICT-related agency (persex—knowledge base related to personal life experiences, profex—knowledge base related to professional teacher education, shortle—short-term goals related to students, shortte—short-term goals related to the teacher herself/himself, longle—long-term goals related to students, longte—long-term goals related to the teacher herself/himself, class—classroom environment, and school—school environment).

chi-square indices were also good in the case of all models, ranging from 1.68 to 1.74 in the case of planning teaching and learning activities, and from 1.97 to 1.99 in the case of using ICT in teaching. However, the comparison of the models indicated that the conclusions about the invariance should be made more modestly. In the case of using ICT in teaching, the metric model did not differ statistically significantly from the configural model ( $\chi^2=22.871$ ,  $df=16$ , and  $p=0.117$ ), but the scalar model was different from the metric model ( $\chi^2=40.675$ ,  $df=16$ , and  $p=0.001$ ). Respective normed chi-square indices were 1.43 and 2.54, indicating a good fit in the first case and an acceptable fit in the second case. It shows that the agency instrument is suitable for describing the same components among pre-service and in-service teachers in the ICT domain; however, the intercept is different in these groups, implicating certain limitations in direct comparisons of average scores of teachers in two groups. In the case of planning teaching and learning activities, both of the compared models differ statistically significantly from the model used for comparison—the metric against configural ( $\chi^2=28.634$ ,  $df=16$ , and  $p=0.027$ ) and scalar against metric ( $\chi^2=54.095$ ,  $df=16$ , and  $p<0.001$ ). The normed chi-square index was good in the first case but not acceptable in the second case (1.79 and 3.38, respectively). It shows that in the case of planning teaching and learning activities, it depends on the indices of what kind of conclusions we can make about the invariance of the questionnaire across pre-service and in-service teachers. The normed chi-square and delta of RMSEA, CFI, and SRMR show that the instrument is suitable for measuring the same components of agency; however, the significant difference between the metric model and the configural model calls for modesty in making conclusions. Taking into consideration all findings, it seems that there are some indices, suggesting that this instrument satisfies conditions for metric invariance between two groups of teachers, but when it comes to the scalar invariance, findings are not supportive.

## Discussion

The results of the study show that the developed questionnaire is suitable for studying teachers agency in a reliable and valid way as we could confirm eight factors in both investigated domains, and the composite reliability of the scales was high. The eight factors were developed based on the ecological model of agency (Priestley et al., 2015; Leijen et al., 2020). Similar to the other currently available questionnaires for assessing agencies (AUS and TPA), our questionnaire addresses teachers' individual knowledge base as a component of an agency. Uniquely, our instrument allows distinguishing between the origins of the knowledge base (personal life experiences and professional learning context). Somewhat similar to AUS, our questionnaire allows us to explore how environmental conditions constitute teachers' decision-making in concrete settings. The difference with AUS is that our questionnaire is closely related to the teacher's work context, and we distinguish between class- and school-level enablers of agency. Dissimilar to AUS and TPA, our questionnaire focuses more clearly on the projective dimension of agency, distinguishing between long-term and short-term purposes related to supporting students learning and teacher's own development (see Pietarinen et al., 2013; Soini et al., 2015; Jääskelä et al., 2017). Supporting teachers in exploring their purposes is especially

TABLE 1 Models for testing invariance of agency questionnaire across pre-service ( $n = 196$ ) and in-service teachers ( $n = 158$ ) in two domains.

Model	$\chi^2$	Df	RMSEA	CFI	SRMR	$\Delta$ RMSEA	$\Delta$ CFI	$\Delta$ SRMR
Planning of teaching and learning activities								
Configural model	758.2	448	0.062	0.944	0.062			
Metric model	780.84	464	0.062	0.941	0.07	0	0.004	0.008
Scalar model	834.93	480	0.065	0.934	0.072	0.003	0.007	0.002
Using ICT in teaching								
Configural model	890.74	448	0.075	0.934	0.053			
Metric model	913.61	464	0.074	0.933	0.062	0.001	0.001	0.009
Scalar model	954.28	480	0.075	0.929	0.063	0.001	0.004	0.001

important as empirical studies (Priestley et al., 2015; Oosterhoff et al., 2020) have shown that teachers' decisions are most influenced by their accumulated knowledge base and immediate practical considerations and much less by long-term purposes, which, in turn, limits their agency.

Moreover, based on indices related to the invariance test (Kline, 1998; Ullman, 2001; Chen, 2007), we demonstrated metric invariance of the questionnaire across pre-service and in-service teachers in both domains. The finding that the scalar invariance was not demonstrated for these two groups of teachers suggests that intercept terms might be different. It means that the factor structure of items and dimensions are the same for the two groups of teachers, regardless of significant differences in terms of their professional experience. This means we can use the questionnaire to investigate teacher agency in each group independently but with no direct comparison of the average scores of the two groups on teacher agency dimensions. It might suggest two options—either the professional experience of pre-service and in-service teachers is different in substantive terms that limit the creation of an instrument that would meet conditions of the scalar invariance or the instrument used in this study needs to be improved in some respect to ensure the scalar invariance. Therefore, the issue of scalar invariance needs to be studied further to explore the reasons behind such findings.

The current study did not include longitudinal data. Therefore, as a limitation of the study, it is not certain whether the questionnaire is sensitive enough to monitor teacher agency across all eight factors longitudinally. An earlier, 20-item version of the eight-factor questionnaire (Leijen et al., 2022a) detected changes regarding teachers' agency dynamics during the in-service professional development course. These results were promising; however, additional studies are needed to investigate this further using the 24-item questionnaire.

Finally, this study reported on a quantitative study exploring the psychometric properties of a questionnaire designed to assess pre-service and in-service teachers' agency. Although such studies are valuable for developing instruments for large-scale studies, such as national monitoring studies or studies exploring the effect of teacher education programs on agency development, they also have limitations. Agency is a highly idiosyncratic and context-specific phenomenon (Archer, 2000), and a structured questionnaire can only capture some general tendencies related to agency. For a more in-depth approach, mixed-methods and qualitative studies are more appropriate.

## Data availability statement

The datasets presented in this article are not readily available because data analysis is in process. Requests to access the datasets should be directed to [leijen@ut.ee](mailto:leijen@ut.ee).

## Ethics statement

Ethical approval was not required for the studies involving humans because Data was collected anonymously and on voluntary basis from adults. Informed consent was received from all participants. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

ÄL: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. MP: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft. AB: Conceptualization, Methodology, Writing – review & editing.

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## Conflict of interest

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

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2024.1336401/full#supplementary-material>

## References

- Archer, M. S. (2000). *Being human: The problem of agency*. Cambridge: Cambridge University Press.
- Bandura, A. (2009). Exercise of human agency through collective efficacy. *Curr. Dir. Psychol. Sci.* 9, 75–78. doi: 10.1111/1467-8721.00064
- Biesta, G. (2009). Good education in an age of measurement: on the need to reconnect with the question of purpose in education. *Educ. Assess. Eval. Account.* 21, 33–46. doi: 10.1007/s11092-008-9064-9
- Biesta, G., Priestley, M., and Robinson, S. (2015). The role of beliefs in teacher agency. *Teachers Teach.* 21, 624–640. doi: 10.1080/13540602.2015.1044325
- Billett, S. (2008). Learning throughout working life: a relational interdependence between personal and social agency. *Br. J. Educ. Stud.* 56, 39–58. doi: 10.1111/j.1467-8527.2007.00394.x
- Bowen, N. K., and Guo, S. (2011). *Structural equation modeling*. Oxford: Oxford University Press.
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Struct. Equ. Model. Multidiscip. J.* 14, 464–504. doi: 10.1080/10705510701301834
- Emirbayer, M., and Mische, A. (1998). What is agency? *Am. J. Sociol.* 103, 962–1023. doi: 10.1086/231294
- Erss, M. (2018). Complete freedom to choose within limits – teachers' views of curricular autonomy, agency and control in Estonia, Finland and Germany. *Curric. J.* 29, 238–256. doi: 10.1080/09585176.2018.1445514
- Eteläpelto, A., Vähäsantanen, K., and Hökkä, P. (2015). How do novice teachers in Finland perceive their professional agency? *Teachers Teach.* 21, 660–680. doi: 10.1080/13540602.2015.1044327
- Eteläpelto, A., Vähäsantanen, K., Hökkä, P., and Paloniemi, S. (2013). What is agency? Conceptualizing professional agency at work. *Educ. Res. Rev.* 10, 45–65. doi: 10.1016/j.edurev.2013.05.001
- Jääskelä, P., Poikkeus, A.-M., Vasalampi, K., Valleala, U. M., and Rasku-Puttonen, H. (2017). Assessing agency of university students: validation of the AUS scale. *Stud. High. Educ.* 42, 2061–2079. doi: 10.1080/03075079.2015.1130693
- Juutilainen, M., Metsäpelto, R. L., Mäensivu, M., and Poikkeus, A. M. (2024). Beginning student teachers' agency in teacher identity negotiations. *Teach. Dev.* 28, 178–194. doi: 10.1080/13664530.2023.2299683
- Juutilainen, M., Metsäpelto, R. L., and Poikkeus, A. M. (2018). Becoming agentic teachers: experiences of the home group approach as a resource for supporting teacher students' agency. *Teach. Teach. Educ.* 76, 116–125. doi: 10.1016/j.tate.2018.08.013
- Kauppinen, M., Kainulainen, J., Hökkä, P., and Vähäsantanen, K. (2020). Professional agency and its features in supporting teachers' learning during an in-service education programme. *Eur. J. Teach. Educ.* 43, 384–404. doi: 10.1080/02619768.2020.1746264
- Kline, R. B. (1998). *Principles and practice of structural equation modeling*. Guilford Press: New York.
- Leijen, Ä., Pedaste, M., and Baucal, A. (2022b). Assessing student teachers' agency and using it for predicting commitment to teaching. *Eur. J. Teach. Educ.* 45, 600–616. doi: 10.1080/02619768.2021.1889507
- Leijen, Ä., Pedaste, M., and Lepp, L. (2020). Teacher agency following the ecological model: how it is achieved and how it could be strengthened by different types of reflection. *Br. J. Educ. Stud.* 68, 295–310. doi: 10.1080/00071005.2019.1672855
- Leijen, Ä., Pedaste, M., and Lepp, L. (2022a). Supporting teacher agency during a collaborative inquiry-based in-service teacher education course. *Eur. J. Teach. Educ.* 45, 1–18. doi: 10.1080/02619768.2022.2132385
- Lipponen, L., and Kumpulainen, K. (2011). Acting as accountable authors: creating interactional spaces for agency work in teacher education. *Teach. Teach. Educ.* 27, 812–819. doi: 10.1016/j.tate.2011.01.001
- Molla, T., and Nolan, A. (2020). Teacher agency and professional practice. *Teachers Teach.* 26, 67–87. doi: 10.1080/13540602.2020.1740196
- OECD (2019). *TALIS 2018 results (volume I): Teachers and school leaders as lifelong learners*, TALIS, Paris, OECD Publishing.
- Oolbekkink-Marchand, H. W., Hadar, L. L., Smith, K., Helleve, I., and Ulvik, M. (2017). Teachers' perceived professional space and their agency. *Teach. Teach. Educ.* 62, 37–46. doi: 10.1016/j.tate.2016.11.005
- Oosterhoff, A. M., Oenema-Mostert, I. C., and Minnaert, A. E. (2020). Aiming for agency: The effects of teacher education on the development of the expertise of early childhood teachers. *Teach. Teach. Educ.* 96:103176. doi: 10.1016/j.tate.2020.103176
- Pedaste, M., Raave, D. K., and Baucal, A. (2023). *Digitaalsete õppematerjalide kasutamise efekt õpilaste õpitulemustele. DigiEfekti projekti lõppraport. [The effect of using digital learning materials on students' learning outcomes. Final report of the DigiEfekt project]*. Tartu: University of Tartu.
- Pietarinen, J., Pyhältö, K., Soini, T., and Salmela-Aro, K. (2013). Reducing teacher burnout: a socio-contextual approach. *Teach. Teach. Educ.* 35, 62–72. doi: 10.1016/j.tate.2013.05.003
- Põlda, H., Roosalu, T., Karu, K., Teder, L., and Lepik, M. (2021). Agency and development of key competences in nonformal learning contexts. *Estonian J. Educ.* 9, 60–87. doi: 10.12697/eha.2021.9.1.03
- Priestley, M., Biesta, G., and Robinson, S. (2015). *Teacher agency: an ecological approach*. London: Bloomsbury Publishing.
- Ruan, X., Zheng, X., and Toom, A. (2020). From perceived discrepancies to intentional efforts: understanding English department teachers' agency in classroom instruction in a changing curricular landscape. *Teach. Teach. Educ.* 92:103074. doi: 10.1016/j.tate.2020.103074
- Soini, T., Pietarinen, J., Toom, A., and Pyhältö, K. (2015). What contributes to first-year student teachers' sense of professional agency in the classroom? *Teachers Teach.* 21, 641–659. doi: 10.1080/13540602.2015.1044326
- Tinn, M., and Ümarik, M. (2022). Looking through teachers' eyes—investigating teacher agency. *Br. J. Educ. Stud.* 70, 419–435. doi: 10.1080/00071005.2021.1960268
- Ukkonen-Mikkola, T., and Varpanen, J. (2020). Integrated initial and continuing training as a way of developing the professional agency of teachers and student teachers. *Teach. Teach. Educ.* 96:103189. doi: 10.1016/j.tate.2020.103189
- Ullman, J. B. (2001). "Structural equation modeling" in *Using multivariate statistics*. eds. B. G. Tabachnick and L. S. Fidell. 4th ed (Needham Heights, MA: Allyn & Bacon), 653–771.
- Vähäsantanen, K. (2015). Professional agency in the stream of change: understanding educational change and teachers' professional identities. *Teach. Teach. Educ.* 47, 1–12. doi: 10.1016/j.tate.2014.11.006
- Wallen, M., and Tormey, R. (2019). Developing teacher agency through dialogue. *Teach. Teach. Educ.* 82, 129–139. doi: 10.1016/j.tate.2019.03.014